RESEARCH REPORT TO:

THE AGRICULTURAL RESEARCH FOUNDATION FOR 2007

TITLE: VegNet Regional Pest Monitoring Program

RESEARCH LEADER: Daniel McGrath
PHONE: 503-931-8307
EMAIL: daniel.mcgrath@oregonstate.edu
FAX: 541-967-9169

COOPERATORS: Manual Silveira and Jim Gill, NORPAC; Wayne Parker, Jason White, and Neil MacInnes, National Frozen; Jon Brown, Truitt Bros; Larry and Ron Pearmine Farm, Richard and Delbert Haener Farms, Mark and Mike Dickman Farm, Skip Gray Farm, Matt and Gary Cook Farm, Dave Obersinner Farm, Hendricks Brothers Farm. Technical support for this project was provided by Lydia Brown, OSU Department of Horticulture.

This Report is also submitted to the Oregon Processed Vegetable Commission Broccoli and Cauliflower, Corn and Bean Research Committees.

Introduction ~ Regional Pest Monitoring

VegNet is a regional pest monitoring and reporting network serving the Oregon processed vegetable industry, managed by the OSU Extension Service, and funded by the Oregon Processed Vegetable Commission. In the early spring of 2007, a variety of insect traps were placed on cooperating farms in vegetable production areas around the Willamette Basin and maintained during the growing season.

At each cooperating farm, selected fields will be scouted for immature insects (aphids and the larvae of cabbage looper, cabbage white butterfly, diamondback moth, Bertha armyworm, black cutworm, corn ear worm, and 12 spot beetles to confirm the correlation between trap counts and actual egg laying events ("ground truth").

The target audiences for VegNet Regional Pest Trends is the community of ag chemical and processor field representatives who scout vegetable plantings and make pest control recommendations and the growers they serve. We recognize that pest control decisions are made on the basis of field-specific scouting results. Regional pest trends, however, that are broadcast through the VegNet system serve as an "early warning" system which signals (high or low) when field-specific scouting efforts should be intensified.

During the 2007 growing season, regional pest population trends were analyzed and broadcast to growers and agricultural professionals via email, broadcast fax, and web posting (See Appendix A). A total of nineteen issues of the VegNet newsletter were distributed to about one hundred and twenty five growers and agricultural professionals on a weekly basis from May through October. Insect samples from were collected during the growing season from cooperating processors to determine which insect contaminates were intercepted by quality assurance programs.

The goals of the VegNet Regional Pest Monitoring and Reporting System are:

- To save growers money by providing them with advanced notice of population outbreaks for key vegetable pests in broccoli, cauliflower, snap beans, and sweet corn
- To alert agricultural field representatives when to intensify their field-specific pest management scouting due to very high or very low pest population trends
- To strengthen the communication network among Agricultural Professionals serving the Willamette Valley processed vegetable industry regarding pest and disease trends
- To demonstrate the commitment by the Oregon Processed Vegetable industry toward the use of integrated pest management strategies that protect crops and the quality of the environment.

