OPVC CONTINUING PROJECT REPORT: 2015 **PROJECT YEAR**: 1

1. OPVC REPORT COVER PAGE (maximum 2 pages)

OPVC Project Number:

Project Title: Monitoring and Reporting Insect Pests in Cole Crops and Sweet Corn (VegNet)

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Total Project Request (all years):
Year 1: $21,588 **Year 2:** **Year 3:**

Other funding sources: none

2. EXECUTIVE SUMMARY (ABSTRACT):

Oregon State University's VegNet is a regional pest monitoring program that provides activity reports for 10 common insect pests that affect broccoli, cabbage, cauliflower, sweet corn, and snap beans. Crop pests are sampled weekly and raw data is compared to activity trends from previous years. Regional pest monitoring helps growers and agricultural field representatives adjust their scouting effort when an outbreak is detected, and the combination of area-wide monitoring plus field-specific scouting reduces risk of crop loss. Reports are available on www.oregonvegetables.com, and sent via an email newsletter that currently serves over 400 subscribers. In 2015, increases in pest pressure were noted for black cutworm, spotted cucumber beetle, cabbage white butterfly, bertha armyworm, and diamondback moth.

3.a BACKGROUND

VegNet provides activity data for a variety of crop pests that affect snap bean, cabbage, cauliflower, broccoli, and sweet corn production. For each species of insect, current trends are compared to archived data of the most recent year prior as well as the 10-year average. The strength of this program is two-fold. First, monitoring is conducted on a regional scale, and therefore can reveal landscape-scale trends that would not be evident to individual landowners. Secondly, the ongoing, perennial nature of the program (19 years strong!) provides a data-based record of pest activity within the Willamette Valley and how it has changed over time.

3.b OBJECTIVES

1. Monitor insect pests that affect brassica crops, sweet corn, and snap beans and provide weekly data reports and pest alerts to provide advance warning of potential outbreaks.
2. Utilize climate data and growing degree-day models to estimate the first emergence and final flight of cabbage maggot.
3. Evaluate program efficacy and user demographics via direct surveys and website metrics.

3.c. SIGNIFICANT FINDINGS

- Black cutworm activity was higher than historical averages, and has been for the past few years (Fig. 1). Damage was not always evident in sweet corn fields, despite high trap counts. It is unclear whether the recent increase is due to emigration from warmer areas each spring, or if populations are building up by successfully overwintering in the Willamette Valley.
- Spotted cucumber beetle levels were extremely high this year. The pattern was noticed because of sticky-trap counts but also confirmed in sweep net samples of snap beans (Fig. 2), suggesting that beetle activity could have contributed to actual pest pressure. This is not always the case with 12-spot beetles because they are so migratory in the landscape.
- The most notable insect problem in cole crops was a dramatic increase in diamondback moth activity, which resulted in contamination issues for some growers. There was a late peak of diamondback in 2014 (Fig. 3), which could have contributed to increased pressure this year. Climate conditions, overwintering, and/or insecticide resistance are some potential reasons why we saw an increase of diamondback moths in 2015.

3.d. METHODS

Crop pests were monitored using time-tested passive and active sampling techniques including: pan traps, sticky cards, pheromone lures, leaf pulls, and sweep netting. Pheromone lures were changed every 4 weeks. Nine distinct field sites were selected to give an accurate assessment of pest trends throughout the Willamette Valley, Oregon. VegNet sites were chosen based on cropping system, geographic location, proximity to the crop, and grower participation. When possible, traps were placed at or near prior-year locations to maintain consistency in data collection. Monitoring stations (15 total) were located near Aurora, Brooks, Mt. Angel, Stayton, Dever-Connor road, Albany, Corvallis, and Monroe. Website use was analyzed using Google Analytics™ and on-line surveys were conducted using Qualtrics™.

