PROCEEDINGS

68TH ANNUAL PACIFIC NORTHWEST INSECT MANAGEMENT CONFERENCE JANUARY 12 & 13, 2009

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Section I.
Invasive and Emerging Pests

DELIMITATION AND POSSIBLE ERADICATION OR CONTROL OF THE APPLE MAGGOT (*RHAGOLETIS POMONELLA*) IN THE UMATILLA COUNTY, OREGON, 2008

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In 1979, the Apple maggot (AM), *Rhagoletis* pomonella (Walsh) (Diptera, Tephritidae) native to the eastern United States, was first reported in Oregon. Since then it has been found in all counties in western Oregon and east to Wasco County, and in the Pendleton area of Umatilla Co., posing a serious threat to the apple production in Oregon.

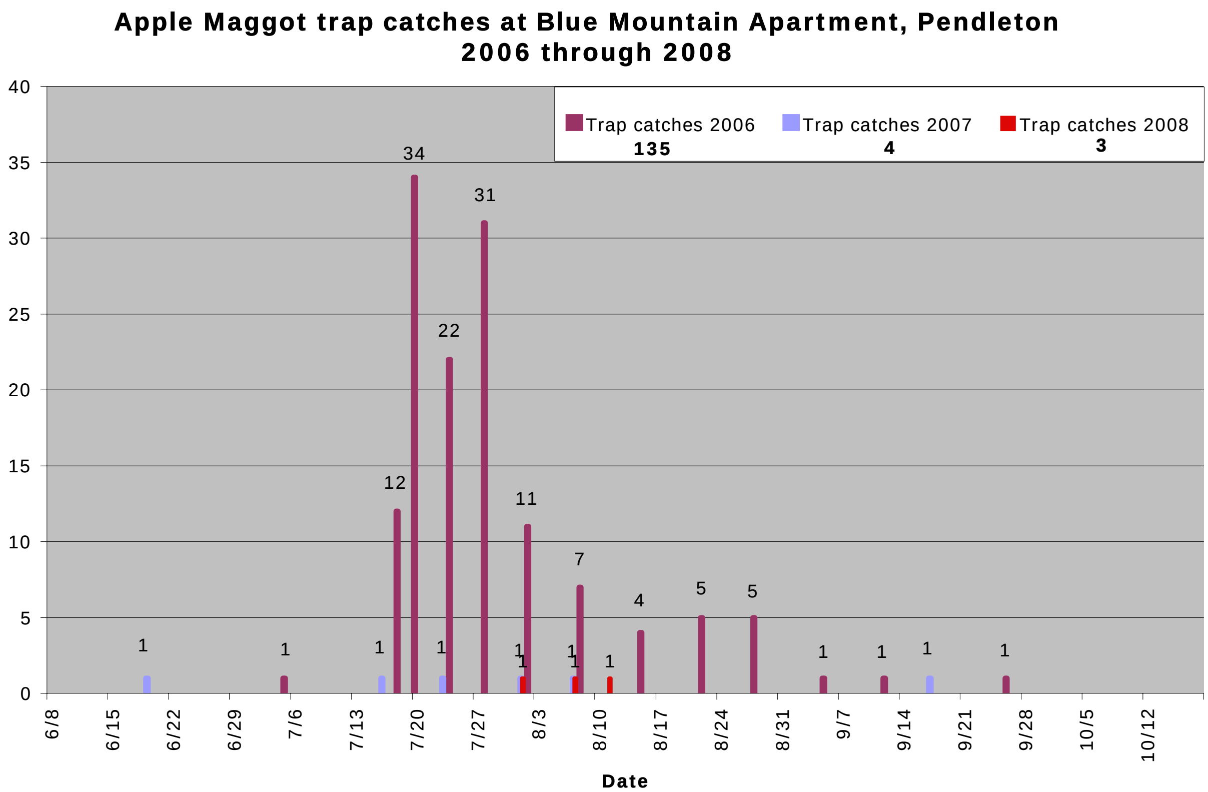
The Oregon Department of Agriculture (ODA) is trapping for AM in Eastern Oregon, in particular in the Milton-Freewater area, for more than 25 years. In 2000, one apple maggot was recorded in Echo; three were recorded in Arlington, and one each in Moro and Condon. Eradication efforts immediately implemented by ODA, OSU and local authorities in Arlington and Echo were successful in eradicating the apple maggot population. In 2001, more than 60 apple maggots were caught in southwest Pendleton on ornamental hawthorn. A delimitation survey in 2002 recorded 387 specimens around the Blue Mountain Apartments in southwest Pendleton. In a combined effort between homeowners, OSU, ODA and the Milton-Freewater private apple industry, host trees were either removed or sprayed. Due to economic limitations the spray actions were stopped after two applications. Continuous surveying in 2004 and 2005 by ODA and OSU showed positive trap catches for the southwestern part of Pendleton but is so far negative for the Milton-Freewater area.

If AM were to spread to the Milton-Freewater area, local apple production would be put at risk and pesticide use would likely significantly increase. These increased pesticide applications by commercial apple producers as well as homeowners may result in increased levels of pesticide residues potentially impacting Oregon watersheds and riparian forest trees.

In 2006, ODA began an AM eradication program at the Blue Mountain apartment complex in Pendleton that included: the removal of 70 hawthorn trees, the setting of yellow sticky baited apple maggot traps on the remaining 29 trees, a chemical treatment program, and the placing of more than 400 meters of fine insect proof netting to prevent apple maggots from hatching out of the soil. In early April 2007, ODA staff and several volunteer OSU Master Gardeners removed soil from around the hawthorns most heavily infested with AM and buried the soil under several feet of dirt to kill any overwintering AM pupae. After the first AM catch, a licensed applicator company applied neonicotinoid (a.i., acetamiprid) and imidacloprid treatments on the ground and foliage of all hawthorns at the apartment complex. Fifty-six traps were placed from June through September in host trees at the infestation site and within a 0.5-mile radius area.

A total of 135 AM were caught at the apartment complex in 2006, 4 AM in 2007, and 3 AM in 2008. Also one AM fly was trapped within the 0.5-mile buffer around the Blue Mountain apartment complex in 2006, and one AM in 2007. No other apple maggot was caught in any other trap outside the Blue Mountain Apartment complex.

In addition to Umatilla County apple maggot traps were also placed in La Grande, Union County (40 traps) and in the Ontario area, Malheur County (21 traps). All traps were negative.



Graph 1: AM catches at the Blue Mountain Apartment complex, Pendleton in 2006 through 2008

Section I.
Invasive and Emerging Pests

PESTS OF CAMELINA AND CANOLA GROWN IN THE VALLEY FOR BIOFUEL

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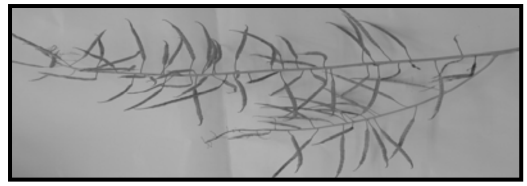

Recent volatility in petroleum prices has greatly increased interest in local production of oilseed crops in Oregon to provide feedstock for biodiesel and other bio-based products such as meal. Camelina (*Camelina sativa*) and Canola (*Brassica napus* L., spp. *oleifera*) are oilseed crops currently being grown and tested in the PNW to produce biodiesel. The oil content of camelina (36 – 42%) and canola (35 – over 45%) makes them competitive as a low cost feedstock for biodiesel. After oil is extracted from the seeds, the remaining by-product, seed meal, is used as a high protein animal feed.

Questions have arisen regarding the negative effects of growing these crops in the Willamette Valley, such as: “Can camelina be established between grape rows without interfering with wine grape production?” In most vineyards, clean cultivation or permanent perennial grasses are grown between the vine rows and the soil directly under the vine is kept weed free. There are many reasons to grow cover crops in vineyards. Cover crops suppress weeds, improve soil quality, enhance soil structure by adding organic matter increase biological activity, improve water infiltration, remove vigor (necessary in Oregon), reduce dust levels and help avoid soil erosion. Finally, cover crops can act as a refuge and provide food for natural enemies of vineyard pests; and most of all enhance natural control of arthropod pests. We planted camelina in the rows of two grape vineyards and we are monitoring for diversity and abundance of pest and beneficial organisms and observing the effects on vine quality.

Another question of concern: “Can canola be grown in the Valley without greatly interfering and increasing insect and disease pressure on specialty seed *Brassica* fields?” We will address pest management issues on these crops in the Valley and discuss a number of insects (e.g., cabbage maggot (*Delia radicum* L.), cabbage seedpod weevil (*Ceutorhynchus obstrictus*), 3 species of aphids (cabbage aphid (*Brevicoryne brassicae* (Linn)), green peach aphid (*Myzus persicae* (Sulzer)), and the turnip aphid (*Lipaphis erysimi* (Kaltenbach)), black pollen beetles (*Meligethes* spp.) that damage canola crops as well as other *Brassica* (Crucifer) crops. Seasonal assessments of pests were performed using sweep net, beat sheet, and visual plant examination over 2007 and 2008 season (Table 1).

Figure 1. Non-irrigated camelina growing between rows in an establishing vineyard and broadcasted in a field.

Table 1. Mean no. of seed pod weevils and black pollen beetles using sweep net samples in fall-planted canola fields

Field Site	Mean no. of Seed Pod Weevils (SPW) per ten, 180° sweeps[1]				Mean no. of Black Pollen Beetles (BPB) per ten, 180° sweeps[2]			
	5/6	5/20	5/23	6/9	5/6	5/20	5/23	6/9
South of Valley TILLED Planted 27-Sept	**2.7**	**2.3**	**2.1**	**1.7**	**4.5**	**7.5**	**2.2**	**3.4**
South of Valley NO-TILL Planted 27-Sept	**3.2**	**--**	**2.8**	**1.9**	**6.9**	**--**	**12.5**	**7.6**
North of Valley TILLED Planted 25-Sept	**3.4**	**2.5**	**1.8**	**0**	**5.7**	**2.2**	**2.6**[3]	**0**
Hyslop Farm	**--**	**--**	**--**	**0.5**				

[1] The SPW threshold documented in Canada is 2 per 180° sweep.
[2] Healthy well established winter oilseed canola (fall-planted) warrants a threshold of 15 BPB beetles per plant to justify treatment.
[3] North Valley field was sprayed for SPW on the 29th of May.

Approx. 10% of the canola terminals were infested with aphids in 2007; and no aphids were present in either of the fields in 2008. In both years, less than 5% of roots were infested with cabbage maggot injury.

Section I.
Surveys of Invasive and Emerging Pests

APPLE CLEARWING MOTH SURVEY IN WASHINGTON STATE AND NORTHWESTERN WASHINGTON DETECTIONS, 2008

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The first established population of the apple clearwing moth (ACM), *Synanthedon myopaeformis* Borkhausen (Lepidoptera: Sesiidae) (Figure 1) in North America was identified in 2005, in British Columbia, Canada. Since then, distribution of ACM has been determined to include areas east and west of the Cascade Mountains in southern B.C. as well as in Whatcom County in Northwestern Washington State, the first U.S. occurrence of this exotic species.

ACM is a European pest of apple and other Rosaceaeous trees, damaging host plants via larval feeding in the bark on the trunk and branches. Larval development usually takes two years in our climate, and attacks are usually associated with entry sites around pruning wounds, mechanical damage, or around graft unions. Larval frass is kept in larval galleries (not extruded) and external signs of infestation may be inconspicuous.

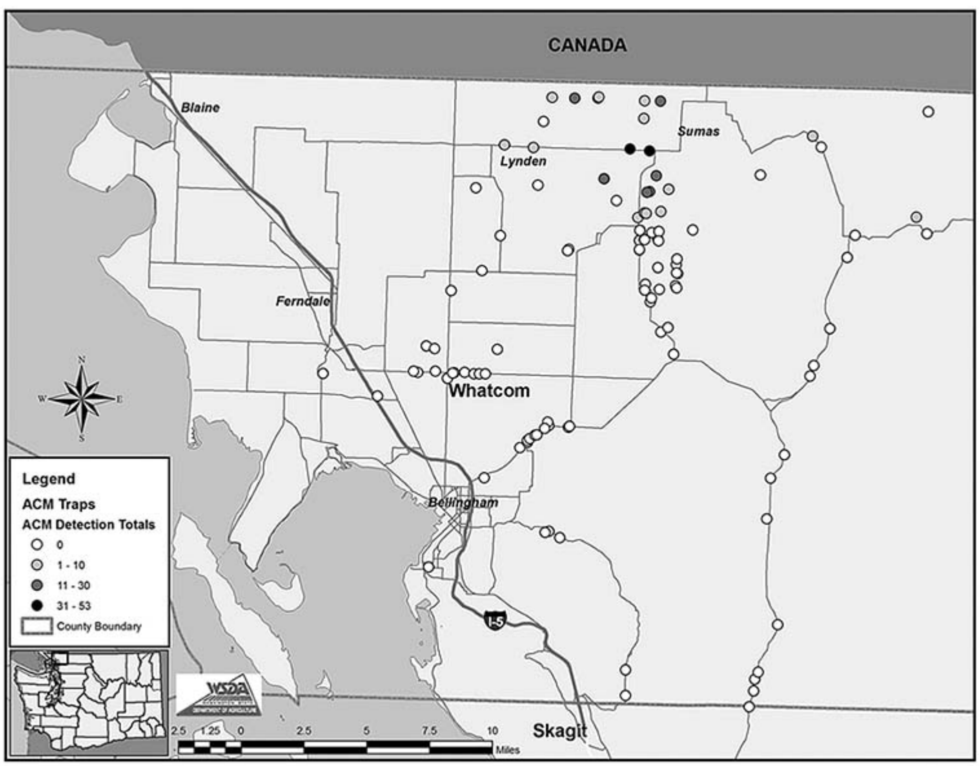
In 2008, two USDA APHIS Cooperative Ag Pest Survey (CAPS) funded surveys were conducted to detect ACM (if present) in Okanogan County in Eastern Washington, delimit the extent of the currently infested area in Northwestern Washington, and survey commercial nurseries statewide that imported foreign apple stock in recent years. Pheromone-traps, consisting of Pherocon P2-type (diamond) sticky-traps baited with peach tree borer lure were used at a total of 588 sites (Table 1.) Additionally, a small-scale test of alternate lure formulations provided by Ag. Canada and Scentry Inc. was conducted at 15 sites in the Whatcom County infested area (Table 2.).

Table 1. 2008 ACM Traps

County	# of Trap Sites
Whatcom	115
Skagit	136
Snohomish	60
King	60
Okanogan	52
Douglas	6
Grant	110
Franklin	12
Yakima	37
Survey Total	588

No ACM were detected in Okanogan County or elsewhere in Eastern Washington and in Western Washington only Whatcom County had ACM collections, in the north-eastern portion, west of the Cascade foothills (Figure 1).

Figure 1. Whatcom County Apple Clearwing Moth Collections, 2008



Catch numbers in the 4-way lure comparisons showed promising results for the Scentry lures, as both types captured more ACM than the USDA (Otis) or Ag. Canada 2x peach tree borer lures

(Table 2). The Scentry lures consisted of proprietary blends of the following components in Fibertape dispensers;
CWB: Z,Z-3,13-C18-Acetate and E,Z-3,13-C18-Acetate, and ACM: Z,Z-3,13-C18-Acetate and E,E-3,13-C18-Acetate.

Examination and sampling of unmanaged apple trees near ACM multiple-catch sites did find ACM larvae present around old graft unions, although the sites were more heavily infested with high populations of cherry bark tortrix (CBT) larvae, *Enarmonia formosana* Scopoli. CBT is another introduced pest of Rosaceous trees, first found in Whatcom County in 1991, and at all sites where ACM larvae were found, CBT larvae numbers were much higher than ACM (more than 30 to 1).

Table 2. ACM Lure Tests

Pheromone Lure	Total ACM Trapped
Otis ACM (PTB)	11
Scentry CWB	45
Scentry ACM	38
Canada ACMx2 (PTB)	4

Section I.
Invasive and Emerging Pests

2008 IDAHO ANT SURVEY

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ISDA and the University of Idaho, W.F. Barr Entomology Museum initiated a cooperative ant survey targeting exotic species and species of regulatory importance to Idaho. The key species targets including: Imported red fire ant (*Solenopsis invicta*), Argentine ant (*Iridomyrmex humilis*), and Pharaoh ant (*Monomorium pharaonis*). Cooperating organizations collecting survey samples included: The ISDA field investigators, members of the Idaho Mosquito and Vector Control Association, and the Idaho Environmental Care Association. Special ant collection kits were assembled and mailed to 127 survey participants. Each kit contained 6 plastic collection vials making the potential collection total 762. At the conclusion of the survey, ISDA received 167 ant samples from cooperators for a response rate of 22%. Collection sites were distributed through most of Idaho with individual samples taken from 25 of 44 Idaho counties. Ant collection sites included: urban premises, urban-rural outdoor sites and nurseries. Ant species determinations were made by Frank

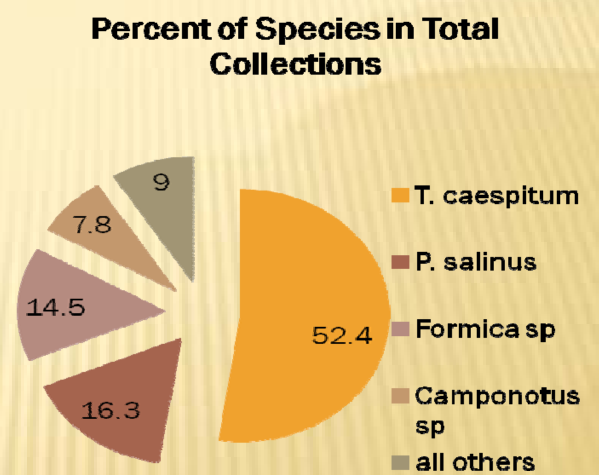
Pavement ant (*Tetramorium caespitum*)
Photo credit-California Academy of Science, AntWeb

Merickel, U of I Entomology Museum curator. The results of the ant survey and relative species collection frequencies are presented in the table below. **No ants of regulatory concern were collected nor were there any new species records as a result of this survey.** The dominant species in the survey was the Pavement Ant (*Tetramorium caespitum*). The first state record was 1979 in Lewistion, Nez Perce County, collector H. Homan. The first Boise, Idaho record was 1988*. *T. caespitum* has spread rapidly across the Gem State becoming a dominant pest species in the current list of 102 Idaho formicid species

**Pan-Pacific Entomologist 70(2) 148-158 1994 Merickel F. and W. Clark*

IDAHO ANT SURVEY SUMMARIZED

Common name	Scientific name	Number of Collections
Pavement ants	*Tetramorium caespitum*	87
Harvester ants	*Pogonomyrmex salinus*	27
Field ants	*Formica sp*	24
Carpenter ants	*Campanotus sp*	13
Cornfield ants	*Lasius sp*	10
Odorous house ants	*Tepinoma sessile*	3
Thief ants	*Solenopsis molesta*	2
Total		166



Section I
Surveys of Invasive and Emerging Pests

NEW DETECTIONS BY THE OSU INSECT CLINIC

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This year the OSU Insect Clinic continued normal operations and expanded its services to include honey bee pest and pathogen screening. County extension agents, general public and commercial industries of Oregon will submit an estimated 400+ specimens and 300 voice/digital ID's. The break down of physical samples is as follows: Baker (1), Benton (70), Clackamas (14), Clatsop (1), Columbia (2), Coos (20), Crook (10), Curry (3), Deschutes (8), Douglas (3), Gilliam (0), Grant (0), Harney (1), Hood River (8), Jackson (1), Jefferson (4), Josephine (0), Klamath (1), Lake (5), Lane (11), Lincoln (2), Linn (19), Malheur (1), Marion (36), Morrow (0), Multnomah (35), Polk (11), Sherman (4), Tillamook (2), Umatilla (26), Union (5), Wallowa (0), Wasco (6), Washington (16), Wheeler (1), and Yamhill (9) Counties and the states of AK, CO, MI, MT, VA, and WA.