Part One ~ Broccoli and Cauliflower Pests

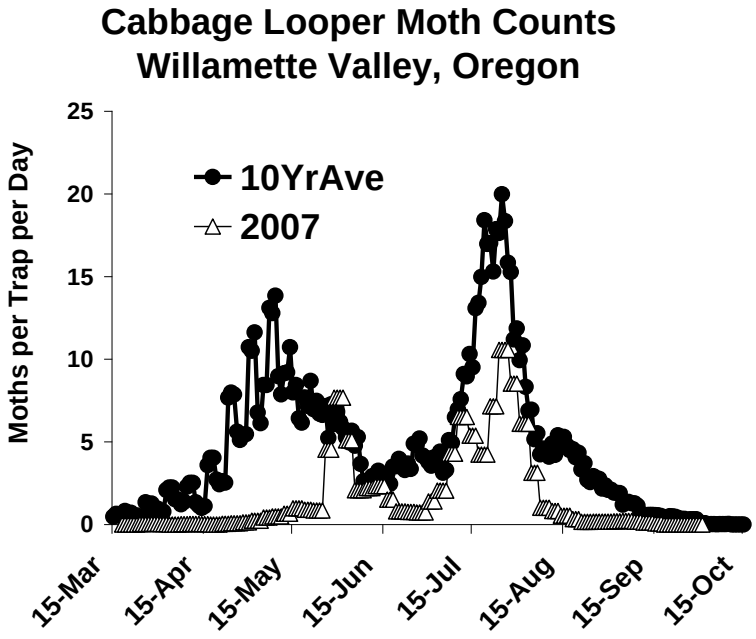
Four Lepidopteran insects and one aphid species damage and contaminate broccoli and cauliflower: cabbage loopers (*Trichoplusia ni*), diamondback moth (*Plutella xylostella*), cabbage white butterfly (*Pieris rapae*), Bertha armyworm (*Mamestra campestra*) and the cabbage aphid (*Brevicorynae brassicae*). Field scouting plus regional pest monitoring generally do not lead to no-spray decisions because the probability of all five contaminating insect populations crashing during the same growing season is very low. Therefore, regional pest monitoring for broccoli and cauliflower pests is focused on detecting outbreaks and signaling growers and agricultural professionals when to intensify their field scouting and to increase their aggressiveness in preventing crop losses. We now have enough historical data to detect major regional looper outbreaks in time to warn the grower and agricultural professional community in a timely fashion (Table One).

Table One ~ Regional Looper Outbreaks Can Be Detected Early
Willamette Valley, Oregon 1998-2007

	Looper [1)] Pressure	WV Ave May 21st	WV Ave July 21st
1998	**High**	**4.37**	**28.2**
1999	**Low**	**0.02**	**0.02**
2000	**Low**	**0.34**	**1.9**
2001	**High**	**34.95**	**34.7**
2002	**Low**	**0.60**	**1.0**
2003	**High**	**28.07**	**34.9**
2004	**Moderate**	**0.91**	**16.36**
2005	**High**	**19.03**	**38.7**
2006	**Low**	**na**	**3.7**
2007	**Moderate**	**0.89**	**7.15**
9Yr Ave		**14.9**	**19.9**

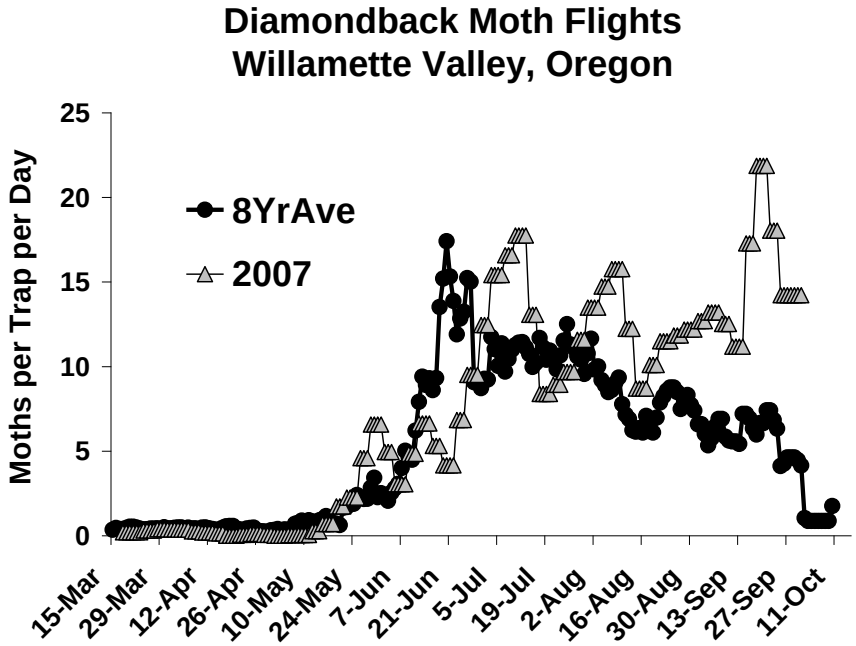
1) Moths/trap/day averaged across all stations.