3.e. RESULTS & DISCUSSION

OBJECTIVE 1 - Data results from the 2015 trapping season are presented per cropping system. Figures display trap counts averaged from all locations, unless otherwise noted, and numbers are reported as the number of adult insects per day. In each graph, the current year's data is presented as a dark, solid line and is usually plotted against the 15 year historical average (1996-2011) for easy reference.

SWEET CORN and SNAP BEAN

Corn earworm (CEW) was an issue only at 2 of the 8 field sites. In each case, the first peak of adults occurred in late July, and was about 10 moths/day at both sites. During the weeks that followed (Aug 1 - Sept 1), 20 moths per day were observed at a site in the mid-valley, and up to 50 moths/day in the northern end of the mid-valley.

Black cutworm (BCW) counts have been steadily increasing in this area since 2013. In a normal year, the BCW season extends from late March to early October, and there is a single activity peak, when trap counts are 1-2 moths/day (Fig. 1, solid shaded area). This year, however, numbers were significantly higher than that for nearly every week that was sampled. In fact, the pattern more closely resembled the outbreak of BCW (Fig. 1, patterned shaded area) that Willamette Valley growers experienced in 1997. All pests can cycle between years when population levels are of concern and when they are not, but we do not know the exact reason why BCW moth flights have been consistently high for the past few years. Adult moths do migrate up from warmer areas (southern US and Mexico) each spring, but we are beginning to wonder if BCW is also overwintering in the Willamette Valley.

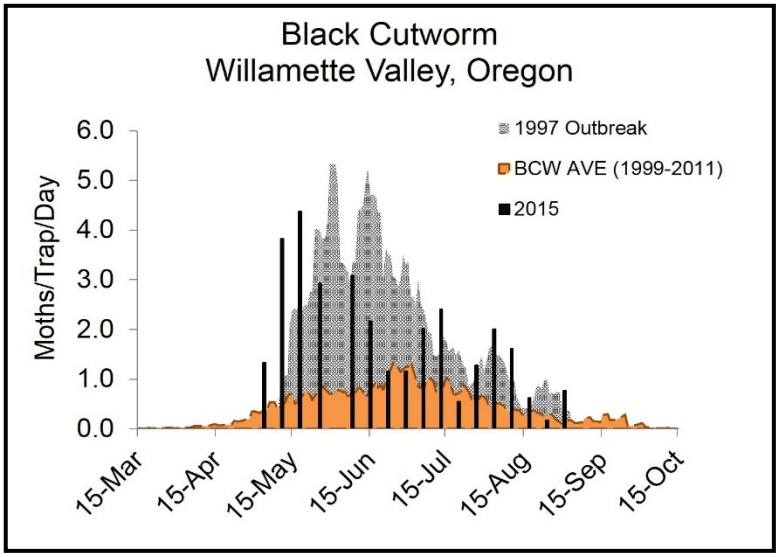


Figure 1 - Black cutworm can be very damaging during the establishment phase of many crops. Trap counts of BCW have been increasing over the past few years, compared to historical averages.

Western spotted cucumber beetles, also known as 12-spot (12S), were unusually prevalent this year. Some adult beetles overwinter, so it is not uncommon to see activity early in the spring. The rapid and sudden increase of 12S this year however, can likely be attributed to the early development and harvest of grass seed acreage. Beetles are known to move into vegetable crops when grass fields are cut, which occurred about 3 weeks early in 2015. That is one reason we also conduct sweep-net samples before and during snap bean bloom – to determine if the perceived increase on yellow sticky traps (Fig. 2, bars, YST) in the landscape translates into feeding pressure within the crop. Unfortunately, we found that sweep net samples (Fig. 2, crosses, SN) did indeed suggest a higher-than-normal amount of cucumber

beetles.