This year new state records, new host records for established pests and some sporadic pests were submitted to the Clinic for Identification.

New Introductions/Detections:

Honey Locust Plant Bug, *Blepharidopterus (Diaphnocoris) chlorionis* (Say, 1832)
Historic range: Eastern USA
Hosts: Honeylocust (*Gleditsia triacanthos*)
Found by Robin Rosetta in Tigard, OR striping and distorted growth was observed on honeylocust. This pest over-winters as an egg. Eggs hatch in spring as the buds begin to expand. Adults appear in summer and lay their eggs in the bark of 2 and 3 year old twigs.

Tegenaria saeva (Blackwall 1844)
Historic range: Europe
Recent Expansion: Vancouver Isl, BC & Issaquah, WA
This spider is a close relative of the Giant house spider and the Hobo. Literature searches suggest this is the first time this species has been recorded in the US (sample submitted from Washington). I will be including this species in the Hobo Spider allies Pub (Manuscript & Illustrations in preparation).

Powder Post Beetle *Lyctus africanus* Lense
Historic range: India
Recent Expansion: Middle East
Hosts: *Bambusa bambos*, *Dendrocalamus strictus* and other Tropical hardwoods.
The sample was submitted by a home owner that found the beetles emerging from a recently purchased decorative mask.

Carpophilus obsoletus Erichson
The USDA recently identified this pest as a non- Quarantine pest when evaluating Thai pineapple pests. This beetle feeds on mature fruits much like many of our native Nitidulids. This species is well established in California.

Potential New Introduction:

Southern Purple Mint Moth, *Pyrausta laticlavia*
A badly damaged sample was submitted for ID. New material has been requested from the grower for confirmation. The moth was reared by the grower and was found feeding on and causing considerable damage to Rosemary and Lavender.

Rarities:

Twenty-plume Moth, *Alucita hexadactyla*
Historic range: Europe
Hosts: Honeysuckle
Found at a light in a home in Lane Co. This strange moth is rarely encountered in Oregon and will be the first specimen of this species deposited in OSAC.

Swallow Bed Bug, *Synxenoderus comosus*
Found by a home owner in her chimney. The home owner recalled hearing a birds in the chimney during the summer months. This species historically has not been found in the Willamette valley.

***Chaetechidius speciosus* (weevil)**
No host is known for this species. It was originally thought to be a transient species given that it was only found in Portland (ca. 1958). This specimen was submitted from a rural area in Western Benton Co. where a house was infested.

***Otohius lagophilus* (Acari, Argasidae)**
A rarely encountered rabbit tick that found imbedded on a dog's ear.

***Ozognathus cornutus* (Anobiid beetle)**
Only 1 specimen of this species is currently in OSAC (1950 Portland). The species is native to southern CA and the SW USA. The beetles were found dead in home dropping from the ceiling. This species has been collected emerging from acorns and oak galls.

Cheese skippers (Piophilidae)
Found by a home owner in a garden bed near the curb.

Hololena curta
Funnel Web Spider that is rarely encountered. Known from California and Washington(?).

Hololena rabana
Funnel Web Spider that is rarely encountered and only known from Oregon. Species has not been discussed or mentioned in the literature since its original description in Chamberlin & Ivie 1942.

Continuing Problems:

The Walnut twig beetle continues to be found throughout the state in conjunction with declining walnuts. It has not been linked to the cause of the decline. The beetles are prevalent in dead wood and failed galleries have found in the outer bark layers of living branches. A full report of the status Oregon Walnut decline can be found in Jay W. Pscheidt's 2008 Annual Report.
4 Bed bugs (*Cimex lectularius*) were submitted in 2008 (Multnomah, Umatilla & Benton Co.) Several false ID's were submitted by homeowners that were misled by pest control companies.

Section I
Surveys of Invasive and Emerging Pests

JAPANESE BEETLE SURVEY AND CONTROL VIA TRANSPORTATION VECTORS 2008

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According to an analysis that our Department's Diana Kimberling put together recently the annual impact on Oregon industry, primarily nursery, were Japanese beetle to become established in Oregon would be 34 million dollars.

Japanese beetle adults feed on the foliage and fruits of several hundred species of host plants, including rose blossoms, stone fruits, berries, including Himalayan blackberry, of great abundance in the Northwest, and many other plants. Grubs develop in the soil and feed on grass roots and prefer well-manicured grass to wild grasses, like those found at golf courses.

Like Gypsy moth and other pests homeowners do introduce Japanese beetles in vehicles traveling in the summer from back east, or as eggs and grubs in soil brought with plant stock from infested regions.

Utah and Colorado have fought significant populations of Japanese beetle in recent years, Cherry Hills Golf Course in Colorado trapped more than 56,000 Japanese Beetles in 2008.

For many years we have been aware of, and participated in, the national Japanese beetle program (U.S. Domestic Japanese Beetle Harmonization Plan) where quarantined states in the northeastern and Midwestern parts of the United States engage in efforts to exclude Japanese beetle from transportation via air cargo to protected states in the West, which includes Washington, Oregon, and Idaho, among many others. Due to positive catches in the immediate vicinity of the area where air cargo planes arrive and exchange cargo pallets since the early 1990s the ODA has focused its energy on surveying for and eradicating Japanese beetle coming in to Portland International Airport on aircraft.

In 2008 the Oregon Department of Agriculture threatened to fine air cargo carriers under the Oregon Quarantine Against Japanese Beetle Act (603-052-0127) in the amount of $10,000.

Due to our aggressive eradication program, which typically includes one treatment of soil pesticide (Merit, or more recently Arena) to attack Japanese beetle grubs and three foliar treatments (Tempo) to kill adult Japanese beetles, we assume that we have reintroductions of Japanese beetle via air cargo on an annual basis. During the season Japanese beetle are active in upper-midwest/Northeastern region, which runs roughly from mid-June to the end of August. Analysis of trap catches of Japanese beetle, interceptions of dead, moribund, and live Japanese beetle on air cargo plane inspections, and seasonal wind patterns gives us a fairly clear picture of introduction and population spread characteristics in our particular micro-region. You can access the windrose graph for the nearest large city to your area at http://www.wcc.nrcs.usda.gov/climate/windrose.html.

Oregon Department of Agriculture insect survey technicians or entomologists attempt to thoroughly inspect every air cargo flight coming to Portland International Airport from regulated airports in the east (as well as high risk flights from non-regulated airports like Louisville, Kentucky).

Japanese beetle's peak diurnal flight period is at peak temperature of the day. In the east this occurs between 11 am and 1 pm, the precise time when air cargo planes bound for western states are being loaded. In the West peak diurnal temperature occurs between 4 and 6 pm, the precise time that air cargo planes from quarantined states arrive in Portland and off-load their cargo. The typical tarmac conditions at off-load time is a constant 10 to 15 mile per hour wind coming out of the west.

At Portland International Airport Japanese beetles are impeded from establishing a population by many non-irrigated, sandy areas inhospitable to Japanese beetles. Japanese beetles are not, according to our trap catch data, attracted to the tall, non-irrigated grasses immediately surrounding the tarmac at the airport. Unfortunately east of the cargo area of Portland International Airport, beyond the Air National Guard air base, which has little or no irrigated areas, is Colwood golf course, which has hosted burgeoning populations of Japanese beetles at least twice in recent years. Japanese beetles are particularly attracted to frequently mowed, daily-irrigated grounds of golf courses.

Portland International Airport and the Port of Portland have been very cooperative in supporting our eradication efforts. Mitigation of habitat in coordination with spray projects can help reduce the likelihood of future introductions of Japanese beetles taking hold around airports.

While we have been diligent about the Japanese beetle s coming in at Portland International Airport, we have probably not paid enough attention to the dangers of introduction via ground transport of cargo. Though we have made attempts to place detection traps at and around sorting facilities, we probably have not been diligent enough to guarantee that Japanese beetles are not coming in at those facilities. In 2006 28 Japanese beetles (20 male and 8 female) were detected in a single trap in a small, irrigated bio-swale at the FedEx ground sorting facility on Swan Island. This is the primary FedEx Ground hub for the Pacific North-West and Alaska. There is little or no connection with FedEx air cargo except for express packages/containers. The facility receives trucks directly from 24 major metropolitan centers across the United States. Trailers with open doors and Indiana plates were found parked adjacent to positive trap site. Soil treatment of Arena was applied in September of that year. In 2007 10 Japanese beetles (3 female, 7 male) were detected in four traps surrounding the bio-swale. In 2008, during our second complete round of pesticide applications we caught only a single Japanese beetle just outside the spray boundary. Next season we shall take a wait-and-see posture before applying any further pesticide there to see if the population has been eradicated or moved beyond our application area.

Though there is only tenuous relationship between FedEx air cargo at Portland International Airport and FedEx ground operations on Swan Island, we were at least aware of the potential for introductions at the ground satellite facility. In Troutdale we caught a single Japanese beetle in 2006, but did not have sufficient evidence to surmise what the introduction vector was. In 2007 we caught another single Japanese beetle in Troutdale near the previous catch, but this time at the back of a hotel directly between two very busy commercial truck stops. We guess that Jbs are being introduced either with cargo, or in the cabs of trucks with the drivers. Regardless, truck traffic should be a focus of any regional Japanese beetle survey program. In September 2007 we applied Arena to a one-acre area surrounding the hotel and restaurants where the 2007 single was caught. In 2008 we conducted the full compliment of eradication measures of Arena and three applications of Tempo, including mowing down about an acre of 12-foot high blackberry bushes to mitigate food material for adult beetle and provide access to spray applicators to make contact with more of the plant material in the area.

Under continuing financial pressures, we are running out of avenues for funds to survey for and eradicate Japanese beetles as they come into the state from these transportation vectors. Since the nursery industry is the first most directly effected stakeholder to be impacted by Japanese beetle establishing itself here, an 800 million dollar industry, we continue to seek coordinated efforts with all stakeholders to intercept and eradicate Japanese Beetles as they arrive.

Section II
Bee Poisoning, Environmental Toxicology, Regulatory Issues

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The Washington State Commission on Pesticide Registration was formed in 1995 to support evaluations, studies, or investigations approved by the commission on pesticide registration regarding the registration or reregistration of pesticides for minor crops or minor uses.

In 1999, recognizing the need to pursue pest management solutions beyond pesticides the mandate of the Commission was broadened evaluations, studies, or investigations approved by the commission regarding research, implementation, and demonstration of any aspect of integrated pest management.

At the time of the transition from an entity solely devoted to pesticide registration to one devoted to integrated pest management no provision was included to change the name of the Commission on Pesticide Registration. The Commission continued on with its new mandate and its old name. The Commission funds projects in three areas; protection of human health, reducing risk to the environment and economic development.

The economic impact of the Commission between July 1, 2005 and June 30, 2007 will exceed \$23 million. The cumulative impact of all projects funded by the Commission since 1995 will exceed \$1 billion. In the period covering the 2006 and 2007 fiscal years, the Commission has funded 103 projects representing over 85 crops. Funding totaled \$1.53 million during the prior or an average of \$14,854 per project. The participating organizations provided \$2.05 million in matching funds and in-kind support, an average of \$18,049 per project. For every state general fund dollar provided by the Commission, participating organizations contributed \$1.06 in matching support. Combined Commission and matching funds spent during this period were \$3.6 million or an average of \$32,902 per project.

Between the time the Commission first met in October of 1995 and the end of the 2007 fiscal year, it has funded 613 projects veering over 100 crops and sites. The WSCPR funded an average of \$14,607 per project, for a total of \$33,392 per project over the past ten years.

The Commission was instructed to spend at least 25% of its funding on minor, minor crops (those crops not in Washington's top 20 in terms of value of production.) Of the \$1.53 million spent by the Commission during the 2006 and 2007 fiscal years, 44% supported projects on minor, minor crops.

Section II
Bee Poisoning, Environmental Toxicology, Regulatory Issues

INSECTICDIAL PACKAGE MIXES: GREAT DEAL FOR GROWERS OR THE DEATH OF IPM AND AN INVITATION FOR INSECT RESISTANCE

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For the past five years, the only commonly used insecticidal package mix product registered in the Pacific Northwest was Leverage (Bayer CropScience), a combination of the neonicotinoids, imidacloprid, and the pyrethroid, cyfluthrin. For the past four years this product has been the most widely used insecticide on potatoes in the Pacific Northwest. In the past six months five additional insecticidal package mixes have been registered on various crops in the PNW, although potatoes has been a primary target for all of them. Interestingly two companies, Syngenta and FMC, are responsible for all five. Several other companies are engaged in research and development for more than a dozen other combinations or look-a-like products. Since some products will contain only off patent products, generic versions will undoubtedly soon follow.

Insecticidal package mixes share some common features, five of the six contain a pyrethroid. Three of the six contain a neonicotinoids. Most future package mixes are expected to contain one of these two classes of chemistries and most will contain both. Five of the six contain one post patent product.

Registrant motivations are several. Many products contain a single post patent product combined with a patented protected product. The combination of the two products affords some protection and allows an increased financial margin to be included in the cost of the product. A second common motivating factor is the increase in spectrum of control A third factor is increased efficacy. Grower's like package mixes because they tend to be broad in spectrum, highly effective and often the products are priced comparably to single ingredient products. The combination of registrant and grower motivation is a potent force that will drive increased reliance on this type of product.

Pest management professionals with responsibility for creating, implementing and delivering integrated pest management programs prefer products that are selective for target pest insecticides and that minimize negative impact on beneficial organisms. WSU tree fruit IPM guideline recommenders will not include a package mix in their recommendations. The PNW potato insect IPM guidelines include an extended period that contains a pyrethroid prohibition that excludes the use of most package mixes.

Colorado potato beetle has developed resistance to pyrethroid insecticides in Idaho and to neonicotinoid insecticides on the East Coast and in the Mid West. Currently neonicotinoids are commonly used at planting time in potatoes. Due to concerns associated with resistance development, all current neonicotinoid labels contain a prohibition on foliar use if a product of that class has been used at planting. This prohibition is based on a joint voluntary agreement among base manufacturers of neonicotinoids. With the widespread use of package mixes coming to the PNW it is likely that use of neonicotinoids and pyrethroids will increasingly be used whether a particularly active ingredient is the appropriate choice. With the increase in generification of neonicotinoids and pyrethroids, it is likely that reliance on these classes will increase.

The increased use of insecticidal package mixes has the potential to negatively impact beneficial populations, flare secondary pest outbreaks and foment the development of resistant insect pest populations. Careful consideration should be made on use of package mixes when developing or implementing insect IPM programs.

Section III
Biological and Cultural Control

2008 BAYER CROP SCIENCE SPRING WHEAT TRIAL

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Protocol
A trial of six randomized replicates of three treatments was design to test the efficacy of Poncho 600 FS towards Basin Wire Worm in spring wheat at Central Ferry WA. Seeding was by the Hegi Cone Seeder in 4 x 20 foot replicates at 60 lbs seed per acre. The variety used was Alpowa. Seeding was 05/16/2008. Plant stand per ¼ meter square was measured on 06/10/2008 due to extremely cold weather subsequent to seeding preventing emergence. The treatments included a UTC with materials used in attaching treatments, a Raxil fungicide package for a control, and the Chlothianidin (Poncho 600) insecticide on trial for early season pest management in an IPM system.

Table 1. Plants stand 10 DPE (6/10/08) One-Way AOV for: L1397 Poncho RXMW

Source	DF	SS	MS	F	P
Between	2	145.333	72.6667	31.00	0.0000
Within	15	35.167	2.3444		
Total	17	180.500			
Grand Mean		11.833	CV 12.94		

Homogeneity of Variances	F	P
Levene's Test	4.82	0.0242
O'Brien's Test	3.81	0.0461
Brown and Forsythe Test	4.29	0.0337

Welch's Test for Mean Differences

Source	DF	F	P
Between	2.0	20.23	0.0004
Within	9.5		

Component of variance for between groups 11.7204
Effective cell size 6.0

Observations per Mean 6
Standard Error of a Mean 0.6251
Std Error (Diff of 2 Means) 0.8840

Table 2. LSD All-Pair wise Comparisons Test Plant Stand 10 DPE

Treatment	Mean plants ¼ meter sq	
Poncho	15.833	A
L1397	10.167	B
RXMW	9.5000	B

Alpha 0.05 Standard Error for Comparison 0.8840
Critical T Value 2.131 Critical Value for Comparison 1.8842
There are 2 groups (A and B) in which the means
are not significantly different from one another.

Wire worm management was SD compared to the UTC and fungicide only treatments confirming that this rate is sufficient for wire worm management in spring wheat as demonstrated in several years of research on wire worm damage to plant stands.

Russian Wheat Aphid became a major factor in crop destruction after jointing of the wheat. Aphids per tiller were counted as 100 tillers randomly selected from center rows of each treatment to eliminate edge effects…

Table 3. One-Way AOV for: L1397 Poncho RXMW - RWA per tiller

Source	DF	SS	MS	F	P
Between	2	2586.11	1293.06	25.64	0.0000
Within	15	756.33	50.42		
Total	17	3342.44			

Grand Mean 30.556 CV 23.24

Homogeneity of Variances	F	P
Levene's Test	0.69	0.5176
O'Brien's Test	0.54	0.5915
Brown and Forsythe Test	0.26	0.7756

Welch's Test for Mean Differences

Source	**DF**	**F**	**P**
Between	2.0	32.75	0.0001
Within	9.4		

Component of variance for between groups 207.106
Effective cell size 6.0
Observations per Mean 6
Standard Error of a Mean 2.8989
Std Error (Diff of 2 Means) 4.0997

Table 4. LSD All-Pair wise Comparisons Test for Russian Wheat Aphid on 07/10/2008

Treatment	Mean Russian Wheat Aphid per tiller	
L1397	42.500	A
RXMW	35.000	A
Poncho	14.167	B

Alpha 0.05 Standard Error for Comparison 4.0997
Critical T Value 2.131 Critical Value for Comparison 8.7383
There are 2 groups (A and B) in which the means are not significantly different from one another. Poncho at 0.19 Fl oz/Cwt provided SD aphid control at this date.

The appearance of RWA in this spring trial was a rare occurrence after many years of total biological management below economic injury levels by parasitoids (*Diarettiella rapae* Hymenoptera: Braconidae). Aphid management at very low rates for up to 30 DP is iffy when cold wet weather prevents the wasps from searching as occurred in 2008. The level of aphid management for this time period was exceptional for the 0.19 fl oz Cwt rate. After the 30 DPE RWA increased to a mean of 60 % in the UTC and over whelmed the trial during the very hot July resulting in no pollination of plant vigor for grain production.

However the wheat plants were very vigorous and growing rapidly when the RWA increase began. This is the first time since the 1980’s I have witnessed crop loss due to RWA at Central Ferry.

Section III
Biological & Cultural Control

RECRUITING NATURAL ENEMIES WITH METHYL SALICYLATE IN STRAWBERRY

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Herbivory induces plants to produce signaling volatiles. Methyl salicylate (MeSA) is commonly released from infested crops and is attractive to predators (DeBoer & Dicke 2004). In grape and hop fields, the application of synthetic MeSA has increased the abundance of predators and parasitoids (James and Price 2004). Application of MeSA can potentially prevent aphid and spider mite outbreaks in strawberry fields since MeSA attracts a variety of foliar predators. The impact on ground dwelling predators and the optimum distance and timing of MeSA application in the field are not well known.