Figure One



Looper pressure in broccoli and cauliflower, for example, varies from year to year. During the looper outbreak of 2003, dollar losses associated with rejected loads of looper contaminated broccoli were zero, in part, due to VegNet early warning. We were not so lucky during the 2005 growing season. During the looper outbreak of 2005 we also had a diamondback moth outbreak. The combined effect was one of the worse outbreaks on record. Some growers ignored warnings based on regional pest population monitoring because when they checked their fields, the egg laying events were not yet apparent. They did not modify their spray program. By the time worms matured and became visibly a problem prior to harvest, it was too late. They experienced serious financial losses. Cabbage looper counts (Figure One) were normal during the 2007 growing season.

Figure Two



Diamondback moth pressure also varies from year to year. Diamondback moth pressure was normal during the 2007 season (Figure Two). Diamondback moth populations generally do not survive in the Willamette Valley. The moths have to re-colonize Oregon the following spring by flying up from the south or riding up from the south on contaminated seedlings. This explains why, in some low pressure years, the diamondback moth population gets a late start. As the climate temperature increases and winters will be milder in the Willamette Basin, we may experience earlier and more

intense diamondback moth pressure. The 2005 growing season was an outbreak year for both cabbage looper and diamondback moth. This accounts for the large number of contaminated broccoli samples during the 2005 growing season (Table Two). Although some broccoli was rejected due to hollow core rot, losses due to insect contamination of broccoli were minimal during the 2007 growing season.

Table Two~ Looper Pressure versus Dollar Loses in Broccoli Willamette Valley, Oregon 1998 to 2006

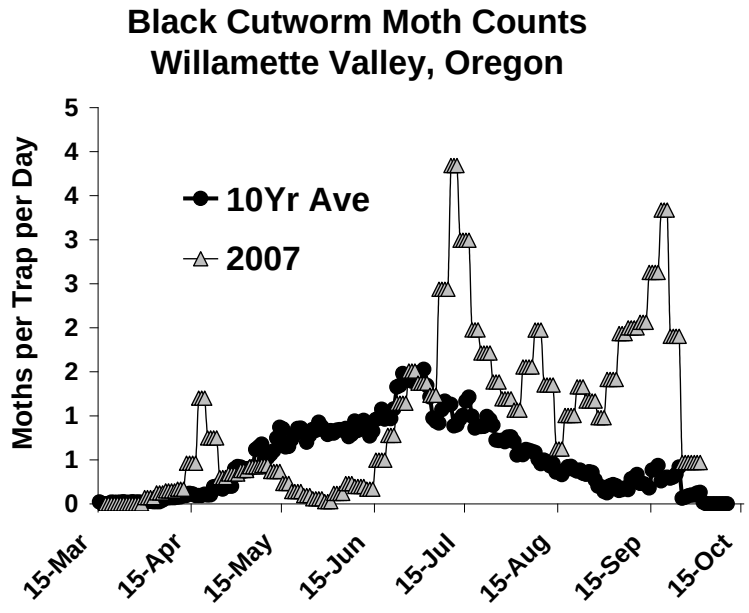
Year	Looper Pressure	Totes [1)] Rejected	Loses due to Insect Contamination	Loses Adjusted [2)] by Volume ($/5,000Tons)
1998	High	313	$44,415	$18,537
1999	Low	0	$0	$0
2000	Low	20	$2,949	$1,848
2001	High	63	$9,220	$8,043
2002	Low	0	$0	$0
2003	High	0	$0	$0
2004	Moderate	24	$3,658	$2,297
2005	High	235	$31,995	$17,938
2006	Low	$0	$0	$0
2007	Moderate	$0	$0	$0

1) Totes of broccoli rejected due to looper contamination.

2) Dollar loses/5,000 tons harvested broccoli based on average raw-product prices.