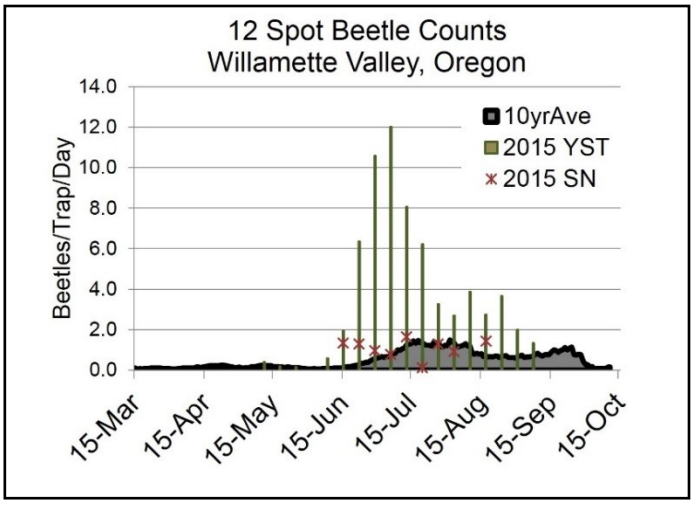
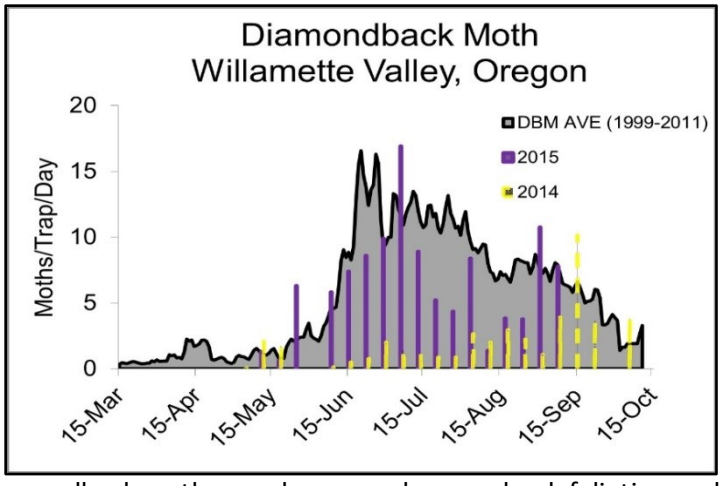


Figure 2 - 12-spot beetles are a generalist pest and were detected at record-high levels this vear.

COLE CROPS

Broccoli and cauliflower fields were evaluated for species that damage and contaminate brassica crops: diamondback moth (DBM), cabbage and alfalfa loopers (CL and AL), cabbage white butterfly (CWB), and Bertha armyworm (BAW).

Diamondback moth (DBM) is considered one of the worst pests of crucifers in the U.S., and can be particularly hard to manage because of tendency to develop resistance against multiple insecticides. Currently, resistance has been noted in over 600 cases worldwide, for nearly 100 unique active ingredients including carbamates, pyrethroids, and spinosyns. The most recent concern of resistance is within the diamide insecticide class, which includes products that Willamette-Valley brassica producers rely on such as chlorantraniliprole, cyantraniliprole, and flubendimide. Trade names include Coragen, Exirel, and Synapse. 2015 DBM activity was highly variable between sites, and therefore, the valley-wide average does not appear to be much worse than historical norms (Fig. 3). However, processed vegetable growers at certain locations were plagued with DBM this year; between 30 and 50 moths per night for many weeks in a row. Some growers reported that their insecticide regime wasn't working as well as it had in years prior.



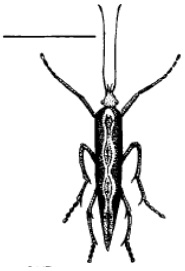


Figure 3 - Diamondback moths can damage cole crops by defoliation and/or contamination of the heads. A late peak in DBM activity in 2014 may have contributed to this year's problem.