Objectives

1. Determine if MeSA affects ground dwelling predators
2. Determine if synthetic MeSA lures can increase foliar natural enemy (NE) abundance, and can reduce pest abundance
3. Determine the effects of MeSA spatially and temporally

Methods

Control and MeSA plots were embedded in a large strawberry field. In MeSA plots, one 30 d Predalure® (AgBio Inc.) dispenser was hung at the center, 1.5ft aboveground, and another at ground level. The effect on ground dwelling predators was monitored by pitfall traps, and the effect on foliar insects by white sticky traps and visual inspection of strawberry leaves. To determine spatial trends, pitfall and sticky traps were set up at the point source, 5 and 10 m away, and ten leaf samples were taken at 1, 5, and 10 m radius from the point source. Six collections made over a month described temporal trends. Centers of each plot were spaced 100 m apart to minimize volatile overlap. Previous tests with various volatiles including MeSA have reported differences from the unbaited control when bait stations were 15 m apart (James 2005).

Does MeSA affect ground dwelling predators?

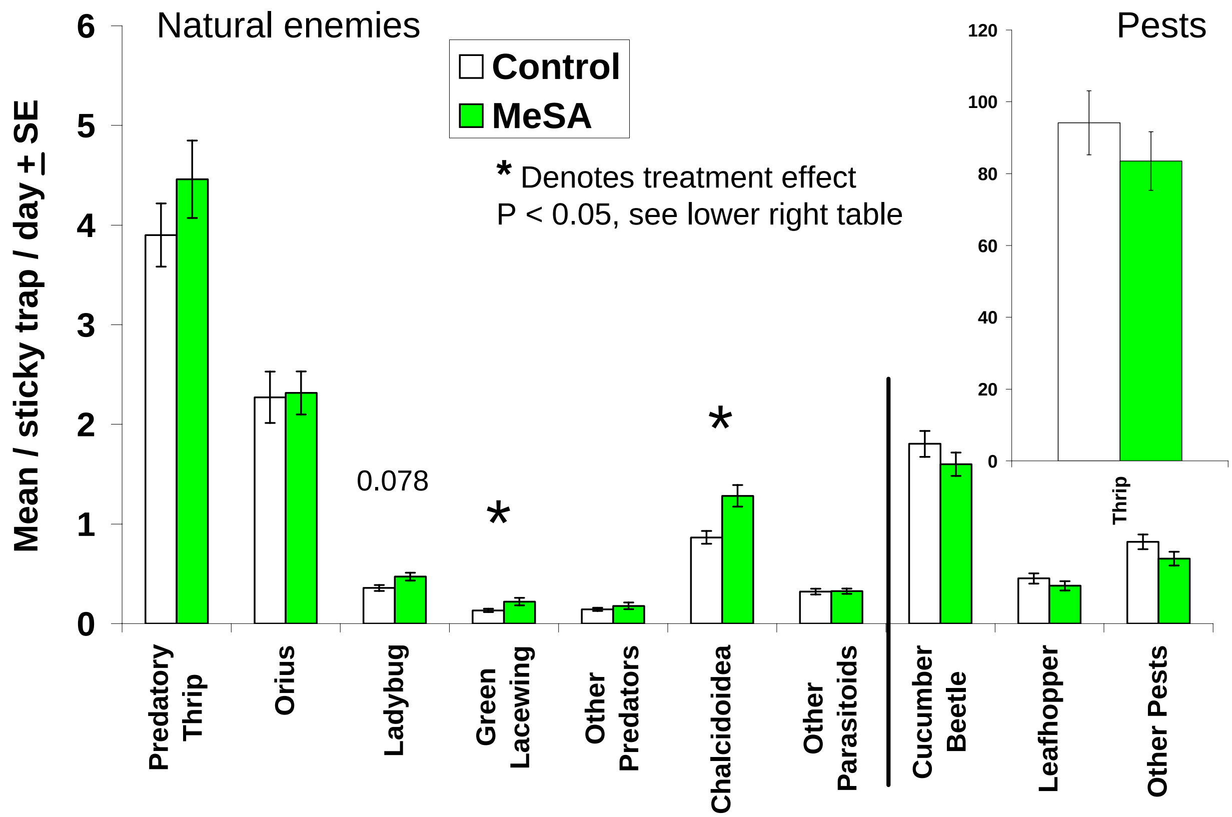
Pitfall captures were similar for most groups, including the dominant carabid. Other carabid species were slightly higher in MeSA than control plots. Additional testing when other carabids are more active is needed.

Mean captures / pitfall trap / day ± SE

	P. melanarius	Other carabids	Spiders	Daddy long legs
Control	17.6 ± 1.0	0.15 ± 0.018	0.32 + 0.044	0.21 ± 0.031
MeSA	17.4 ± 1.1	0.19 ± 0.022	0.31 ± 0.047	0.26 ± 0.035

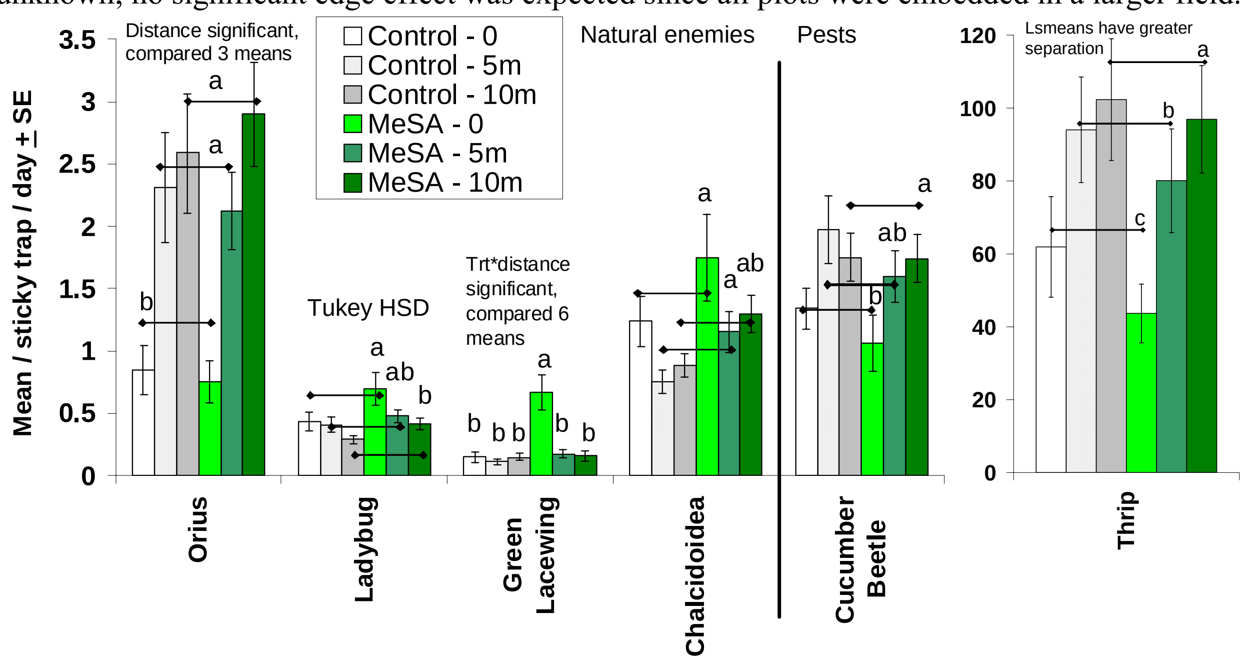
Does MeSA affect foliar NE / pests in the field?

In MeSA plots, marginally more ladybugs, 2X more green lacewings, and 45% more Chalcidoidea were captured from sticky traps (graph below), and 2-4X more total NE were observed on leaf samples. Pests were found in similar numbers from sticky traps and leaf samples.



What about spatial trends?

In sticky traps treatment*distant interactions affected green lacewings. More lacewings were captured at the point source of MeSA than at other stations (graph below). More ladybugs and Chalcidoidea were captured at the center, regardless of treatment, whereas fewer *Orius*, cucumber beetles, and pest thrips were captured at the center. Reasons for these trends are unknown; no significant edge effect was expected since all plots were embedded in a larger field.



What about temporal trends?
Differences in natural enemies captured on sticky cards appeared around 3-24 days after MeSA was placed in the field. Captures from 0-3 and 24-31 days were not different. In the beginning, a few days were possibly needed for MeSA dispensers to induce surrounding plants. Towards the end, volatiles may have overlapped across the field or plants may have acclimated to these signals.

Number of natural enemies observed directly on strawberry leaves was 2-4X greater in MeSA than control plots on days 14 and 17, and the reverse trend on day 28. While the number of pests on leaves was not significantly affected by treatment, pest abundance appeared somewhat lower in MeSA plots on days 17 and 21.

References
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Section III
Biological & Cultural Control

CEREAL LEAF BEETLE BIOLOGICAL CONTROL PROGRAM IN OREGON, 2008

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Annual survey
Our 2008 survey found one new positive county - Lincoln County, for cereal leaf beetle (CLB), *Oulema melanopus*. The beetle is now considered distributed in 20 counties in Oregon: Baker, Benton, Clackamas, Columbia, Crook, Deschutes, Jefferson, Lane, Lincoln, Linn, Malheur, Marion, Multnomah, Polk, Tillamook, Umatilla, Union, Wallowa, Washington, and Yamhill (Figure 1).

In 2008, ODA, USDA, and OSU continued cooperation on the biological control program to monitor, release, and redistribute the two parasitoid species, *Anaphes flavipes* and *Tetrastichus julis*, within the CLB infested counties in Oregon.

Egg parasitoid – *Anaphes flavipes*
We did not release any egg parasitoids in 2008 due to lack of source and funding. Instead, our effort was directed toward the recovery surveys at previous insectaries or release sites.
Two field insectaries in Washington Co. - at Banks and Scholls, one in Union Co., and various growers' fields in Washington and Linn counties, have been utilized as release sites for the egg parasitoid since 2000. After several seasons of releases, the parasitoids had a brief establishment

in the Banks and Scholls insectaries during 2002-05, where the parasitism rate (PR) reached a maximum of 30%. However, all recovery rates dropped to zero in 2007. Recovery surveys in 2008 also resulted in no parasitoid. A recovery effort was also made in Union County for the first time since the release there in 2005. CLB population was so low there that no eggs could be collected. To date no *A. flavipes* is permanently established at detectable levels at any of the release sites. Future recovery efforts may yet detect *A. flavipes* but, given its lack of success in other western states, the outlook is bleak.

Larval parasitoid – *Tetrastichus julis*

The goal for 2008 was to monitor *T. julis* distribution and parasitism rates, and to continue redistribution of the parasitoid to central Oregon. Collected CLB larvae were routinely dissected for parasitism assessment.

The OSU insectary field in Union County was discontinued since 2007. That area had high *T. julis* and low CLB populations in recent years. In fact, the success of *T. julis* there made it difficult to find CLB in Union County in 2008. The OSU insectary field at the Central Oregon Agricultural Research Center in Madras, Jefferson County, was still active in 2008 but received no *T. julis* releases. *T. julis* were redistributed and released in only two counties. The numbers of parasitized CLB larvae (and estimated number of *T. julis*) released in each county in 2008 are: Crook, 330 (1,600) and Deschutes, 405 (1,964). The parasitism rates among CLB release material from all areas ranged from 97 to 100%. *T. julis* continues to establish well in previous release areas. Samples tested from Umatilla County showed a 100% PR very early in the season. Baker and Multnomah counties continue to have high PRs after many years of establishment. The peak PRs of *T. julis* in each county were as follows: Baker (100%), Crook (0%), Deschutes (0%), Jefferson (12%), Linn (18%), Marion (3%), Multnomah (97%), Umatilla (100%), Washington (84%) (Figure 2**).** An estimated 383,626 *T.julis* parasitoids were released and redistributed in Oregon during 2000-2008 (Table 1**)**.

Economic Impact

Spraying for CLB is up considerably in Oregon in 2008 according to the most recent pesticide use survey by USDA/APHIS/PPQ. The acres of grain planted increased 6.7% in the state (Oregon Ag statistics). An estimated 57,347 acres were treated, up from 19,141 acres in 2007. The high price for grain this year and the increased cost of chemicals and fuel combine to increase the economic impact of CLB in 2008. The estimated cost to treat CLB in Oregon this year was $742,644.

T. julis can spread long distances on its own within grain production areas. In Union and Baker counties larval parasitism rates have been high since 2006. Growers there have gained confidence that the parasitoids will kill CLB larvae before yields are affected. Treated acres are down 99% compared with that of 2003, the peak year for CLB treatments. Experience in Union County indicates *T. julis* can effectively reduce CLB damage below economic levels.

Fig.1

Cereal Leaf Beetle 2008 Survey

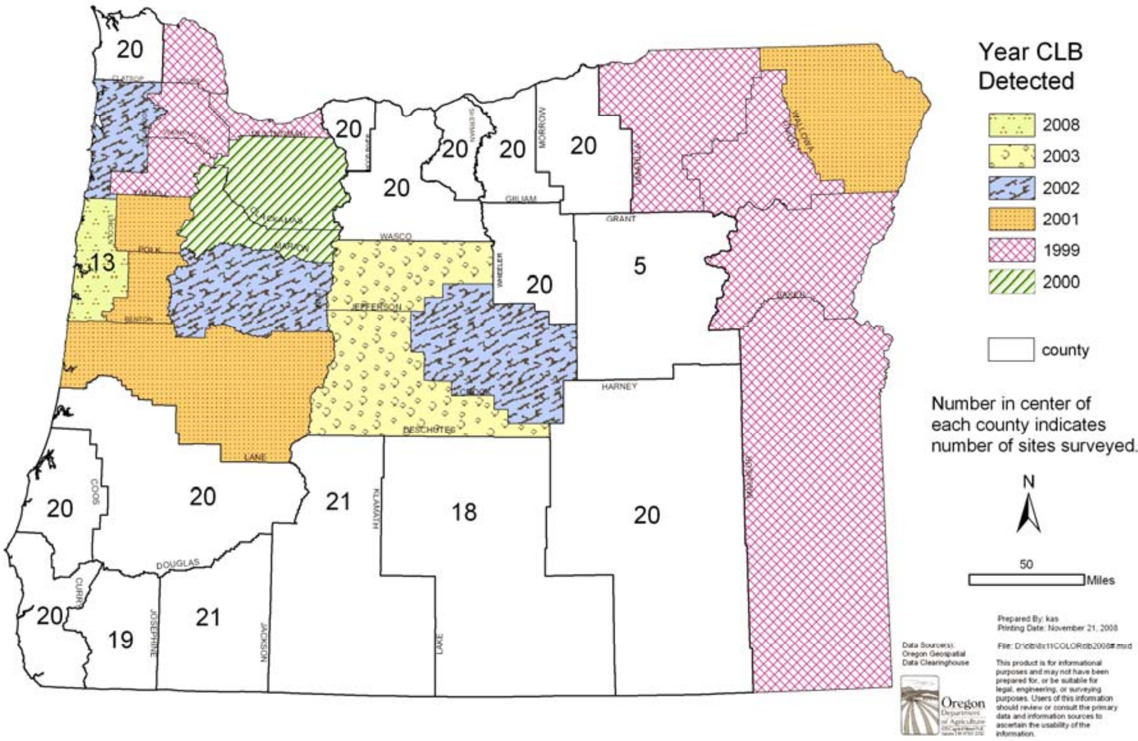

Fig. 2

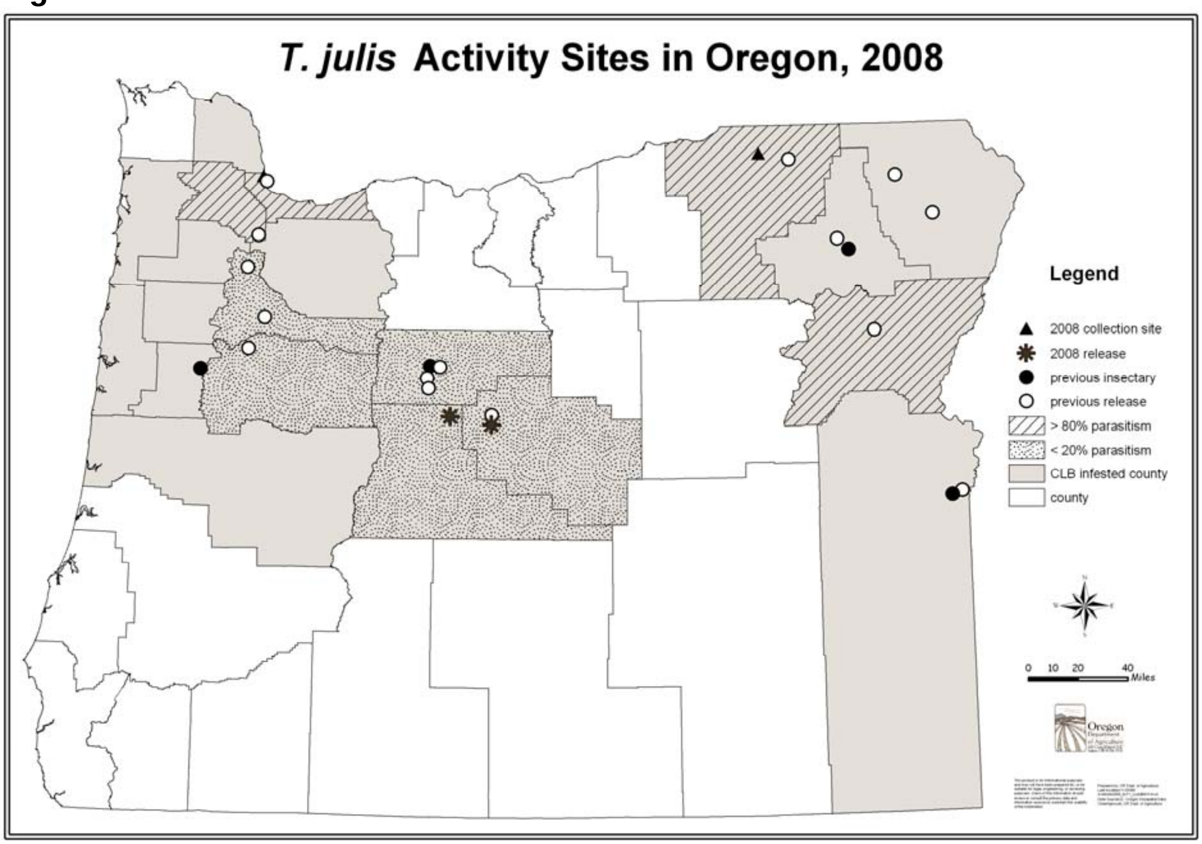

Table 1. Estimated number of parasitoids released in Oregon during 2000-2008.

Year	***A. flavipes***	***T. julis***
2000	263	12,310
2001	434	18,905
2002	6,200	107,566
2003	28,111	108,949
2004	26,213	51,000
2005	31,904	23,160
2006	16,750	41,965
2007	4,285	16,207
2008	0	3,564
Total	**114,160**	**383,626**

Section IV
Small Grain Pests

2008 VALENT WINTER WHEAT SEED TREATMENT TRIAL

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Protocol
A RBCD trial of winter wheat seeded 10/09/2007 at Central Ferry Washington included seed treatment rates of Standard Imidacloprid (Gaucho 600 FS, Thiomethoxam (Cruiser 5 FS) , and Chlothianidin (Valent V10170) as a test for rate specificity for Basin Wire Worm *(Limonius canus)* and subsequent crop pests. Ratings of stand per ¼ meter sq indicate fall wire worm stand reduction. Rates are in Grams/Kg active ingredient. A standard CO2 backpack sprayer was used for the Warrior Zeon application 10 days after plant emergence.