Part Two ~ Sweet Corn Pests

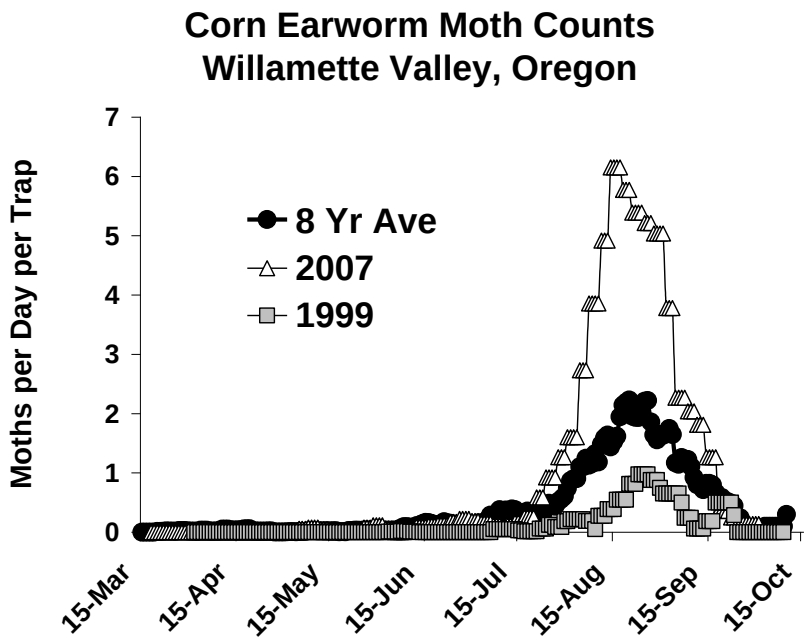
Figure Three



Black cutworm (Agrotis ipsilon) outbreaks occur about once or twice per decade. Cutworm outbreaks are hard to detect in the field because early cutworm instars are small, gray-brown in color, and subterranean. Significant cutworm moth egg laying flights, on the other hand, are easy detect. The last major Willamette Valley black cutworm outbreak occurred in 1997. Based on historical trends, we are due for another black cutworm outbreak in the near future.

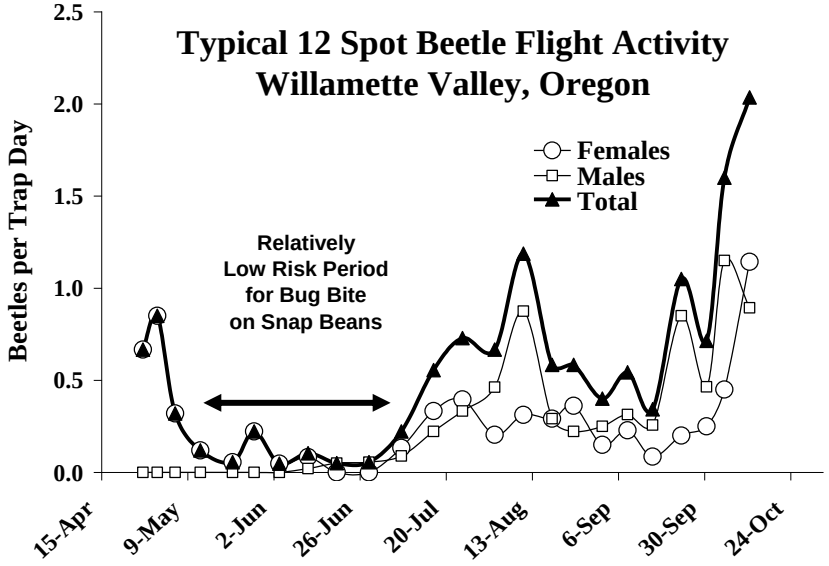
Figure Four

During the 2007 growing season, cutworm moth counts reach fairly high levels but the timing of the egg laying flights was late, past the middle of July (Figure Three). Most of the susceptible crops, including sweet corn, were already planted and past the vulnerable stage. In addition to the annual intensity of cutworm flights, the timing of egg lying relative to the planting periods is an important predictor of crop damage.



Corn earworm pressure varies a great deal from year to year. Processed vegetable growers very rarely treat for earworm because the tips of the corn ears (and the earworms) are removed during the early stages of processing. The 2007 growing season was an outbreak year for corn earworm (Figure Four) with moth counts reaching historically high numbers. Conversations are on going with growers, agricultural professionals, and processor field representatives about whether, in retrospect, we should have treated for earworm during the 2007 growing season. On the one hand, insecticide applications are very expensive because they generally have to be applied by air. Multiple applications are needed to completely control earworm damage. On the other hand, a single application of insecticide will control the first wave of earworms. The next wave of earworms that survive have limited time to develop prior to harvest, and generally do not cause a problem because they are small and have not penetrated deeply into the ear by the time harvest takes place.