For the most part, looper (CL and AL) trap counts were within normal range this year, except for 2 field sites in the north end of the valley. At both locations, there was an early peak on June 8th, when counts were 2-4 times greater than historical averages, and again during the week of July 6th, when there were 18 moths/day at one site and 25 moths/day at the other site.

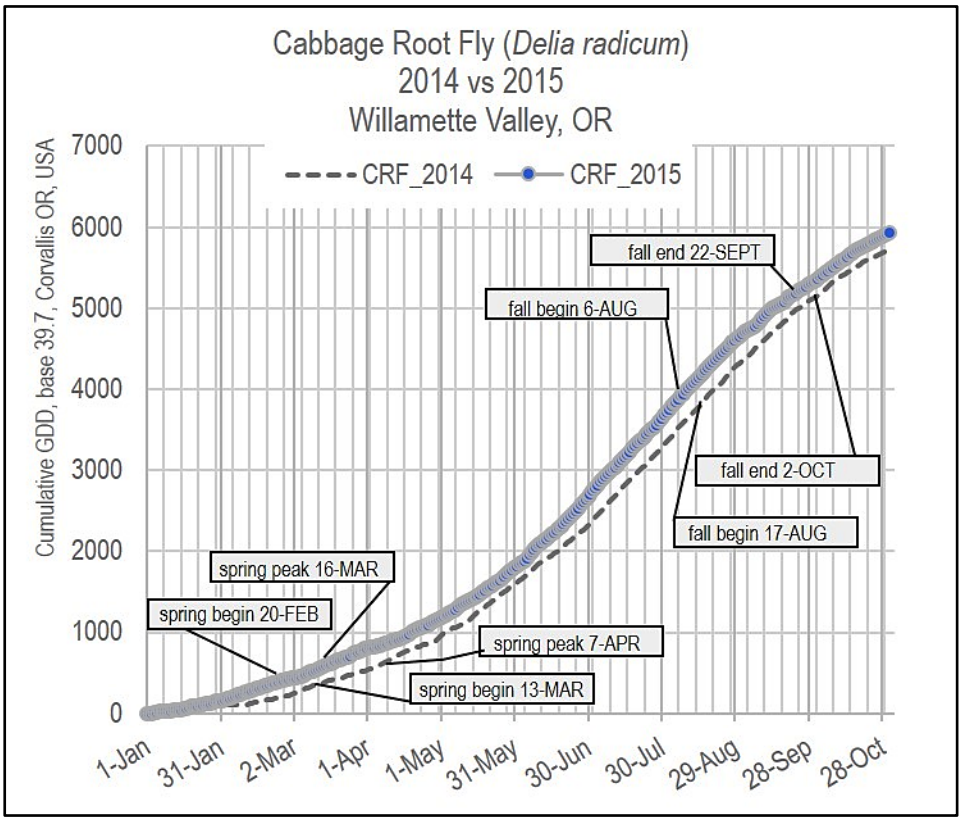
Larvae of the cabbage white butterfly (CWB) are called greenworms and can cause severe damage to cabbage and cauliflower. Other cruciferous hosts are susceptible as well. There are multiple generations of CWB in this region, with the first appearance of adults beginning in mid to late April. Greenworms can defoliate outer leaves and bore into developing cabbage and cauliflower heads. Additionally, they produce profuse frass (excrement), which can discolor heads and reduce marketability. There is no pheromone available to trap CWB, so population estimates are done by visually scanning the landscape for adults. Numbers of CWB this year were 2-3 times greater than normal in many locations.

At present, the only armyworm species that is monitored by VegNet is Bertha armyworm (BAW, *Mamestra configurata*), but the cutworm and armyworm complex that affects cole crops can be quite extensive. Because armyworms are so destructive, we have always cautioned VegNet users that any detection of BAW (anything above 0 moths per day) is something to be aware of. In 2015, BAW moths were present at higher-than-normal levels during many weeks, both in spring and fall (Tbl. 1). BAW overwinters as pupae, so it will be necessary to start monitoring adult emergence in early spring to determine the potential for risk to 2016 crops.