Table 1. One-Way AOV for: Cru Gau UTC V5 V7.5 V10 V20 V30 V50 WAR (aerial)

Source	**DF**	**SS**	**MS**	**F**	**P**
Between	9	145.900	16.2111	21.61	0.0000
Within	30	22.500	0.7500		
Total	39	168.400			

Grand Mean 15.300 CV 5.66

Homogeneity of Variances	**F**	**P**
Levene's Test	0.81	0.6112
O'Brien's Test	0.52	0.8497
Brown and Forsythe Test	0.43	0.9074

Welch's Test for Mean Differences

Source	DF	F	P
Between	9.0	21.48	0.0000
Within	12.2		

Component of variance for between groups 3.86528
Effective cell size 4.0

Observations per Mean 4
Standard Error of a Mean 0.4330
Std Error (Diff of 2 Means) 0.6

Table 2. LSD All-Pair wise Comparisons Test for plant stand 10 DPE

Treatment	Mean plant stand	
V20	17.750	A
V10	17.500	A
V20	17.250	A
V30	17.000	A
Gau 0.30	15.000	B
V7.5	15.250	B
V5	14.000	C
Cru 0.19	13.250	D
UTC	12.750	D
WAR	12.750	D

Alpha 0.01 Standard Error for Comparison 0.6124
Critical T Value 2.750 Critical Value for Comparison 1.6840
There are 4 groups (A, B, etc.) in which the means
are not significantly different from one another. The group followed by A, B, C had acceptable stands for winter wheat with 14 plants per ¼ sq meter good. No wire worm control was exhibited by the UTC and Warrior treatments. Cruiser at 0.19 continues to be below the desired level of wire worm control at 5 gm/kg.

Table 3. One-Way AOV for: CRU GAU UTC V5 V7.5 V10 V20 V30 V50 WAR

Source	DF	SS	MS	F	P
Between	9	10207.9	1134.21	8.67	0.0000
Within	30	3924.7	130.82		
Total	39	14132.6			

Grand Mean 90.170 CV 12.68

Homogeneity of Variances	**F**	**P**
Levene's Test	1.34	0.2567
O'Brien's Test	0.86	0.5693
Brown and Forsythe Test	1.00	0.4621

Welch's Test for Mean Differences

Source	**DF**	**F**	**P**
Between	9.0	11.95	0.0001
Within	12.1		

Component of variance for between groups 250.846
Observations per Mean 4
Standard Error of a Mean 5.7189
Std Error (Diff of 2 Means) 8.0878

Table 4. LSD All-Pair wise Comparisons Test of yield in Bu/Ac

Treatment	Mean Yield	
V10	106.63	A
V30	105.53	A
V50	104.53	A
V20	102.10	A
GAU	99.375	A
V5	94.150	A
WAR	80.975	B
V7.5	78.200	C
CRU	72.625	D
UTC	57.600	E

Alpha 0.01 Standard Error for Comparison 8.0878
Critical T Value 2.750 Critical Value for Comparison 22.241
There are 5 groups (A, B, etc.) in which the means
are not significantly different from one another.

Yield in Bu/Ac affected by wire worm damage in the seedling stage the SD cutoff rate for V-10170 is 10 grams per hectare. Very obvious SD for UTC, Cruiser at 5 grams, and Warrior spray which is slightly better than the V-10170 5 gram and 7.5 gram rates. I would choose the 10 gram rate rather than 5 or 7.5 for wire worm efficacy expressed as yield since the bump is 12 bu over V10170 5 gram rate. It appears that the Warrior foliar treatment may have enhanced yield through management of Bird- Oat Cherry Aphid vectoring of BYDV in the late fall

Section IV
Small Grain Pests

VALENT 2008
SPRING BARLEY SEED TREATMENT TRIALS

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Trial protocol. To study rates and efficacy of seed treatment insecticides on Cereal Leaf Beetle (CLB), Russian Wheat Aphid (RWA), and Basin Wire Worm, the barley variety Baronesse was seeded into a RCBD design of 8 by 20 feet replications with 4 replications per treatment. Seeding date was May 15, 2008. Soil temperature at 6 inches was 52 F at seeding. Treatments included an UTC and two rates of Thiomethoxam (Cruiser 5C), two rates of Gaucho 600 ST, and four rates of Valent 10170. The first evaluation was a count of plant stand per ¼ square meter 10 DPE. Stand reduction is a standard measure of wire worm activity and damage in seedling cereals.

Table 1. One-Way AOV for: Cru10 Cru30 Gau32 Gau5 UTC V10 V20 V30 V5

Plants stand 10 DPE ¼ meter indicating early wire worm damage

Source	**DF**	**SS**	**MS**	**F**	**P**
Between	8	474.500	59.3125	36.19	0.0000
Within	27	44.250	1.6389		
Total	35	518.750			

Grand Mean 14.917 CV 8.58

Homogeneity of Variances	**F**	**P**
Levene's Test	0.89	0.5407
O'Brien's Test	0.57	0.7951
Brown and Forsythe Test	0.49	0.8558

Welch's Test for Mean Differences

Source	**DF**	**F**	**P**
Between	8.0	47.20	0.0000
Within	11.1		

Component of variance for between groups 14.4184
Standard Error of a Mean 0.6401
Std Error (Diff of 2 Means) 0.9052

Table 2. LSD All-Pair wise Comparisons Test Barley plant stand ¼ meter

Treatment	Mean plant stand	
V30	21.000	A
V20	21.000	A
V10	16.000	B
Cru10	14.750	B
Cru30	14.500	B
Gau32	12.500	C
V5	12.250	C
Gau5	12.000	C
UTC	10.250	D

Alpha 0.1 Standard Error for Comparison 0.9052
Critical T Value 1.703 Critical Value for Comparison 1.5419
There are 4 groups (A, B, etc.) in which the means
are not significantly different from one another.

Plant stand fort spring barley which does not tiller like wheat is critical for good production. The groups A and B have good plant stands even though SD. Groups C and D are SD from A and B which are poor to marginal. Wire worm efficacy is provided by all groups compared to the UTC.

Cereal Leaf Beetle was a serious defoliation pest in 2008 due to a long cold wet winter and spring. Barley is less a preferred host for CLB than wheat, but the number of larvae per plant did approach the wheat economic loss level. This was due in part to summer generation adults appearing in late July.

Table 3. One-Way AOV for: Cru10 Cru30 Gau32 Gau5 UTC V10 V20 V30 V5 as CLB larvae/Plant

Source	DF	SS	MS	F	P
Between	8	55.2637	6.90797	6.86	0.0001
Within	27	27.1952	1.00723		
Total	35	82.4589			

Grand Mean 2.0853 CV 48.13

Homogeneity of Variances	F	P
Levene's Test	1.34	0.2672
O'Brien's Test	0.86	0.5631
Brown and Forsythe Test	1.39	0.2471

Welch's Test for Mean Differences

Source	DF	F	P
Between	8.0	M	0.0000
Within	M		

Component of variance for between groups 1.47518
Effective cell size 4.0
Observations per Mean 4
Standard Error of a Mean 0.5018
Std Error (Diff of 2 Means) 0.7097

Table 4. LSD All-Pair wise Comparisons Test Cereal Leaf beetle larvae/plant per plant 7/10/08

Treatment	Mean CLB larvae per plant	
UTC	4.0000	A
V5	3.5000	AB
Gau5	3.0000	B
Gau32	2.5000	B
Cru10	2.2500	B
V10	1.5000	C
V30	1.2525	D
V20	0.7550	D
Cru30	0.0100	E

Alpha 0.05 Standard Error for Comparison 0.7097
Critical T Value 2.052 Critical Value for Comparison 1.4561

These data show a reduction in CLB larvae compared to the UTC, with the higher rates of V10170 and Cruiser 30 grams having close to no larvae per plant. A conclusion based on this trial and previous trials of the same products in wheat that the seed treatment products under test do affect CLB populations at higher rates. If this is true the same efficacy should show in managing populations of aphids in spring barley.

Russian Wheat Aphid (RWA) appeared in the trial about the same time as the CLB larvae and were countable as a crop pest for the first time in several years at Central Ferry. The RWA appearance was also affected by the lack of early season predation by H. convergens and parasitoidism by *D. rapae,* an introduced Braconidae parasitoid of aphids, below 70 F.

Table 5. One-Way AOV for: Cru10 Cru30 Gau32 Gau5 UTC V10 V20 V30 V5 Russian Wheat

Aphid per 100 tillers on 7/10/08

Source	**DF**	**SS**	**MS**	**F**	**P**
Between	8	43.2654	5.40818	7.63	0.0000
Within	27	19.1354	0.70872		
Total	35	62.4009			

Grand Mean 1.2539 CV 67.14

Homogeneity of Variances	**F**	**P**
Levene's Test	1.29	0.2919
O'Brien's Test	0.82	0.5896
Brown and Forsythe Test	1.11	0.3858

Welch's Test for Mean Differences

Source	**DF**	**F**	**P**
Between	8.0	M	0.0000
Within	M		

Component of variance for between groups 1.17486
Effective cell size 4.0
Observations per Mean 4
Standard Error of a Mean 0.4209
Std Error (Diff of 2 Means) 0.5953

Table 6. LSD All-Pair wise Comparisons Test percentage Russian wheat aphid/100 plants

Treatment	Mean RWA on 7/10/2008	
UTC	35.000	A
Gau5	25.000	A
Gau32	20.000	B
V5	10.025	C
V10	7.550	D
V20	7.550	D
Cru10	5.050	D
V30	2.575	D
Cru30	1.000	D

Alpha 0.05 Standard Error for Comparison 0.5953
Critical T Value 2.052 Critical Value for Comparison 1.2214

These data are the mean percentage of RWA per 100 plants. The established RWA economic injury threshold for spring grains is ca. 16%. The treatments in the group C and D all provided efficacy below this threshold in this trial. Normally the RWA would not be noticed in spring barley.

Hippodamia convergens is the major Coccinellid predator of RWA and CLB in cereals. Ladybird Beetle larvae and adults can consume 40% of the CLB larvae and RWA in spring cereals. Since ladybird beetles have few natural enemies, counts of them indicate effects of the seed treatment insecticides that may pass through plant feeding insects.

Table 7. Hippodamia convergens adults (CLB predator) 100 plants on 7/10/08

One-Way AOV for: Cru10 Cru30 Gau32 Gau5 UTC V10 V20 V30 V5

Source	DF	SS	MS	F	P
Between	8	1624.22	203.028	5.98	0.0002
Within	27	916.75	33.954		
Total	35	2540.97			

Grand Mean 18.528 CV 31.45

Homogeneity of Variances	F	P
Levene's Test	2.04	0.0798
O'Brien's Test	1.30	0.2831
Brown and Forsythe Test	1.26	0.3036

Welch's Test for Mean Differences

Source	DF	F	P
Between	8.0	4.26	0.0142
Within	11.2		

Component of variance for between groups 42.2685
Effective cell size 4.0
Observations per Mean 4
Standard Error of a Mean 2.9135
Std Error (Diff of 2 Means) 4.1203

Table 8. LSD All-Pair wise Comparisons Test H.c 100 plants

Treatment	Mean Ladybirds per 100 plants 7/10/08	
UTC	35.000	A
V30	25.000	B
Cru10	17.500	C
Gau32	17.500	C
Gau5	15.000	C
V10	15.000	C
V5	15.000	C
Cru30	13.750	C
V20	13.000	C

These very strange data show no SD in between treatments. Lower H.c populations are likely due to the Poisson distribution typical of active Coleoptera.

Table 9. One-Way AOV for: Cru10 Cru30 Gau32 Gau5 UTC V10 V20 V30 V5 barley yield

Source	DF	SS	MS	F	P
Between	8	1803889	225486	8.86	0.0000
Within	27	687500	25463		
Total	35	2491389			

Grand Mean 1219.4 CV 13.09

Homogeneity of Variances	F	P
Levene's Test	2.01	0.0845
O'Brien's Test	1.28	0.2930
Brown and Forsythe Test	1.17	0.3515

Welch's Test for Mean Differences

Source	DF	F	P
Between	8.0	26.56	0.0000
Within	10.6		

Component of variance for between groups 50005.8
Effective cell size 4.0
Observations per Mean 4
Standard Error of a Mean 79.786
Std Error (Diff of 2 Means) 112.83

Table 10. LSD All-Pair wise Comparisons Test for barley yield in lbs/acre

Treatment	Mean lbs barley acre	
Cru30	1625.0	A
V30	1512.5	AB
Cru10	1350.0	BC
V10	1225.0	CD
V20	1150.0	DE
Gau32	1112.5	DE
V5	1100.0	DE
Gau5	1012.5	E
UTC	887.50	F

Alpha 0.1 Standard Error for Comparison 112.83
Critical T Value 1.703 Critical Value for Comparison 192.19
These data show SD in barley yield in three groups compared to the UTC. Several factors may have affected yield, but the basic and most likely factor in 2008 was wire worm damage to the stand. It is clear that 1650 lbs is about 50% of an expected yield and that cold weather in June damaged yield potential after wire worm damage occurred.

Conclusions:

Very late predation by *Hippodamia convergens* due to cold weather allowed RWA and CLB populations to increase above economic thresholds. Wire worm larvae reduced stand similar to other trials in the same rotation/location. So insect factors in this trial included Basin wire worm, Cereal Leaf Beetle, and Russian Wheat Aphid. Parasitoid activity was reduced by very cold and wet weather. Treatments of Chlothianidin and Thiomethoxam at the 30 grams/Kg level doubled yield over the UTC in this trial.

Section IV
Small Grain Pests

VALENT 2008
SPRING WHEAT SEED TREATMENT TRIALS

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Trial protocol. To study rates and efficacy of seed treatment insecticides on Cereal Leaf Beetle (CLB), Russian Wheat Aphid (RWA), and Basin Wire Worm, the wheat variety Alpowa was seeded into a RCBD design of 8 by 20 feet replications with 4 replications per treatment. Seeding date was May 15, 2008. Soil temperature at 6 inches was 52 F at seeding. Treatments included an UTC and two rates of Thiomethoxam (Cruiser 5C), two rates of Gaucho 600 ST, and four rates of Valent 10170. The first evaluation was a count of plant stand per ¼ square meter 10 DPE. Stand reduction is a standard measure of wire worm activity and damage in seedling cereals. This trial was seeded into wire worm infested recrop ground.

Table 1. One-Way AOV for: Cru10 Cru30 Gau32 Gau5 UTC V10 V20 V30 V5

Plants stand 10 DPE ¼ meter indicating early wire worm damage

Source	DF	SS	MS	F	P
Between	8	474.500	59.3125	36.19	0.0000
Within	27	44.250	1.6389		
Total	35	518.750			

Grand Mean 14.917 CV 8.58

Homogeneity of Variances	F	P
Levene's Test	0.89	0.5407
O'Brien's Test	0.57	0.7951
Brown and Forsythe Test	0.49	0.8558

Welch's Test for Mean Differences

Source	DF	F	P
Between	8.0	47.20	0.0000
Within	11.1		

Component of variance for between groups 14.4184
Standard Error of a Mean 0.6401
Std Error (Diff of 2 Means) 0.9052

Table 2. LSD All-Pair wise Comparisons Test plant stand ¼ meter sq

Treatment	Mean plants ¼ meter sq
Cru30	16.250 A
V30	15.750 AB
V20	15.250 BC
V10	14.750 C
Gau32	14.500 C
Cru10	13.250 D
V5	11.500 E
Gau5	10.500 E
UTC	8.5000 G

Alpha 0.1 Standard Error for Comparison 0.4665
Critical T Value 1.703 Critical Value for Comparison 0.7945
Based on a desired stand of 14 plants per ¼ meter sq treatments Cru 10, chlothianidin 5, Imidacloprid 5 failed to meet this standard due to wire worm damage. All treatments outperformed the UTC in stand protection.

Cereal Leaf Beetle was a serious defoliation pest in 2008 due to a long cold wet winter and spring. Wheat is a preferred host for CLB , and the number of larvae per plant did approach the wheat economic loss level in the UTC. This was due in part to summer generation adults appearing in late July reducing plant vigor through leaf destruction. The adult CLB normally emerge later and begin fall adult feeding on other grain crops including corn and Sorghum, then over winter in crop stubble

Table 3. One-Way AOV for: Cru10 Cru30 Gau32 Gau5 UTC V10 V20 V30 V5 as CLB larvae/Plant on 7/10/08

Source	**DF**	**SS**	**MS**	**F**	**P**
Between	8	55.2637	6.90797	6.86	0.0001
Within	27	27.1952	1.00723		
Total	35	82.4589			

Grand Mean 2.0853 CV 48.13

Homogeneity of Variances	**F**	**P**
Levene's Test	1.34	0.2672
O'Brien's Test	0.86	0.5631
Brown and Forsythe Test	1.39	0.2471

Welch's Test for Mean Differences

Source	**DF**	**F**	**P**
Between	8.0	M	0.0000
Within	M		

Component of variance for between groups 1.47518
Effective cell size 4.0
Observations per Mean 4
Standard Error of a Mean 0.5018
Std Error (Diff of 2 Means) 0.7097

Table 4. LSD All-Pair wise Comparisons Test Cereal Leaf beetle larvae/plant per plant 7/10/08

Treatment	Mean CLB larvae per plant	
UTC	4.0000	A
V5	3.5000	AB
Gau5	3.0000	B
Gau32	2.5000	B
Cru10	2.2500	B
V10	1.5000	C
V30	1.2525	D
V20	0.7550	D
Cru30	0.0100	E

Alpha 0.05 Standard Error for Comparison 0.7097
Critical T Value 2.052 Critical Value for Comparison 1.4561

These data show a reduction in CLB larvae compared to the UTC, with the higher rates of V10170 and Cruiser 30 grams having close to no larvae per plant. A conclusion based on this trial and previous trials in wheat is that the seed treatment products under test do affect CLB populations at higher rates. If this is true the same efficacy should show in managing populations of aphids in spring wheat.

Russian Wheat Aphid (RWA) appeared in the trial about the same time as the CLB larvae and was countable as a crop pest for the first time in several years at Central Ferry. The RWA appearance was also affected by the lack of early season predation by H. convergens and parasitoidism by *D. rapae*, an introduced Braconidae parasitoid of aphids, below 70 F.

Table 5. One-Way AOV for: Cru10 Cru30 Gau32 Gau5 UTC V10 V20 V30 V5 Russian Wheat Aphid per 100 tillers on 7/10/08

Source	**DF**	**SS**	**MS**	**F**	**P**
Between	8	43.2654	5.40818	7.63	0.0000
Within	27	19.1354	0.70872		
Total	35	62.4009			

Grand Mean 1.2539 CV 67.14

Homogeneity of Variances	**F**	**P**
Levene's Test	1.29	0.2919
O'Brien's Test	0.82	0.5896
Brown and Forsythe Test	1.11	0.3858

Welch's Test for Mean Differences

Source	**DF**	**F**	**P**
Between	8.0	M	0.0000
Within	M		

Component of variance for between groups 1.17486
Effective cell size 4.0
Observations per Mean 4
Standard Error of a Mean 0.4209
Std Error (Diff of 2 Means) 0.5953

Table 6. LSD All-Pair wise Comparisons Test percentage Russian wheat aphid/100 plants

Treatment	Mean RWA on 7/10/2008	
UTC	35.000	A
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V5	10.025	C
V10	7.550	D
V20	7.550	D
Cru10	5.050	D
V30	2.575	D
Cru30	1.000	D

Alpha 0.05 Standard Error for Comparison 0.5953
Critical T Value 2.052 Critical Value for Comparison 1.2214

These data are the mean percentage of RWA per 100 plants. The established RWA economic injury threshold for spring grains is ca. 16%. The treatments in the group C and D all provided efficacy below this threshold in this trial. Normally the RWA would not be noticed in spring cereals.

Hippodamia convergens is the major Coccinellid predator of RWA and CLB in cereals. Ladybird Beetle larvae and adults can consume 40% of the CLB larvae and RWA in spring cereals. Since ladybird beetles have few natural enemies, counts of them indicate effects of the seed treatment insecticides that may pass through plant feeding insects.