Figure Five

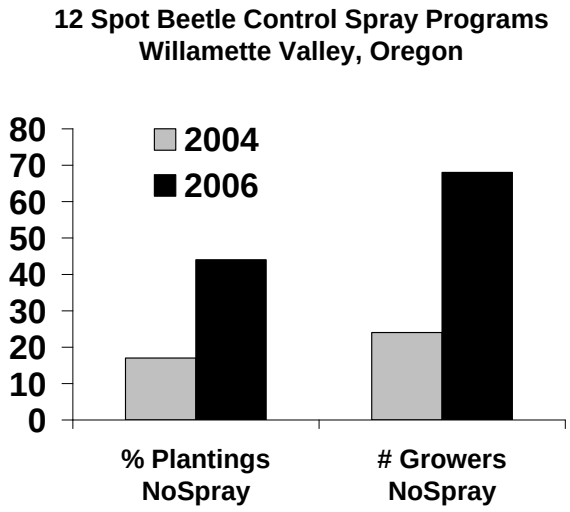


Part Three ~ 12 Spot Beetle in Snap Beans

The 12 spot beetle (*Diabrotica undecimpunctata*) is the key insect pest of snap beans. The adult beetle feeds on developing "pin" beans causing deformation of the developing pod and on mature pods causing the defect "bug bite". Field scouting techniques and action thresholds based on sweep net sampling are

well known for snap beans and 12 spot beetle in the Willamette Valley. Generally, if four to five sets of sweep netting with ten arcs of the sweep net per set result, on average, in two to three beetles per ten arcs of the sweep net, an insecticide application is justified.

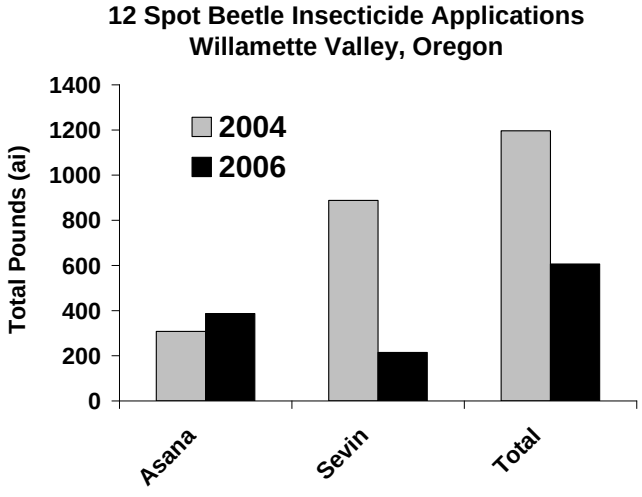
Figure Six



Sweep net sampling, however, is labor intensive and expensive. Monitoring beetle populations on a regional basis reduces the cost of field sampling by informing growers and agricultural professionals when to intensify their sweep net sampling.

In the early spring, over wintering beetles (mostly females) come out of their refuges and lay their eggs in the soil next to preferred host plants (including sweet corn). What follows is a period of quiet when most of the beetle population is in the larval or pupal stages and in the soil (Figure Five). Although this pattern varies around the Willamette Basin and varies from year to year, this low spot is the best time to sweep net bean fields. Growers and agricultural professionals have a double safe decision making environment. If they detect no beetles in the field (based on sweep net sampling) and we do find very many beetles in the landscape (based on regional monitoring) then it is pretty safe to skip the insecticide application for control of 12 spot beetles at that time.