Table 1 – Bertha armyworm (BAW) trap counts were higher than normal on 9 of the weeks sampled in 2015. There are 2 overlapping generations of BAW per year.

Date (week sampled)	BAW 2015 (averaged across all sites)	BAW 1999-2011
	no. of moths per day	
Jun 8	0.22	0.06
Jun 16	0.10	0.04
Jul 6	0.93	0.02
Jul 13	0.86	0.04
Jul 20	0.17	0.07
Jul 27	0.65	0.22
Sep 21	0.07	0.03
Sep 28	0.10	0.01
Oct 12	0.03	0.00
AVE	0.34	0.05

OBJECTIVE 2 – It is presumed that cabbage root fly (*Delia radicum*, cabbage maggot) activity in the Willamette Valley follows closely to predicted patterns based on degree-days (DD). Although there can be multiple, overlapping generations, there are typically two distinct periods when adult flies are most active – in the spring and again in the fall (Fig. 4). By monitoring the two critical periods of root fly activity in Willamette Valley brassica fields, we were able to compare DD model estimates with on-the-ground trap counts. One issue we ran into in 2015 is that by the time we identified field sites planted to cruciferous vegetables (week of May 4th), the spring flight peak had already occurred. Cabbage root flies continued to be detected late into October, longer than was suggested by the DD model. We stopped sampling cabbage maggot when crops were harvested, but egg-laying flights likely occurred until the first freeze. Understanding cabbage maggot activity and timing is important, especially in light of the proposed revocation of chlorpyrifos (Lorsban).



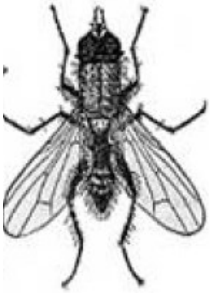


Figure 4 – According to a growing degree-day model specific to this region, cabbage maggot phenology was shifted this year (2015, line with circles) compared to last year (2014, dashed line). Figure is based off data from A. Dreves, 2005, and is available at http://uspest.org.

OBJECTIVE 3 - A PRE-season opinion and use survey was conducted in March 2015. Replies were received from 23 anonymous respondents. They contributed answers to various questions regarding the utility of the VegNet program overall, as well as specific ratings for program aspects including ease of use, timeliness of reporting, and usefulness of the data. When asked if VegNet was a valuable resource, 75% of respondents 'strongly agreed', and 25% 'somewhat agreed'. Over 60% of people who answered the survey have been using VegNet for more than 5 years. Demographically, all but one of the respondents were male, and 74% were over the age of 45. People who replied to the survey represented many sectors of industry professionals (Tbl. 2). We plan to conduct a POST-season VegNet survey in February 2016. This year was the first time we issued personalized reports to each cooperating grower at the end of the season. We hoped that providing individual activity graphs could help growers identify patterns that occurred at their specific location, and that the information might be useful for the upcoming year. The reports seemed to be well received and appreciated.

Table 2 – Online survey participants were asked to classify themselves according to which sector of the ag industry they represent. Diverse answers indicate that VegNet is utilized by many different groups.

#	Answer	% of Responses
1	Landowner / Ag producer - PRIVATE	30%
2	Ag producer - COMMERCIAL	15%
3	Research	10%
4	Consulting	30%
5	Sales	10%
6	Other	5%
	Total	*100%*

3. **BUDGET**

Item		Notes / Justification
Salaries	9927	Research Assistant / Program manager with 63% OPE
Benefits	6254	
Wages	2400	Seasonal worker with 8% OPE
Benefits	192	
Equipment	240	Replacement and repair of cone traps
Supplies	1135	Monitoring supplies (lures, liners, pan traps)
Travel	1440	Between field sites (180 miles x 20 weeks)
Plot Fees	---	---
Other	---	---
Total	21, 588	