Conclusions: very late predation by *Hippodamia convergens* due to cold weather allowed RWA and CLB populations to increase above economic thresholds. Wire worm larvae reduced stand similar to other trials in the same rotation/location. So insect factors in this trial included Basin wire worm, Cereal Leaf Beetle, and Russian Wheat Aphid. Parasitoid activity was reduced by very cold and wet weather. Treatments of Chlothianidin and Thiomethoxam at the 30 grams/Kg level doubled yield over the UTC in this trial.
The basic results are plant stand protection from wire worm larvae.

Section V.
Soil Arthropods

WIREWORM CONTROL IN POTATOES

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Efficacy trials in potatoes were conducted at the Kimberly R&E Center of the University of Idaho. The experimental plots consisted of four 25 ft long rows (36 inch row spacing), with the two central rows treated with the insecticide and the two bordering rows left as checks. Seed treatments and in furrow at planting application methods were included. The center two rows and the bordering rows of each plot were harvested the last week of September for wireworm damage evaluations. Fifty tubers per each 25 ft row, for a total of 100 tubers per plot and 400 tubers per treatment, were examined for feeding damage. Fifty tubers per each check row were also examined. Weight and number of external feeding sites were recorded for each tuber. For percentage of affected tubers, a tuber with one or more wireworm holes was considered an affected tuber. A total of 8,000 tubers were examined for this experiment. Data were analyzed using an analysis of variance. A mean separation test (LSD, p=0.05) was used to determine significant differences between treatments. 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) were evaluated. Results are presented in the table below.

Treatment	Treatment	avg. holes/tuber	% USDA 1	% affected tubers	avg wt / tuber
1	Regent 3.2 oz/A	2.4 ed	44.5ab	71.3ab	183.7a
2	Mocap (63.9 oz/A)	2.1d	46.3ab	62.0ab	185.9a
3	Poncho 600 (0.16 oz/a)	4.3a	46.8ab	80.3a	177.3a
4	Poncho 600 (0.16 oz/a)	4.9a	46.3ab	79.0a	184.0a
	Admire pro systemic (5.7 oz/A)				
5	Poncho 600 (0.32 oz/a)	3.4bc	46.5ab	76.5a	186.4a
6	Admire pro systemic (5.7 oz/A)	2.8d	45.3ab	70.0ab	185.6a
7	Admire pro systemic (8.7 oz/A)	3.4bc	51.0a	75.5a	191.0a
	Regent SC4 (3.2 oz/A)				
8	Dow 1 (71.1 oz/A)	2.9bcd	48.3a	71.0ab	184.4a
9	Dow 2 (88.6 oz/A)	2.7d	45.25ab	61ab	183.1a
10	Dow 3 (107.4 oz/A)	1.6 f	44.5ab	53.5b	179.8a
11	Untreated control	2.8cd	38.2b	74.0ab	171.9a

Section V
Soil Arthropods

BLACK VINE WEEVIL CONTROL ON STRAWBERRY, 2008

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Black vine weevil (BVW), *Otiorhynchus sulcatus* (F.) field trial. Sprench treatments of two experimental insecticides were compared with three registered weevilcides and an untreated check in a 3 year-old 'Totem' planting in Burlington, WA. Each treatment was applied to five replicates separated by 5' buffers and arranged in a randomized complete block. A single row separated each block and blocks were composed of three, 30' row plots. Treatments consisted of experimental chlorotraniliprole (DPX-E2745 1.67 lb/gal SC, 0.09 lb(AI)/acre) and metaflumizone (BAS 320 I, 0.178 and 0.25 lb(AI)/acre + Penetrator Plus 0.25% v/v). They were compared with thiamethoxam (Actara™, 0.047 lb(AI)/acre); bifenthrin (Discipline™, 0.1 lb(AI)/acre; zeta-cypermethrin (Mustang™, 0.05 lb(AI)/acre and an untreated check. The treatments were applied between 9:30 to 10:30 pm on 16 July 2008, with a tractor-mounted plot sprayer equipped with three Spray Systems™ row application units. Each unit was equipped with 3 twin, fan spray tips (TJ60-8006) mounted on a row boom to deliver 150 gal/acre at 45 psi at 1.8 mph. BVW density per plot was determined from 3 minute, timed counts of adult weevils on strawberry foliage after 10 pm with the aid of flashlights at 1, 5 and 9 days posttreatment.

Both rates of metaflumizone performed comparably and there were no significant differences in adult BVW mortality with our standard bifenthrin at 5 to 9 days posttreatment (Table 1). At 5 DAT, the strawberry rows in each metaflumizone plot were littered with BVW adults in a state of *relaxed paralysis*. All were lying on their backs with weak leg and mouthpart movements. These symptoms fit those described by BASF for their sodium channel blocker insecticide, with death delayed 1-72 hours after ingestion. Although chlorotraniliprole's mode of action is very different from that of metaflumizone, affected insects exhibit very similar symptoms including paralysis, cessation of feeding and ultimately death. Pending their registrations, these data indicate both new chemistries could be rotated with registered weevilcides, thus ensuring their long-term use and sustainability in small fruit IPM programs.

Table 1. Mean black vine weevils per three minute search, 2008.

		Mean adult BVW		
Treatment	lb(AI)/acre	1 DAT	5 DAT	9 DAT
Actara	0.047	7.6b	2.6b	7.4b
DPX-E2Y45 1.65SC	0.090	5b	5.8b	9.8b
Discipline 2EC	0.10	0	0.2b	0.2b
BAS 320 I	0.178	11.4b	0.4b	0.2b
BAS 320 I	0.25	12.4b	0.8b	0.2b
Mustang	0.05	3.4b	4b	3b
Untreated check	-	26.2a	22a	32.4a

Mean within columns followed by the same letter are not significantly different (Fisher's protected LSD, P<0.05), PRC ANOVA SAS.

Section V
Soil Arthropods

CLAY COLORED ROOT WEEVIL CONTROL ON RED RASPBERRY, 2008

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Clay colored root weevil, *Otiorhynchus singularus* (L.). Clay colored weevils (CCW) were collected from the Lynden area on 'Meeker' red raspberry on 26 June, 2008. Individual trifoliate leaves were placed in water-filled vials capped with a cotton roll plug. Each treatment consisted of 30 weevils placed on 6 individual leaf arenas held in 5-inch diameter Petri dishes held at room temperature. These leaf arenas were each dipped in respective deionized water-insecticide solutions for approximately 5 sec and air-dried (Table 1). After 1 day posttreatment, Brigade™ (bifenthrin) and two rates of experimental BAS 320 I provided complete mortality of CCW through contact and ingestion under lab conditions. Under these ideal lab conditions, the results provided no evidence for the onset of CCW resistance to Brigade as was suggested from 2006 results from a field population collected at the same location. BAS 320 I represents a new class of chemistry (Group 22) that controls insects by ingestion, blocks the flow of sodium ions and does not require metabolic bio-activation to become insecticidal. CCW exposed to BAS 320 I were in a moribund state after 1 day posttreatment. Symptoms observed were cessation of feeding, metabolic stress (e.g., diarrhea) and uncoordinated movements that result in prolonged morbidity and death that extended to12 DAT (e.g., 63% low rate, 100% high rate). These post exposure responses are similar for other species of root weevils when also exposed to neonicotinoids such as Actara™. Though the target site of BAS 320 I differs from the neonicotinoids, population mortality upon exposure to Actara often is variably prolonged for 3-5 days as well in adult root weevils. We scored the moribund weevils as dead because they were incapable of pest status and population survival under field conditions given their responses in the laboratory. The insecticidal effect on root weevils is irreversible, as we have observed for the pyrethroids and neonicotinoids, and slower acting compared with the mode of actions of the old carbamate and OP chemistries. BAS 320 I is pending registration in blueberry and we will suggest it as an 'A' priority next year for strawberry and caneberry IR-4 residue projects.

Other than spotty clay colored weevil infestations in the north Lynden area, black vine weevil, strawberry root weevil and rough strawberry root weevils were generally economically managed throughout Whatcom and Skagit counties this past red raspberry growing season. These empirical observations suggest the root weevil complex still remains susceptible to Brigade/Capture and Malathion, especially if applied as an evening application when the adults are known to be actively feeding during their pre-egg laying period. Growers are learning and becoming more confident with application/timing of the neonicotinoid chemistries registered for foliar control of root weevils in caneberries (i.e., Actara, Assail™).

Table 1. Clay colored root weevil bioassay, 2008.

Treatment	lb(AI)/acre	Percent Mortality 1DAT
BAS 320 I	0.18	100a
BAS 320 I	0.25	100a
Brigade 2EC	0.10	100a
Untreated check	0.03	0b

Mean within columns followed by the same letter are not significantly different (Fisher's protected LSD, $P<0.05$), PRC ANOVA SAS.

Section V.

BLACK VINE WEEVIL (OTIORHYNCHUS SULCATUS) MONITORING IN FIELD GROWN ORNAMENTALS

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The black vine weevil (BVW), *Otiorhynchus sulcatus* (F.) (Coleoptera: Curculionidae) is a serious pest of nursery crops. Trials were performed at field-grown wholesale nurseries in 2008 to test plant derived attractants of the BVW. A number of plant-based compounds were tested in the field and their attractiveness determined.

Summary of 2008 Results:
In April 2008 Dr. van Tol visited Oregon visiting different nurseries and developing together suitable field trial set-ups. During the field trials Plant Research International provided test odors for field testing the attractiveness to the black vine weevil. Field trials were conducted at three wholesale nurseries in 2008. One of the odors tested consistently captured 2-3× as many black vine weevil (BVW), *Otiorhynchus sulcatus* L. (Coleoptera: Curculionidae) adults as the untreated control plots throughout the growing season (Figure 1 and 2). Another odor was attractive to preovipositional adults (2-3×), however, once egg laying commenced, it was no longer attractive. We also identified an odor that potentially acts as a repellent. We conducted a limited number of trials with this odor as our primary objective was to attract weevils. However, a repellent odor would also have practical implications in situations were growers were trying to exclude weevils from areas of the nursery. For those odors that were attractive, we observed adult weevils congregating in the plant canopy around odor sources in the field but not increased numbers of weevils in our traps. We are using the Exosect® trap which is commercially available to growers in conjunction with odors for monitoring for BVW in the field. We had hoped that not only could we identify odors attractive to BVW but that an increased number of weevils would be captured in the Exosect® trap. Capturing weevils in traps serves several purposes. Most importantly it simplifies monitoring weevil presence and activity in the nursery. We hypothesize that the lack of increased trap captures in plots containing odors attractive to weevils was do to a behavioral dichotomy between the attractive odors and the trap design. The Exosect® trap is designed to capture weevils as they search for a dark space to hide during the day. On the other hand, the odors are attractive to weevils at night as they feed. At night, normal BVW behavior is to crawl up the plant canopy to feed. We have obtained additional funding from the Oregon Association of Nurseries to develop trap designs that work in conjunction with attractive odors. The advent of effective adult attractants and traps for capturing adults attracted to the odors will revolutionize BVW management. Not only will the goal of this project be realized with spray timing vastly improved, but this research will help lead

to the potential development of new management tactics such as mass trapping and attract and kill strategies.

Figure 1

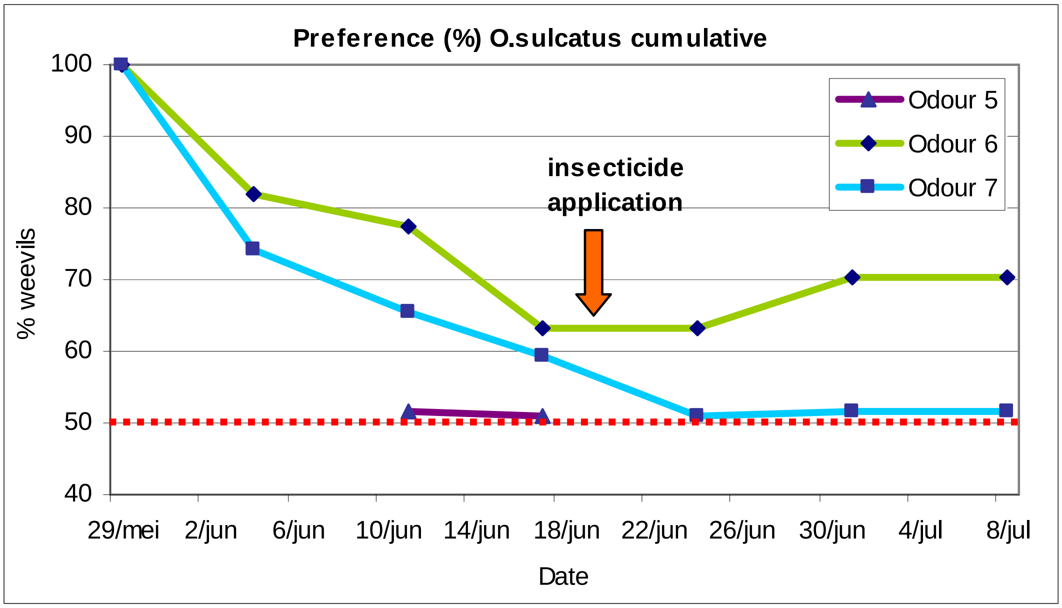
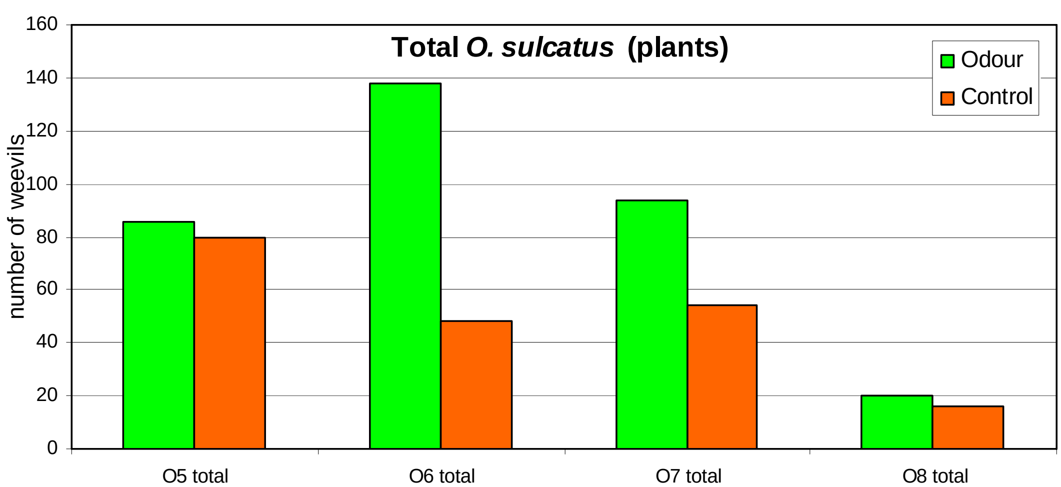


Figure 2



Section V
Soil Arthropods

MANAGING SLUGS AND SOD WEBWORMS IN GRASSES GROWN FOR SEED

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Grass seed fields in the Willamette Valley with *minimum tillage seeding system, reduced field burning, improved field drainage*, and *increased organic matter* are developing a persistent group of pests causing increasingly greater economic losses in grass seed and rotational crop production. Slugs, sod webworms, craneflies, symphylans, cutworms, wireworms as well as stem and leaf feeders like frit fly, meadow spittle bug, plant bugs, are a few of these pests observed in greater numbers over the past few years. We will focus our talk on 2 of the pests including slugs (*Deroceras reticulatum* and *Arion* spp.) and sod webworms (*Chrysoteuchia topiaria*).

First, we will discuss how the seasonal growth and development of SLUGS dictates the windows of opportunity for control; and compare efficacy studies conducted at different seasonal periods and how weather influences the effectiveness of treatments. We will discuss only products, rates and use patterns that are registered for use on grasses grown for seed.

We will emphasize how knowledge of a slug's life history, behavior and dispersal are used in structuring management strategies; and compare slug numbers using various field monitoring techniques (e.g. 19x19 inch slug blankets, 10.5 defined area traps, 10.5 cold water extraction from grass cores, bait stations) for quantifying population densities to help determine the need for treatment.

In addition to slugs, sod webworms severely damaged many Willamette Valley fescue and perennial rye grass seed fields in 2007 and 2008. Up to 15 larvae per crown were collected in some fields. Dead and dying crowns became obvious in SEPT. To control larvae, irrigation or a timely rainfall is very important. Pre-irrigate dry soil and either (as label states) chemigate or immediately incorporate a broadcast sprayed insecticide into the crowns where the larvae feed. Direct control of sod webworm larvae continues to be difficult. This is due to: the lack of sufficient and timely rainfall, large amounts of post harvest residues that accumulate on the crowns of grasses and the inherent low solubility of insecticides coupled with their tendency to permanently adsorb to vegetation, soil and organic matter in the field. Spray should be applied when larvae are small, before plant damage occurs. This timing occurs from mid-AUG to early SEPT depending on field, location and year.

To control sod webworm moths, an insecticide application timed to the approximate peak flight of this pest in a grass seed field appears to reduce subsequent economic infestations of the larvae that can occur from late summer through early fall. The principal is to kill or repel them with an insecticide as they emerge in the field or immigrate to it. This is done early to mid-way through the flight period (usually JUNE 15-20), a little before peak flight. Pheromone traps should be used to monitor moth flight and determine need for spray (moth counts exceed 75 moths/trap for any 5 day period (late June). On MAY 31, commercial pheromone traps were placed in fields (2 for every 40 to 60 acres). Total moths trapped were recorded over 5 day periods: MAY 31- JUNE 5, JUNE 6 – 10, JUNE 10 – 15, JUNE 15 – 20, JUNE 20 – 25, etc. through JULY 20. It is important to move the traps once or twice to different field locations during each 5 day period to account for field variation in the flight. If and when traps in a field average 75 or more moths per trap over a 5 day period there is potential for larval damage. Effective residues for pyrethroid products in grass seed production should kill or repel SWW adults for 2 to 2 ½ weeks. A second moth spray may be indicated if moth pressure is great, swathing date or harvest dates fit with the product(s) used and label restrictions are met. We believe that both Baythroid XL and Lorsban 4E insecticides that were applied for larval control would have performed better on low residue PRG/TF plantings than they did in this high residue tall fescue field. Moribund (sick from insecticide poisoning and eventually dying) and dead larvae were recorded along with live larvae. Mortality and sickness were not noticed in the experimental plots until 10 DAT. We feel this could be attributed to, 1) cold soil temperatures, 2) larvae going into pre-pupal diapause and therefore not actively feeding, 3) it possibly took that long for the small amount of insecticide that is not adsorbed to straw/soil to reach and kill larvae.

Table 1. Mean number of SWW larvae/pre-pupae per tall fescue crown at 0, 3 and 10 days after treatment. Additional percent reduction reported from 3 DAT larval/pre-pupae collection brought to lab. October, 2007

	0 DAT pre- *10/15/07*	3 DAT *10/19/07*	10 DAT *10/26/07*	3 day lab observation[2]
Treatment	**-------Mean number of SWW larvae per crown[1]------**			**% SWW Reduction[3]**
UTC	8.00 ± 0.54	1.06 ± 0.07	0.66 ± 0.18	11
Baythroid XL (4 oz/a)		1.60 ± 0.64	0.13 ± 0.08	30
Lorsban 4E (2 qt/a)		1.87 ± 0.33	0.27 ± 0.07	22

1 No differences in numbers of larvae were seen between treatments.
2 Larvae and pre-pupae were transported back from 3 DAT evaluation and observed for 3 days.
3 Fungal and bacterial pathogens and unknown causes killed some larvae as seen in the untreated control from laboratory observation. No parasites emerged from SWW.