Figure Seven

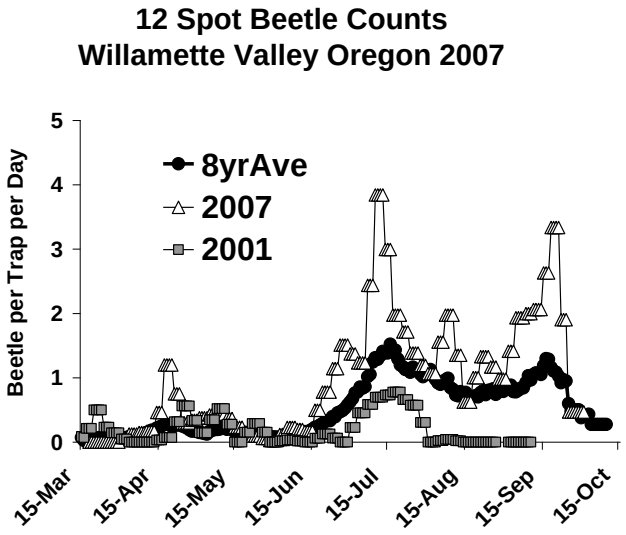


Using this strategy, the Willamette Valley processed vegetable industry was able to dramatically increase the number of bean plantings that were not sprayed with insecticide for 12 spot beetle control (Figure Six). Using a combination of sweep net sampling plus regional pest monitoring, insecticide use for control of 12 spot beetles in snap beans in the Willamette Valley was significantly reduced (41%) during the 2006 growing season (Figure Seven). But regional population trends change dramatically later in the growing season. Risk assessment also changes.

The first generation of new beetles generally emerges from the soil in early July. The above-ground beetle population rises dramatically through the middle of August and can remain high for the duration of the growing season. The first and second summer generations of beetles overlap. At the same time that the beetle populations are surging, surround fields of grass seed and wheat dry down. Beetle populations concentrate in irrigated bean fields. Twelve spot beetle pressure was relatively high during

the 2007 growing season (Figure Eight). In both 2006 and 2007, there were cases where growers or agricultural professionals declared bean plantings safe, the insecticide application was not applied, then the beetles from the surround landscape invaded the field and significantly damaged the crop.

Figure Eight



This situation is made complicated by changes in the timing of our fungicide applications for control of mold in snap beans. Growers now apply their first mold spray at ten percent bloom (one out of ten plants has an open blossom). There are approximately twenty one days between ten percent bloom and harvest, plenty of time for beetles to invade the field from the surrounding landscape and damage the crop. There is not point in applying a short residual insecticide on the beans when no beetles are present. The only solution that I am aware of is to pay attention to regional population trends and to change their risk management strategies once the first summer generation of 12 spot beetles has emerged from the soil. This event is marked by a return in the beetle population to a fifty/fifty male to female sex ratio. We look for, detect, and report the emergence of the first summer generation via the VegNet Newsletter. After this point in the growing season, growers and agricultural professionals need to continue to monitor beetles with sweep nets at the edge of their bean plantings and be prepared to apply insecticides should beetles invade the bean field from the surround landscape.

Conclusion

The VegNet regional pest monitoring program sponsored by the Oregon Processed Vegetable Commission has been fruitful. We learn something every year. The program has saved growers money by providing growers and agricultural professionals with early warnings of insect pest outbreaks. In snap beans, the combination of regional pest monitoring plus field scouting has allowed growers to significantly reduce insecticide applications in snap beans without increasing, in most cases, risk of crop damage. We still have individual cases of significant crop losses described earlier in this report.

In the 2008 growing season, we need to address these gaps in our risk assessment procedures. Firstly, we plan to develop a quick and easy leaf sampling technique for broccoli and cauliflower (five ten leaf samples) that a grower or an agricultural professional can use to ground-truth regional pest population trends. This will help growers to overcome the problem where egg laying events are detecting using pheromone traps but are invisible to the grower until the worms develop and it is sometimes too late to do anything about it. We will also test the concept of setting up sticky traps at the edges of fields that have been declared “safe” from 12 spot beetle damage based on sweep net sampling but still have a couple of week to go before harvest. That way the grower or agricultural professional can more easily check for invading beetles following a no-spray decision. If we see sufficient corn earworm pressure during the 2008 growing season, we will test the effectiveness of a single early insecticide application for processing sweet corn.

Appendix A ~ Example VegNet Newsletter July 9, 2007

VegNet is a pest and disease monitoring and reporting network serving the processed vegetable industry, provided by the Oregon State University Extension Service, and funded by the Oregon Processed Vegetable Commission. VegNet is available on the net: http://extension.oregonstate.edu/linn Go to commercial vegetables then VegNet. If you have questions or suggestions, and if you would like to add or remove your name from this newsletter mailing list, Contact: Dan McGrath, OSU Extension, 3180 Center St. NE, Salem, OR 97301, phone (503) 931-8307; email daniel.mcgrath@oregonstate.edu

Snap Beans ~ Mold Control

There continues to be some confusion about fungicides application timing. I apologies for using the term "popcorn," which is confusing. Let me be more precise.