Table 2. Pheromone trap catches and subsequent larval SWW infestations in three locations in each of three fields treated to kill sod webworm moths with Baythroid XL. July, 2008

	No. of SWW Moths per Pheromone Trap per Date			**Mean No. SWW Larvae per 6"crown[1]**	
PRG FIELD #	**6/18/08**	**6/23/08**	**6/30/08**	**9/3/08 60 DAT**	**9/17/08 74 DAT**
25	**8**	**16**	**35**		
			SE-UTC Unsprayed	**1.4**	**No data**
			NW	**1.9**	"
			NE-Mid	**1.7**	"
27	**2**	**10**	**44**		
			SW-UTC Unsprayed	**3.4**	**0.83**
			NW	**1.4**	**1.67**
			NE-Mid	**0.7**	**0.5**
26	**2**	**45**	**67**		
			S-UTC Unsprayed	**4.2**	**5.8**
			NW	**0.4**	**0.67[2]**
			NW-Mid	**0**	**1.5**

[1] Sample based on 6 or 7, 6-inch grass cores.
[2] One SWW larva was parasitized; small cocoon present.

Table 2. Control of sod webworm infesting tall fescue.

	Mean no. of live SWW larvae per crown		Percent reduction within treatment	Percent reduction compared to UTC
Treatment	**Pretreatment**	**6 DAT**		
	Sept 26, 2008	Oct 2, 2008		
Baythroid XL	5.63	2.50	58%	50%
Lorsban 4E	6.06	3.42	41%	25%
UTC	5.56	4.75	14%	--

[1] Eight, 6-inch grass cores were taken for pre-treatment counts; six, 8-inch cores were taken for post-treatment counts. No statistical differences in SWW numbers were seen between treatments.

MANAGEMENT OF POTATO VIRUSES AND VECTORS

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This experiment was conducted at the University of Idaho, Kimberly Research and Extension Center. The experiment consisted of 16 treatments (see Table 1 for rates and application methods for each treatment) and one control replicated four times in a randomized complete block design. Individual treatment plots were four rows (36 inch row spacing) wide by 25 ft long with 5 ft alleyways separating the plots.

Green peach aphids (GPA) were mass reared in growth chambers on Chinese cabbage plants. Aphids became viruliferous after feeding on an infected *Potato virus Y* (PVY^{o}) tobacco plant. Aphids were then released into the center two rows of each individual test plot on June 24. PLRV-infected GPA in ground cherry, *Physalis floridana* leaf strips were also released into each plot as stated above. Potato aphids (PA) from naturally occurring populations and GPA were counted by non-destructively sampling five plants in the center two rows of each plot for a total of 20 plants per treatment. Aphid counts were taken at weekly intervals for ten weeks from June 18 – Aug 19. Insecticides were sprayed on July 08 and on July 29. ELISA tests were conducted on 5 randomly selected plants /plot (middle two rows) after plant emergence to determine initial virus inoculum. ELISA tests were also conducted on 5 randomly selected plants /plot (middle two rows) before and after each application. All tubers from the middle two rows of each plot were harvested to estimate yields per treatment. Thirty randomly selected tubers per plot (120/ treatment) were collected and stored for three months and then planted. Emerging plants will be ELISA tested in January for PVY and PLRV-infection to determine final infection rates per treatment.

The number of aphids is presented as average per plot (5 plants per plot). Data were analyzed using analysis of variance using Proc GLM (generalized linear model). The treatment means were separated using Fisher's LSD ($\alpha = 0.05$). Statistical analyses were performed in SAS (SAS version 9.1, SAS institute, Cary, NC). Results are presented in the tables below.

Table 1. Treatment list.			
		Amount of Pesticide /Acre	Application Method
1	Untreated Control		
2	Admire Pro	8.7 oz	IFAP
3	Belay	18.0 oz	IFAP
4	Platinum	8.0 oz	IFAP
5	Admire Pro	8.7 oz	IFAP
	Temik 15G	320.0 oz	
6	Movento 240 SC	4.0 oz	Foliar
	NIS	0.25% V/V	
7	Movento 240 SC	4.0 oz	Foliar
	Provado 1.6	3.8 oz	
	NIS	0.25% V/V	
8	Movento 240 SC	4.0 oz	Foliar
	Baythroid XL	2.8 oz	
	NIS	0.25% V/V	
9	Movento 240 SC	4.0 oz	Foliar
	Provado 1.6	3.0 oz	
	Baythroid XL	2.0 oz	
	NIS	0.25% V/V	
10	Movento 240 SC	4.0 oz	Foliar
	Ammonium Sulfate	2.0 oz	
	NIS	0.25% V/V	
11	Movento 240 SC	4.0 oz	Foliar
	NIS	0.25% V/V	
12	Fulfill	5.5 oz	Foliar
13	Monitor	32.0 oz	Foliar
14	Vydate	135.0 oz	IFAP
15	Agricultural Mineral Oil	4 % V/V	Foliar
16	Warrior	2.56 oz	Foliar
17	Assail	4.0 oz	Foliar

Table 2. Effect of various insecticides on Green Peach Aphid												
	Treatment	18-Jun	24-Jun	2-Jul	8-Jul	15-Jul	21-Jul	29-Jul	30-Jul	5-Aug	12-Aug	19-Aug
1	Untreated Control	0.0a	0.0a	0.0b	0.0b	1.0a	0.5b	2.8ab	1.8b	5.0abc	2.0a	0.3bc
2	Admire Pro	0.0a	0.0a	0.5ab	0.0b	0.0c	0.0b	2.0bc	N/A	0.0d	0.0b	0.0c
3	Belay	0.0a	0.0a	0.0b	0.0b	0.0c	0.0b	0.0c	N/A	0.0d	0.0b	0.3bc
4	Platinum	0.0a	0.0a	0.0b	0.0b	0.0c	0.0b	0.0c	N/A	0.3bc	0.0b	0.3bc
5	Admire Pro	0.0a	0.0a	0.3b	0.0b	0.0c	0.0b	0.0c	N/A	0.0d	0.0b	0.0c
	Temik 15G											
6	Movento 240 SC	0.0a	0.0a	0.0b	0.0b	0.3c	0.0b	0.8bc	0.0b	0.3bc	0.5b	1.3a
	NIS											
7	Movento 240 SC	0.0a	0.0a	0.3b	0.0b	0.0c	0.0b	0.0c	0.3b	1.0c	0.3b	0.3bc
	Provado 1.6											
	NIS											
8	Movento 240 SC	0.0a	0.0a	0.0b	0.0b	0.0c	0.0b	0.3c	4.0a	1.0c	0.3b	1.0ab
	Baythroid XL											
	NIS											
9	Movento 240 SC	0.0a	0.0a	0.0b	0.0b	0.0c	0.0b	1.0bc	0.0b	3.0cd	0.0b	0.3bc
	Provado 1.6											
	Baythroid XL											
	NIS											
10	Movento 240 SC	0.0a	0.0a	0.0b	0.0b	0.0c	0.0b	0.5bc	0.3b	0.3d	0.0b	0.3bc
	Ammonium Sulfate											
	NIS											
11	Movento 240 SC	0.0a	0.0a	0.5ab	0.0b	0.8ab	0.3b	1.8bc	1.5b	2.0cd	0.3b	0.0c
	NIS											
12	Fulfill	0.0a	0.0a	0.3b	0.0b	0.0c	0.0b	0.5bc	1.0b	2.8cd	0.0b	0.5abc
13	Monitor	0.0a	0.0a	0.0b	0.0b	0.0c	3.5a	1.0bc	0.5b	0.0d	0.0b	0.0c
14	Vydate	0.0a	0.0a	0.0b	0.0b	0.0c	2.0ab	2.8ab	N/A	6.0ab	0.3b	0.5abc
15	Agricult. Mineral Oil	0.0a	0.0a	1.5a	0.0b	0.0c	1.8ab	1.3bc	N/A	6.3a	0.5b	0.5abc
16	Warrior	0.0a	0.0a	0.8ab	0.3a	0.5abc	0.5b	4.3a	N/A	2.8cd	0.3b	0.3bc
17	Assail	0.0a	0.0a	0.3b	0.0b	0.0c	0.3b	0.8bc	N/A	1.5d	0.5b	0.5abc

*Counts are presented as average green peach aphids per plot (5 plants per plot). Treatment means were separated using Fisher's LSD in SAS (9.1). Treatment means with the same letters are not significantly different from each other ($\alpha = 0.05$).

Table 3. The effect of various insecticides on PVY and PLRV infection									
		Initial		After spray 1		After spray 2		Cumulative	
		PVY %	PLRV %	PVY %	PLRV %	PVY %	PLRV %	PVY %	PLRV %
1	Untreated Control	0	0	0	0	0	5	0	5
2	Admire Pro	5	0	0	0	0	0	5	0
3	Belay	0	0	0	0	0	0	0	0
4	Platinum	0	0	5	0	0	0	5	0
5	Admire Pro	0	0	0	0	0	5	0	5
	Temik 15G								
6	Movento 240 SC	0	0	0	0	0	0	0	0
	NIS								
7	Movento 240 SC	0	0	0	0	0	0	0	0
	Provado 1.6								
	NIS								
8	Movento 240 SC	0	0	5	0	0	5	5	5
	Baythroid XL								
	NIS								
9	Movento 240 SC	0	0	0	0	0	0	0	0
	Provado 1.6								
	Baythroid XL								
	NIS								
10	Movento 240 SC	0	0	5	0	0	0	5	0
	Ammonium Sulfate								
	NIS								
11	Movento 240 SC	0	0	0	0	0	5	0	5
	NIS								
12	Fulfill	0	0	0	0	0	0	0	0
13	Monitor	0	0	0	0	0	0	0	0
14	Vydate	0	0	0	0	0	5	0	5
15	Agricultural Mineral Oil	0	0	10	0	0	15	10	15
16	Warrior	0	0	0	0	0	0	0	0
17	Assail	5	0	0	0	0	5	5	5

*Numbers represent PVY and PLRV-infections rates obtained at three different sampling periods. 5 Plants were sampled for each plot and four such plots for each replication. 5% infection represents that one single plant (1/20) was infected with either PVY or PLRV.

APHIDS AND BARLEY YELLOW DWARF VIRUS IN GRASSES GROWN FOR SEED IN THE WILLAMETTE VALLEY

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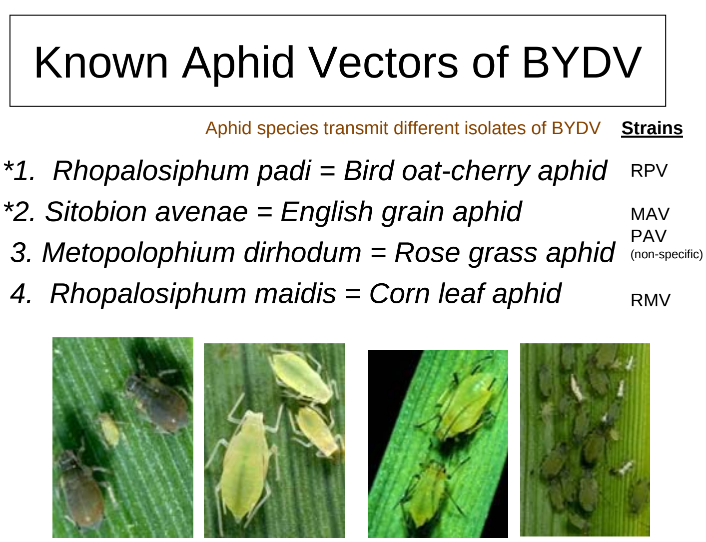
Barley yellow dwarf virus (BYDV) infects more than 100 (Poaceae) species of cultivated and wild grasses, including fescue, ryegrass, and blue-grass. The virus is known to reduce yields up to 25% and is a problem world-wide on cereals, barley, oats, and wheat. Effects of BYDV on grass seed crop yields are not well documented as in the cereal crops. The BYDV is systemic within plants, and once perennial grass plants are infected by this virus, these plants remain infected for the duration of their lives. Some plants may not show symptoms of infection and do not seem to be adversely affected. . However, seeds produced by infected plants do not carry the virus and volunteer plants from these seeds will not be infected unless they are inoculated with BYDV by **APHIDS**. The cool summers and mild winters in these regions provide an ideal environment for maintaining aphid populations on host plants throughout the year.



BYDV is transmitted from plant to plant ONLY by aphids as they feed. In Oregon, the aphids that may vector BYDV include the bird cherry-oat aphid, rose-grass aphid, English grain aphid, corn leaf aphid, and the green bug. Aphid flights were monitored weekly using yellow water traps in establishing and established fields. Seasonal migrations of aphids can move BYDV over large geographic areas.

In-field spread of BYDV occurs when infected apterous aphids crawl or winged (alate) aphids fly to healthy plants and introduce the virus into the phloem while feeding. Berlese funnels containing grass cores and sweep-netting foliage were used to monitor for presence of aphids within the field. Grasses with symptoms were surveyed and randomly-collected tiller samples were tested for BYDV virus by ELISA testing (Table 1, Table 2, Table 3).

Table 1. No. of positive-tested plants with BYDV in newly establishing rye fields. Preliminary data presented; 4 transects/~20 plants =~80 plants. Ocamb08

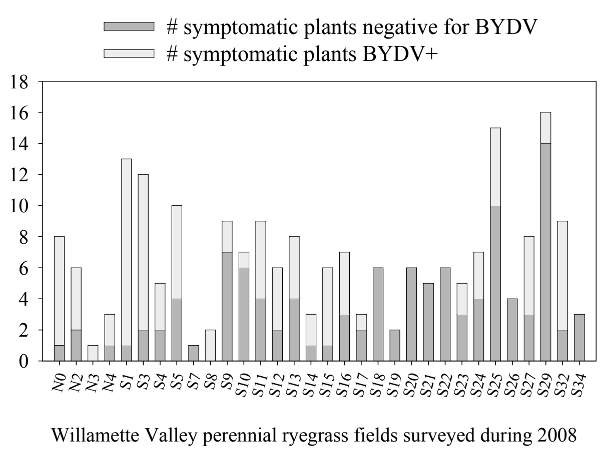
"New" Fields	June 2008 # BYDV PAV+ plants	June 2008 # BYDV RPV+ plants	Sept 2008 # BYDV PAV+ plants	Sept 2008 # BYDV RPV+ plants
JL4	2	2	0	1
JL8	15	1	6	0
JL15	17	24	20	9
BL4	1	5	6	2
BL11	9	6	1	0
BL17	19	21	10	0

Table 2. No. of positive-tested plants with BYDV virus in older perennial rye fields. Preliminary data presented; 2 transect/50 plants = ~90 plants. Ocamb08.

"Old" Fields	Field Age	May 2008 # BYDV PAV+ plants	May 2008 # BYDV RPV+ plants
BL5	1st yr	8	17
BL6	1st yr	1	12
BL8	1st yr	57	4
BL2	2nd yr	26	16
BL9	2nd yr	66	53
BL14	2nd yr	29	24

Preliminary Data: 2 transects/~50 plants = ~90 plants; C. Ocamb 2008

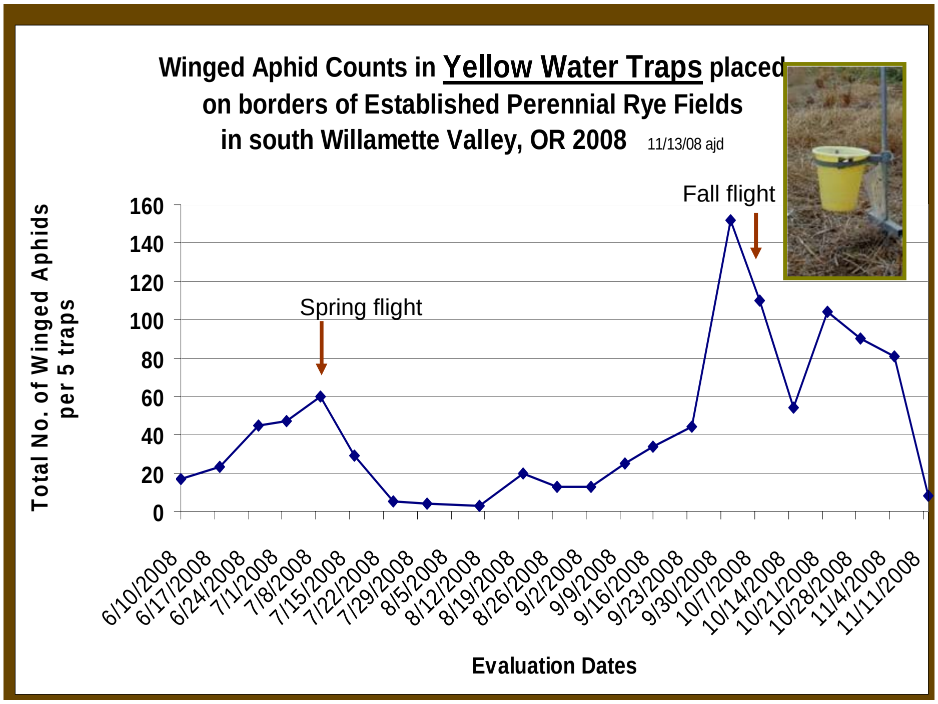
Table 3A/B. Plants with symptoms that appeared to be BYDV, which tested negative for BYDV.



Code	Field-Age	Location	Mean % Incidence of BYDV Symptoms
A	14 - 2nd yr	Green valley	0.3
B	6 - 1st yr	Green valley	4.5
C	5 - 1st yr	Lindsay	5.8
D	2 - 2nd yr	Church	7.8
E	9 - 2nd yr	Kendall East	10.3
F	8 - 1st yr	Kendall West	21.3

In order to prevent the virus from entering the plant, aphid vectors must be controlled. Therefore, two replicated randomized block studies were initiated on establishing perennial grass fields where insecticides were applied during the Fall aphid flight in 2008. It is critical to protect plants at emergence and during the seedling stage, as yield losses from BYDV in cereals was shown to be directly proportional to the age at which the plant is infected.

Three treatments were applied the morning of October 9th, 2008. Each plot measured 250 x 105 feet and 300 x 105 feet. Liquid products were delivered in the equivalent of 100 GPA with a grower-applied tractor at 50 psi using a 20 nozzle boom with TJ8005 nozzles that covered a 70ft swath. The boom spray was situated 36 inches above the ground. Aphid control will be measured by comparing numbers of aphids present in each plot by a unit measure of row (visual assessment), sweep net (10 samples of ten, 180° arc), and by taking 6-inch cores of grass per plot and placing in laboratory Berlese funnels for extraction of aphids. BYDV incidence will be documented and yield per plot will be taken.The 2008 aphid flight is shown in Fig. 1 below.



Section VII
Foliage & Seed Feeding Pests

MANAGEMENT OF THRIPS IN DRY BULB ONION USING CONVENTIONAL SEED TREATMENTS IN 2008

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This study was conducted to evaluate the efficacy of conventional seed-treatment to control onion thrips (*Thrips tabaci* Lindeman).

Materials and methods

Field plots were established on the Hermiston Agricultural Research and Extension Center (HAREC) to evaluate several products incorporated in the coating of pelleted dry bulb onion seed for efficacy controlling thrips. The soil was an Adkins fine sandy loam (coarse-loamy, mixed mesic Xerollic Camborthid), pH 6.8, 0.7% organic matter. The area was fumigated in the fall of 2007 with Sectagon applied at 40 gpa. ‘Granero’ onions were seeded with a Monosem vacuum planter on Apr 10 under center-pivot irrigation in 2 beds/30’ plot with a 1' windbreak strip between plots. Beds were 34" apart, 4 seed rows/bed, 3-4" between rows, 4" in-row. Onions emerged on May 1. Normal commercial production practices were followed throughout the season.

Treatments include: (1) Poncho 600 (0.18 mg ai/seed), (2) Clothianidin+Imidacloprid (-L) (0.18 mg ai/seed), (3) Clothianidin+Imidacloprid (-H) (0.24 mg ai/seed), (4) Icon (fipronil) (25 g ai/kg) and (5) Check. Treated and untreated (check) pelletized seed were supplied by Bayer CropScience.

Beginning Jun 11 (Week 1), two plants per plot were removed weekly, bagged, and transferred to the entomology laboratory, leaves examined for damage, and thrips counted.

The experimental design was a randomized complete block, with 4 replications. The pre and post treatment counts were analyzed with SAS GLM procedures.

Results and discussion

Thrips counts increased linearly until week 5, at which point the threshold (1-2 thrips/plant) for additional control was exceeded. Treatment and sample time did not interact. Post treatment counts were not affected by treatment (Table 1).

Although the post-treatment differences were not statistically significant, thrips counts generally were lower than in the untreated control with the seed treatment series until week 5 (Table 2).

Application of conventional foliar control treatments began following the Jun 26 counts; those receiving seed treatments did not require additional control measures until after the Jul 17 sampling, a delay of three weeks.

Table 1. Onion plant thrips post-treatment counts and weekly differences as affected by seed treatment and time, HAREC, 2008.

Treatment	Weekly Count[1]	Difference[2] *thrips/plant*
Poncho 600	5.3	2.4
Clothianidin+Imidacloprid-L	7.3	5.9
Clothianidin+Imidacloprid-H	3.7	0.7
Icon	4.0	2.2
Check	5.5	0.4
	NS	NS
Week		
1	1.3 c	-
2	5.2 b	4.0
3	5.4 b	0.5
4	5.6 b	0.2
5	9.5a	4.0
	**	NS
$Week_{LINEAR}$	**	NS
Treatment x Week	NS	NS

NS, ** Effect not significant or significant at P=0.01, respectively.
Means followed by different letters significantly different at P=0.05 (Duncans multiple range test).
[1] Count: average 2 plants/plot; [2] Difference = (Weekly count) - (Previous weekly count).

Table 2. Weekly onion plant thrips counts as affected by seed treatment, HAREC, 2008.

Treatment	Week				
	1	2	3	4	5
	thrips/plant[1]				
Poncho 600	1.0	2.0	5.3	7.3	10.7
Clothianidin + Imidacloprid-L	1.3	3.9	6.3	4.2	20.8
Clothianidin+Imidacloprid-H	0.9	3.8	7.0	3.1	3.8
Icon	0.5	1.1	3.3	6.4	9.0
Check	1.7	7.7	5.8	7.0	3.4
	NS	NS	NS	NS	NS

NS Treatment effect not significant; [1] Average 2 plants/plot.

ADVANCES IN WORM BIOLOGY IN PACIFIC NORTHWEST POTATOES

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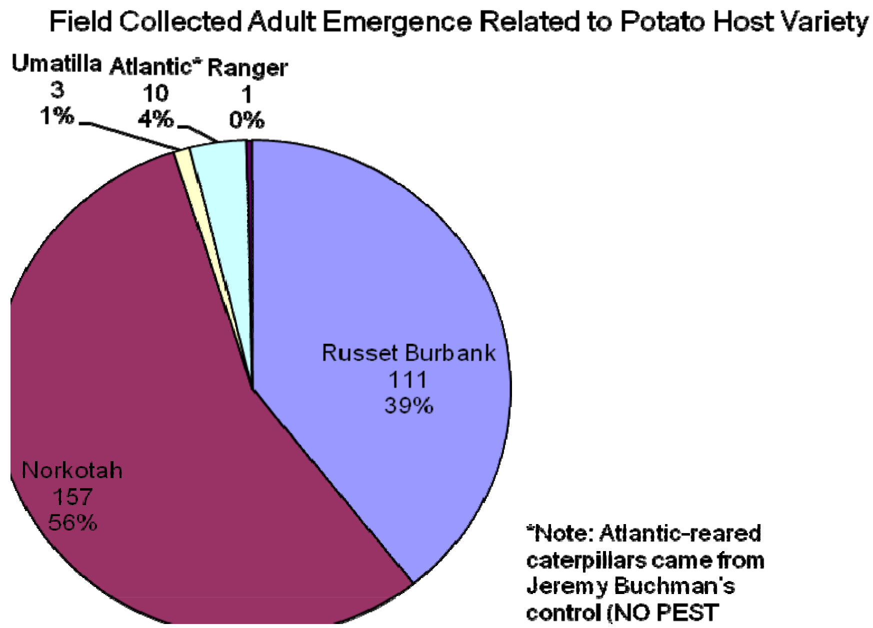
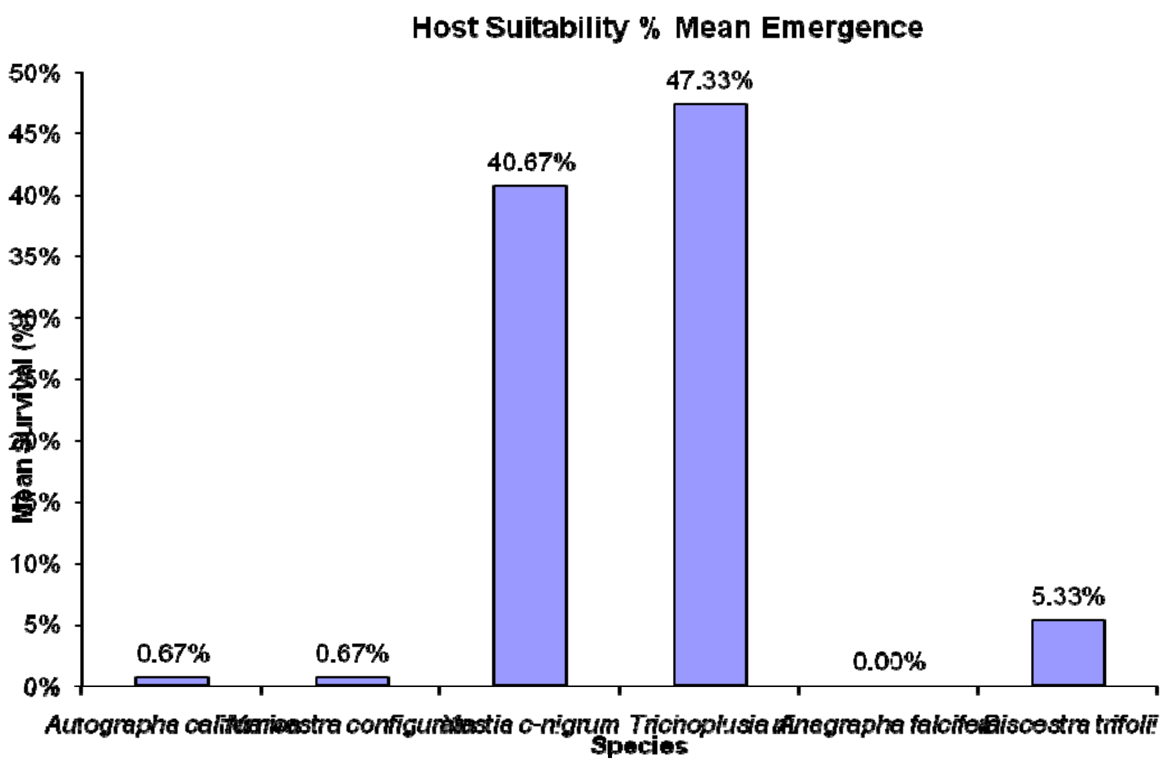
Despite being one of the most widely grown, valuable and research crops in the Pacific Northwest, little is known about one of the most commonly treated for insect pests of potatoes. An exerpt from the 2008 Integrated Pest Management Guidelines for Insects and Mites in Idaho, Oregon and Washington Potatoes by Alan Schreiber and Andrew Jensen states "*Little is known about the biology and management of worms in PNW potatoes. The economic threshold for when to treat for worms is unknown. In the absence of a threshold, growers should consider the level of defoliation by worms to be approximately similar to that of Colorado potato beetles. CPB rates of development and feeding patterns are different from worms, so do not make predictions of expected damage using your knowledge of beetle outbreaks. Also, different worm species can infest potatoes, so your experience for one field may not be appropriate for another field unless the species, environment and other conditions are the same or similar. It is important to scout for living worms in your fields, rather than applying treatments in response to damage. Sometimes worms are absent by the time damage is noticed. Also, some species have nocturnal habits and may not be easily found during the day*."

Funded by the Washington State Potato Commission and the Washington State Commission on Pesticide Registration, a group of researchers has set out to generate some data on worms that feed on, but not in, potato foliage. This particular language is used to exclude potato tuberworm which is the focus of research by other workers. Researchers on the project include Alex Fairchild, WSU graduate student, Richard Zack, WSU, Peter Landolt, USDA-ARS and Andrew Jensen, Washington State Potato Commission.

The project is envisioned as a three year project. The first year of the project focused on determining what species infested potatoes, which could successfully survive on potato foliage and other information related to species composition and survivablity.

A number of species collected from potato foliage were unable to complete development on potatoes. Survivablity was influenced by variety of potato foliage. Most worms were collected from Norkotah and Russet Burbank. This factor was based on largely on the insect control programs that growers used (or did not use.)


Field Collected Adult Emergence Related to Potato Host Variety
Umatilla 3 1%
Atlantic* 10 4%
Ranger 1 0%
Russet Burbank 111 39%
Norkotah 157 56%
*Note: Atlantic-reared caterpillars came from Jeremy Buchman's control (NO PEST


Host Suitability % Mean Emergence
Mean Survival (%)
0%
5%
10%
15%
20%
25%
30%
35%
40%
45%
50%
0.67%
0.67%
40.67%
47.33%
0.00%
5.33%
Species

Potato Variety	**Species of Moth**						
	Alfalfa looper	Bertha armyworm	Spotted cutworm	Cabbage Looper	Lacanobia fruitworm	Celery looper	Clover Cutworm
Control (Dandelion	29/50	1/25		23/25	19/25	12/25	7/25
Norkotah	1/25	0/25	13/25	14/25		0/25	5/25
Russet Burbank	0/25	0/25	10/25	10/25		0/25	2/25
Alturas	0/25	0/25	10/25	11/25		0/25	0/25
Umatilla	0/25	0/25	12/25	10/25		0/25	0/25
Ranger	0/25	1/25	11/25	16/25	19/25	0/25	0/25
Shepody	0/25	0/25	5/25	10/25		0/25	1/25

Section VII
Foliage & Seed Feeding Pests

EVALUATION OF NOVEL MODE OF ACTION INSECTICIDES TO CONTROL WINTER MOTH IN BLUEBERRY, 2008

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Winter moth, *Operophtera brumata* (L.). A population of late instar winter moth were collected on 20 May from a varietal blueberry planting at the WSU Mount Vernon NWREC. The population caused significant economic damage. These larvae had exited from the floral buds and were voraciously feeding and spinning silken thread to tie leaves together. If not controlled, winter moth larvae are capable of severely defoliating blueberry before they drop to the ground to pupate under debris. Infested terminals 3-4 inches long were collected and placed in paper bags and held in a refrigerator before being treated with aqueous suspensions of insecticides with a hand held atomizer until dripping. Five terminal replicates were place in quart sized, clear plastic, disposable food containers. The lids were punctured multiple times with a sharp probe for ventilation. Bayer CropScience's flubendiamide (Belt™) is a new lepidopteran-specific insecticide that is active via ingestion with no contact activity. DuPont's experimental DPX-HGW86 (Cyazypyr™) is formulated as a SE (suspo emulsion) or OP (oil dispersion). It is translaminar via foliar application and systemic via root uptake (drip irrigation application) and broad spectrum. Belt and Cyazypyr are members of a new chemical class

(IRAC) called diamides that modulate ryanodine receptors in muscles cells causing uncontrolled release and depletion of Ca^{2+}.

By 2 DAT all treatments were significantly similar to the standard Success™ with larval mortality for mature larval instars ranging from 83% to 97% (Table 1). Though not significant, the high rate of the oil dispersion formulation, HGW86 and low rate + MSO provided 100% mortality by 7 DAT. There appeared to be some performance differences for Belt when mixed with two different surfactants but by 7 DAT they were similar to that of HGWW86 and Success.

Table 1. Winter moth bioassay on blueberry, 2008.

		Percent Mortality		
Treatment	Rate/acre	1 DAT	2 DAT	7 DAT
HGW86 10SE*	13.6 fl oz	80.0a	86.7a	93.3a
HGW86 10SE*	20.6 fl oz	93.3a	96.7a	100a
HGW86 10SE + MSO*	13.5 fl oz	83.3a	93.3a	100a
HGW86 OD*	13.5 fl oz	76.7a	83.3a	100a
Belt + NIS	4 fl oz	96.7a	96.7a	96.7a
Belt + OS	4 fl oz	80.0a	90.0a	100a
Success	6 fl oz	96.7a	96.7a	100a
Untreated check	0	0	6.7b	20b

Mean within columns followed by the same letter are not significantly different (Fisher's protected LSD, $P<0.05$), PRC ANOVA SAS.
MSO (methylated seed oil adjuvant, NIS (non-ionic surfactant), OS (organosilicone).
*Buffer to a pH of 5.0 or lower.

Section VII
Foliage & Seed Feeding Pests

WESTERN RASPBERRY FRUITWORM ON RED RASPBERRY, 2008

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Western raspberry fruitworm, *Byturus unicolor* Say. Two recommended rates for the recently registered systemic neonicotinoid Assail™ 70WP (acetamiprid) was compared with Brigade™ (bifenthrin) and BASF's experimental BAS 320 I formulation to control the adult western raspberry fruitworm. Residual leaf dip bioassays were conducted using raspberry leaves whose stems were inserted into water-filled vials, plugged with cotton. Individual trifoliate leaves were dipped in respective deionized water-insecticide solutions for 5 sec, air dried and placed in 5 inch diameter Petri dishes. Each treatment was replicated seven times. *B. unicolor* adults were collected on 23 June from a mature 'Totem' field in Lynden, WA. Three adult western raspberry fruitworm adults collected in mid-June, were placed into five arenas and six each in the 6th one and maintained at room temperature.

Within 24 hours, 100% mortality was observed for adult beetles exposed to Assail and Brigade Table 1). All of the adults exposed to BAS 320 I leaves were in a moribund state. They were all observed on their backs, appendages moving while unable to right themselves, diarrhea and females involuntarily laying eggs. We scored these adults in the mortality category because of their moribund state. We conclude that the insecticides currently labeled for caneberries will effectively control western raspberry fruitworm.

Table 1. Adult western raspberry fruitworm bioassay, 2008.

Treatment	lb(AI)/acre	Percent Mortality 1DAT
Assail 70WP	0.083	100a
Assail 70WP	0.10	100a
BAS 320 I	0.10	100a
Brigade 2EC	0.10	100a
Untreated check		0b

Mean within columns followed by the same letter are not significantly different (Fisher's protected LSD, $P<0.05$), PRC ANOVA SAS.

Section VII
Foliage & Seed Feeding Pests

THRIPS CONTROL ON DRY BULB ONIONS

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Onion thrips *Thrips tabaci* Lindeman are the key pest for dry bulb onion production in Washington State. Trials were conducted at the WSU Othello Research Station during the 2008 growing season implementing a complete random block design with four replicates. Plots were evaluated for efficacy by counting the number of adult and immature thrips on the central onion leaf.

Broadcast spray plots were two double rows wide and twenty feet long. Applications were made with a $C0_2$ backpack sprayer applying 37 gallons per acre water at 30 psi. The trail was conducted in a yellow onion field grown under rill irrigation with sequential applications beginning June 24, 2008.. Data were subjected to ANOVA and means were separated from the untreated check using Fisher's PLSD ($p<0.05$).

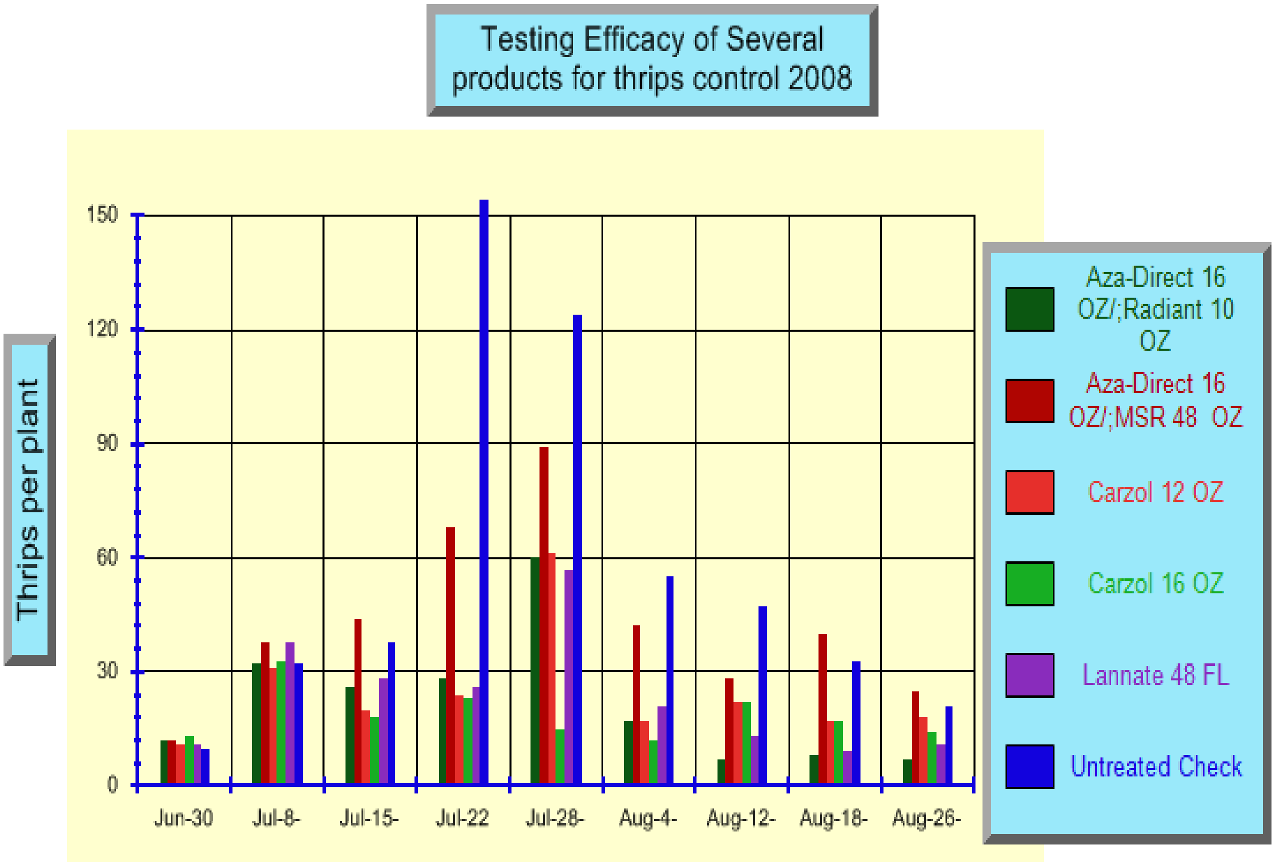

Figure 1. Sequential application of various products to test efficacy at controlling thrips.

Lannate, Carzol, and a tank mix of Aza-Direct and Radiant provided a level of control that was significantly better than the untreated check (Figure 1). There was no difference in the 12 and 16 oz. rates of Carzol tested.

In a separate experiment, Acephate provided thrips control at a level that was significantly better than the untreated check (Figure 2).

Data will also be presented regarding yield and onion size grades of the previously mentioned experiments in addition to a rotational study that was conducted.