There are approximately twenty one days between first bloom and harvest of Oregon 91G Snap Beans. Topsin fungicide has a 14 day pre harvest interval. If it is used in a two-spray program, the first application should be applied **when one out of ten plants has an open bloom.** (This stage has been called, "popcorn," "first bloom," or "early bloom" and "ten percent bloom".)

The second application of Topsin should be applied about a week later but prior to the 14 day pre harvest interval. This two-spray program with Topsin would cover all blossoms from first bloom to harvest.

To my knowledge, we do not have any experimental data yet to resolve the timing issue on a single spray program. That is why OSU is not recommending a one-spray program. If you choose to go with a one-spray program it is advisable that you wait a little later to apply the single spray when approximately five out of ten plants have an open bloom, but prior to the 14 day pre harvest interval for Topsin. Your assumption is that none of the early blossoms are infected with mold. This program covers the later blossoms that are more likely to be infected with mold as the bean canopy closes.

Snap Beans ~ 12 Spot Beetles

Trap counts for 12 spot beetles are significantly higher in most of the valley. The first summer generation is emerging from the soil. From this point forward through mid August, expect rapidly rising beetle counts.

Do not base insecticide applications for 12 spot beetles solely on within-field sweep net counts. Consider what is going on in the landscape around your bean plantings. Beetles can invade bean plantings from surrounding fields as they dry down. Much greater caution is needed in making a no-spray decision.

Broccoli and Cauliflower

Significant cabbage aphid flights continue. Control cabbage aphids before they move up into the broccoli buttons. Once the aphids are in the buttons, you can kill them with an insecticide but they will remain in the broccoli as contaminants.

Cabbage White Butterfly (*Pieres rapae*) counts are rising rapidly. Look for small to medium sized "green worms" (the larvae of cabbage whites). Looper pressure is normal, but the processors reject all worms the same, regardless of species.

Appendix A ~ Example VegNet Newsletter 2007

Week of July 2, 2007 Willamette Valley, Oregon

	Aurora	Dayton	MtAngel	Gervais	Stayton	Dever	Corvallis
BCW	0.13	0.43	0.38	0.00	0.00	0.83	0.00
CEW	0.00	0.57	0.63	0.14	0.22	0.00	0.00
PHX	0.00	0.00	0.25	0.00	0.11	0.17	0.44
12S-YST	1.13	3.71	0.38	2.29	0.22	0.83	2.00
12S-SN	na	na	na	Na	na	na	na
CL	0.00	0.43	0.88	2.50	0.89	0.33	0.11
AL	0.00	0.00	0.25	0.00	0.22	0.00	0.00
DBM	2.50	4.71	4.75	32.00	2.00	19.33	1.22
BAW	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VCW	3.75	9.00	1.50	57.88	2.11	3.83	13.00
CWB/2min	na	na	na	16.00	na	na	na

Willamette Valley 7day Ave Week of July 2nd

Insects	5-Yr Ave.	2006	2007	Note
BCW	1.48	0.04	0.25	Normal risk
CEW	0.1	0.25	0.22	Normal risk
PHX	0.10	0.00	0.14	Normal risk
12S-YST	0.58	0.34	1.51	Above Average
12S-SN	na	na	na	na
CL	2.48	2.47	0.73	Normal risk
AL	0.53	0.51	0.07	Normal risk
DBM	6.9	5.76	9.50	Normal risk
BAW	na	0.00	0.00	Normal risk
VCW	4.1	na	13.01	Above Average
CWB/2min	2.9	1.83	na	na

VegNet Key

BCW = Black Cutworm Moths
CEW = Corn Earworm Moths
PHX = False Corn Earworm Moths
12S = 12 Spot Beetle
CL = Cabbage Looper Moths
AL = Alfalfa Looper Moths
DBM = Diamondback Moths
BAW = Bertha Armyworm Moths
VCW = Varigated Cutworm Moths
CWB/2min = Cabbage Butterflies
YST = Yellow Sticky Trap Counts
SN = Sweep Net Counts

Daniel McGrath, Oregon State University (503) 931-8307
daniel.mcgrath@oregonstate.edu