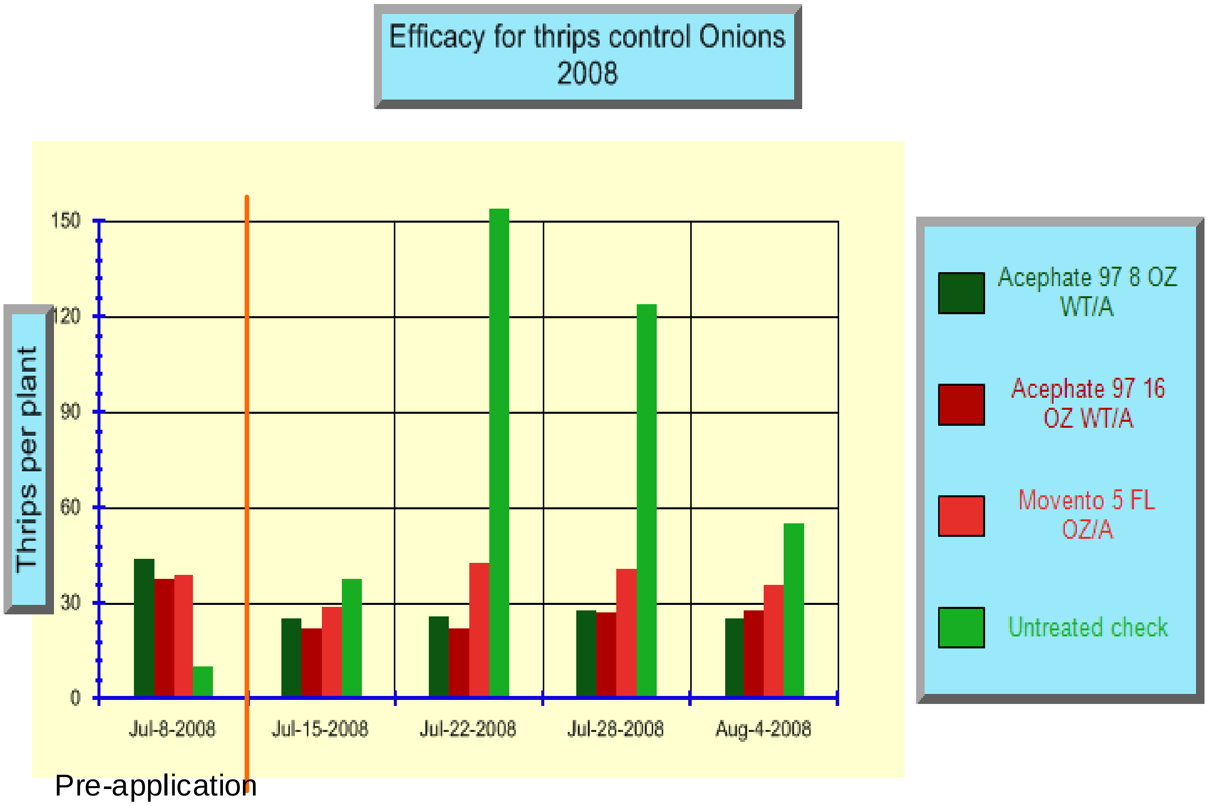

Figure 2. Thrips control trial evaluating the efficacy of Movento and Acephate.

Section VII
Foliage and Seed Feeding Pests

SEED TREATMENT WITH ENTRUST® INSECTICIDE FOR SEEDCORN MAGGOT CONTROL IN ORGANIC VEGETABLE AND VEGETABLE SEED CROPS

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Seedcorn maggot *(Delia platura*, is a serious pest of vegetable crops in the Columbia Basin. Infestations can reduce germination and stand establishment of winter- and spring-planted vegetables. Crops susceptible to seedcorn maggot damage include carrots, onions, beans, peas, and corn. Conventional vegetable producers have relied on post-plant applications of organophosphate, carbamate, or pyrethroid insecticides. For the past several years seed treatments of cloronicotinyl insecticides including imidacloprid, thiamethoxam, and clothianidin have provided effective control of maggots but, to date, there are no effective treatments available for seedcorn maggot control in organic vegetable production. Seed treatment trials conducted in 2007 and 2008 resulted in significantly greater stand establishment of several vegetable crops treated with Entrust® insecticide as compared with untreated seed. Additionally, stand establishment of Entrust treated seeds was equivalent to conventional post-plant insecticide treatments for stand establishment.

Section VIII Mites & Sap-Sucking Pests

EFFORTS TO CONTROL EUROPEAN ASPARAGUS APHID IN ORGANIC ASPARAGUS

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European asparagus aphid is the single biggest pest of asparagus that growers can attempt to control (Fusarium may be a worse pest, but there is no control for it.) All Washington asparagus is treated for this pest. No or poor control of this pest is synonymous with loss of a high value, perennial crop. Anyone wishing to grow organic asparagus must control this pest. Because of the inability to control aphid, there are only two growers of organic asparagus in eastern WA. They grow organic asparagus by raising asparagus conventionally, then go through a 3 year transitional period, and then produce the asparagus organically. Soap is applied during the transitional and organic period, but the asparagus starts to die out during the transition period and only a year or two of organic production is obtained.

There is huge demand for organic asparagus but there is practically no production of organic asparagus due to the inability to control this aphid. However, due to the demand, the acreage of organic asparagus in Washington doubled in 2007. Grower prices for conventional asparagus is 67 cents a pound, organic asparagus sold for $1.50 a pound.

The Washington asparagus industry has made finding an organically acceptable solution for control of aphids in asparagus a priority. A small trial was supported to conduct an efficacy trial in a two year old transitional asparagus field that was one acre in size.

Seven treatments were screened against aphids. The first application was made on September 26, followed by an application on September 30 and a third application on October 6. All applications were made by ground.

Trt No.	Treatment Name	Rate of Application	# of Apps.	Number of aphids per plant 0 DA-A	3 DA-A	7 DA-A	10 DA-A	13 DA-A	TOTAL
1	UNTREATED CHECK			42.8 a	27.3 a	25.5 a	9.8 a	5.8 a	68.3 a
2	M-PEDE	2 % v/v	ABC	42 a	13.3 b	15 ab	12.3 a	7.3 a	47.8 ab
3	SURROUND	25 lb/a	ABC	30.3 a	19.5 ab	18 ab	15.3 a	9.3 a	62 ab
4	AZA-DIRECT	2 pt/a	ABC	29.8 a	12.8 b	10 b	6.3 a	6 a	35 b
5	NEEMIX	7 fl oz/a	ABC	30.8 a	19 ab	20.5 ab	9.8 a	8.8 a	58 ab
6	ECOZIN	10 fl oz/a	ABC	36.8 a	12.5 b	11.8 b	13.3 a	4.8 a	42.3 ab
7	JMS SYTLET OIL	6 qt/a	ABC	27.3 a	18.3 ab	18.8 ab	9.3 a	6.8 a	53 ab
8	ENVIROPEL	12 fl oz/a	ABC	27.3 a	18 ab	20.3 ab	12.3 a	9 a	59.5 ab

Section VIII
Mites & Sap-Sucking Pests

SPIDER MITE CONTROL WITH ACRAMITE 50WS, 2008

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Yellow spider mite field trial.
Population levels of spider mites in northwestern Washington exceeded expectations given the unseasonably cool, wet spring and early mild summer temperatures. This in contrast to 2007 when spider mite populations were generally non-economic, especially in northwestern Washington. Problematic flare-ups of the yellow spider mite (YSM), *Eotetranychus carpini borealis,* were particularly severe in the Northwood area of Lynden, where late May populations on both 'Meeker' and 'Willamette' exceeded our provisional treatment level of 25 motile life stages per leaf, by 10 to 100-fold. Female YSM emerge from diapause earlier and disperse earlier from mid-April to May, than the twospotted spider mite (TSSM). YSM migrates to distal primocane foliage along the top trellis wire of red raspberry in April to May. Our research data has shown the YSM prefers cooler spring and fall temperatures. The onset of warm weather combined with stressed foliage, provided the right conditions for a mid-season (May to August),

region-wide flare up. This flare up consisted of mostly YSM and lesser levels of the TSSM and European red mite on the distal half of the canopy, bearing most of the developing flower buds.

On 9 July 2008, we field-tested 2 rates of the recently registered Acramite 50WS (bifenazate) and Acramite 4SC and experimental Envidor 2SC (spirodiclofen) with Vendex™ (fenbutatin-oxide), on a mature 'Meeker' site in Lynden, WA. Envidor is a Group 23 acaricide. Applications were applied with our plot spray equipped to deliver 133 gpa at 1.8 mph with 2 D4-45 Tee Jet nozzles on top of boom, with 2 D2-25 nozzles pointing up into the row while both vertical arms were equipped with 14 D3-25 Tee Jet nozzles. Treatments were replicated five times and plots measure 30 feet long by 10 feet wide. Twenty-five leaflets were taken at random from primocanes at chest height from both sides of the row. Samples were processed with a mite brushing machine. Empirical comparisons with the untreated check indicated all miticides performed comparably to each other and all were significantly different from the untreated check out to 37 DAT (Table 1).

Table 1. Twospotted spider mite control on red raspberry, Lynden, WA, 2008

			Motile TSSM/leaflet							
Treatment	lb(AI)/acre	Ptrm	3DAT	6DAT	10DAT	14DAT	23DAT	30DAT	37DAT	44DAT
Acramite 50WS	0.37	8.2a	0.2b	0.2b	0	0.1b	0	0.1b	0	0
Acramite 50WS	0.50	12.5a	0.6b	0.4b	0	0.4b	0	0.1b	0	0
Acramite 4SC	0.50	10.5a	0.7b	0.2b	0	0.1b	0	0	0	0
Envidor 2SC	0.28	9.5a	0.6b	0.2b	0.1b	0.2b	0	0	0	0
Vendex 50WP	1.00	9.8a	0.4b	0.4b	0.0	0.2b	0	0	0	0
Untreated check		10.6a	8.6a	5.8a	1.8a	3.5a	1.3a	1.0a	0.7a	0.4b

Means within columns followed by the same letter are not significantly different (Fisher's protected LSD, $P<0.05$), PRC ANOVA SAS.

Mixed spider mite field trial.

Postharvest populations of twospotted spider mite, *Tetranychus urticae* and yellow spider mite were sampled and treated on 25 September 2008 in a 3 year-old 'Meeker' field at the WSU Mt. Vernon NWREC. Pretreatment densities for these late season infestations approximated 10-13 motile life stages/leaf. Though non-economic, these numerically increasing populations and cool/cloudy weather conditions were ideal to compare formulations of Acramite 50WP and Acramite 4SC with experimental IGR Envidor 2SC on an established twospotted spider mite and incipient yellow spider mite infestations. Rates and application methods were identical to those used for YSM above. A silicone surfactant (0.5% v/v) and Volck supreme oil (1% v/v) was included with Acramite and Envidor, respectively. The method and applications were applied as reported above for the Lynden red raspberry trials. Compared with the untreated check, Acramite 50WP provided 6-fold reduction suppression of motile spider mites at 13 days posttreatment (Table 2). This compared with an average comparable to the untreated check at 13 DAT.

Table 2. Yellow spider mite control on red raspberry, Mount Vernon, WA, 2008

Treatment	lb(AI)/acre	Ptrm	Motile YSM/leaflet 4DAT	7DAT	13DAT
Acramite 50WS	0.50	10.4a	0.9b	6.3a	4.6b
Acramite 4SC	0.50	12.8a	3.3b	9.5a	23.5a
Envidor 2SC	0.28	13.2a	3.1b	7.0a	14.3ab
Untreated check		11.9a	9.5a	14.3a	27.7a

Means within columns followed by the same letter are not significantly different (Fisher's protected LSD, $P<0.05$), PRC ANOVA SAS.

Section IX
New Product Development

SWEET CORN EARWORM CONTROL TRIAL IN EASTERN OREGON IN 2008

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The objective of this study was to determine efficacy of chemigated insecticides for earworm control in sweet corn produced in the Columbia basin under center-pivot irrigation.

Materials and methods

Treatments: (1) Coragen SC (rynaxypyr) 5.1 fl oz/a, (2) Gemstar 10 fl oz/a, (3) Belt 3.0 oz/a + MSO 0.25% v/v, (4) Belt 3.0 oz/a + NIS 0.25% v/v, (5) Grower Standard Lannate, Warrior, Sevin, Asana, (6) Control (untreated)

Chemical were applied in 0.05" at 3-day intervals thru center-pivot irrigation, starting at silk emergence (Jul 28). Field plots - Adkins fine sandy loam, pH 7.0, OM 0.7%. Plot size: 8-30' rows/plot, 30" apart, 9" between plants, with overhead center pivot irrigation, plots separated by 45', w/20' guards on ends.

Schedule:

Disced (2X): May 20
Fertilizer broadcast: May 20 75 N, 20 P_2O_5, 25 K_2O, 20 S, 4 Cu, 3 Zn, 1 B
Roller-harrow: May 20
Plant (‘SummerSweet 610’): May 21
Pre-emergence herbicide: May 23
Outlook @ 12 oz/a + Basagran @ 1.5 pt/a + Atrazine @ 1 lb-ai/a
Side-dress (UAN-32):

30 lb/a N	Jun 25
30 lb/a N	Jul 9
30 lb/a N	Jul 16

Grower Standard treatment applications (chemigated in 0.05"):
Jul 28 - Lannate @ 1.5 pt/a
Jul 31 - Warrior @ 3.85 oz/a
Aug 3 - Sevin @ 1.5 qt/a
Aug 6 - Asana @ 8.0 fl oz
Aug 9 - Warrior @ 3.85 oz/a
Aug 12 - Lannate @ 1.5 pt/a
Aug 15 - Sevin @ 1.5 qt/a
Aug 18 - Asana @ 8.0 fl oz
Harvest/evaluation: Aug 21

Results and discussion

The corn earworm population was monitored on-site weekly, with 2 Delta and 2 cone (Hartstack) traps with pheromone lures, and 1 backlight trap. Between 7/15 and 8/19 (6 weeks), a total of four adults were caught with the Delta traps, none with the cone traps, and five with the backlight trap. These numbers are well below published control thresholds (5-10/night for pheromone, 5/night for backlight). Conversations with commercial producers confirmed that regionally, earworm pressure was extremely low, and they had not yet taken any control measures.

One hundred ears were harvested from each of the untreated control plots (400 total), husked, and examined for the presence of earworms or earworm damage. No larvae or damage were found. Another 40-50 ears were randomly examined from treatment plots, and again, no worms or damage. In 2008, with no earworms or damage found, the trial was terminated.

On the other hand, in 2007, the percent ears with earworms were exceptionally high. This may be attributed to the presence of approximately 250 acres of untreated field corn in commercial fields adjacent to the experimental plots, which undoubtedly served as an overwhelming source of moths throughout the season (Table 1).

Table 1. Efficacy of chemigated insecticides for earworm control in sweet corn, Hermiston, OR, 2007.

	Number earworms/ear[1]			
Treatment	0	1	2	3
	Percent (%)			
Lannate LV	46.75	48.50	4.75	0
Lannate LV + Asana	15.50	76.75	4.75	1.00
Standard	25.25	69.50	4.50	0.75
Gemstar	15.00	74.75	10.25	0
Control	27.25	58.00	12.50	2.25
	NS	*NS*	*NS*	*NS*
P-value	*0.31*	*0.18*	*0.15*	*0.33*

[1] Mean of 400 ears/treatment.
[NS] Treatment effect not significant.

Section IX
New Product Development

APHID & COLORADO POTATO BEETLE CONTROL WITH BELAY INSECTICIDE- 2008

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Belay Insecticide 2.13SC (Clothianidin) is a third generation neonicotinoid. In potato trials, Belay gave excellent control of green peach aphid and Colorado potato beetle when applied at planting to soil at rates of 7-12 fl oz/A, as well as when applied as a seed treatment at rates of 0.4 to 0.6 fl oz/cwt of seed. Residual control of aphid and Colorado potato beetle with at planting soil or seed treatment has been equal to or better than earlier registered standard treatments. Residual control with Belay has ranged from 80-100 plus days control after a soil application under heavy to light aphid and Colorado potato beetle pressure.

Section IX
New Product Development

NEW INSECTICIDES FROM DUPONT

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In April of 2008, EPA granted unconditional registration for two new insecticides from DuPont. Altacor® and Coragen® insecticides contain the active ingredient Rynaxypyr™ (chlorantraniliprole) and belong to the anthranilic diamide class of chemistry (group 28). The mode-of-action is classified as ryanodine receptor activator. These insecticides work by locking-on to the ryanodine receptors causing a sudden and massive release of stored calcium resulting in loss of energy, paralysis and death of susceptible insects. Insect control spectrum is primarily limited to Lepidoptera larvae, but also includes other species including the Colorado potato beetle, whiteflies, and leafminers.

The Altacor® formulation (35% WDG) is labeled for tree fruit and grapes while the Coragen® formulation (1.67 lb/gal SC) is registered for vegetable and field crops.

PNW Resource Guide - 2009

Company Name	Product Name	Type	Website	Contact	Tel.	E-Mail Address
Advan	Agree Azatin Cyd-X Crymax Deliver Enforce Javelin Lepinox	Insecticide	www.advanllc.com	Tony Shepherd	503 791-8517	tshepherd@advanllc.com
	Triact Trilogy	Miticide				
Arysta	Azinphos-methyl Battalion	Insecticide	www.arysta-na.com	Jeri West	509 255-1052	jeri.west@arystalifescience.com
	Kanemite	Miticide				
BASF	Counter Regent	Insecticide	www.agproducts.basf.com/	Chuck Rice	509 396-5283	chuck.rice@basf.com
Bayer	Admire Aztec Baythroid Calypso Decis Di-syston Lavin Leverage Monitor Provado Renounce Sevin	Insecticide	www.bayercropscienceus.com	Dean Christie		dean.christie@bayer.com
	Envidor Oberon	Miticide				
	Mocap	Nematicide				
Chemtura	Dimilin Rimon	Insecticide	www.chemtura.com/	Scott Ockey	509 453-8757	scott.ockey@chemtura.com
	Acramite Comite Omite	Miticide				

Company Name	Product Name	Type	Website	Contact	Tel.	E-Mail Address
Dow	Confirm Entrust Lorsban Radiant Success	Insecticide	www.dowagro.com	Harvey Yoshida	509 628-1368	harvey.yoshida@dow.com
	Kelthane	Miticide				
	Telone	Nematicide				
DuPont	Altacor Asana Lannate Vydate	Insecticide	http://www2.dupont.com/Production_Agriculture/en_US	Norm McKinley	503 370-9976	norman.d.mckinley@usa.dupont.com
	Vendex	Miticide				
	Vydate	Nematicide				
Gowan	Ambush Aza-Direct Carzol, Dimethoate Imidan Lorsban Malathion MSR NeXter Prokil Cryolite Supracide Ultiflor	Insecticide	www.gowanco.com	Gary Melchior	509 520-4779	gmelchior@gowanco.com
	Dicofol NexTer Onager Sanmite Savey	Miticide				
Syngenta	Actara Fulfill Platinum Proclaim	Insecticide	www.syngentacropprotection-us.com	Chris Clemens	509 375-0666	christopher.clemens@syngenta.com
	Agri-Mek Zephyr	Miticide				

Company Name	Product Name	Type	Website	Contact	Tel.	E-Mail Address
Valent BioSciences	Biobit DiPel, Novodor XenTari	Insecticide	www.valentbiosciences.com	Chris Ishida	360 834-4457	christopher.ishida@valent.com
	DiTera	Nematicide				
Valent U.S.A.	Belay Clutch Danitol Esteem Knack Venom	Insecticide	www.valent.com	Len Welch	541 386-4557	len.welch@valent.com
	Danitol Zeal	Miticide				