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PRACTICAL ECOLOGY AND MANAGEMENT OF WHITE PINE BLISTER RUST IN CURRANTS

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White Pine Blister Rust in NY

White pine blister rust (WPBR), caused by the fungus *Cronartium ribicola*, is a disease of white pine that greatly impacted the white pine industry in the United States. Like other macrocyclic rust diseases (cedar apple rust, wheat stem rust), WPBR needs two hosts in order to complete its life cycle. The hosts in the life cycle of WPBR are pine and members of the *Ribes* genus (currants, gooseberries, etc.). The most common strategy for eliminating this type of rust disease is to kill off one of the two hosts. In the case of WPBR, it was decided that the Pine industry was more valuable than *Ribes* production, and as early as April 1917, *Ribes* quarantine and eradication legislation was beginning to be put into effect. From 1961 to 1967, there was a more extensive *Ribes* eradication effort in the US (2, 6). This effort was quite successful in the eastern United States to the point where it was believed that wild *Ribes* posed little danger to the pine industry (2). Eventually, the federal ban on currant production was removed due to the development of rust resistant pines (1, 3). However, individual states still impose severe regulations or bans on currant production. Despite the availability of new scientific data and management practices to mitigate dangers to the pine industry, no revisions to state restrictions on were made for some time (2). In New York, planting restrictions on currant production were first discussed in 1998 (7, 8) and restrictions were slightly revised recently in 2003. Rust resistant and immune *Ribes* varieties do exist, but are often less horticulturally desirable than highly susceptible black currant varieties such as Ben Alder(1). Because of these varietal concerns, the New York State Department of Environmental Conservation has established both currant fruiting and currant quarantine districts **(www.dec.state.ny.us/website/regs/part192.html)** to allow some currant production in New York.

Currants produce extremely high levels of antioxidants and vitamin C (4, 5), and are becoming increasingly popular according to a report from the New York Farm Viability Institute (10) **(http://www.nyfarmviability.org/press-07-26-06.htm)**. Previously, the crop profile for currants in New York State in 2000 **(www.ipmcenters.org/cropprofiles/docs/nycurrants.html)** listed total bearing acreage for currants as approximately 9 acres (9). Currently, growers such as Greg Quinn of the Currant Company LLC **(http://www.thecurrantcompany.com/)** and Curt Rhodes of R.H. Rhodes and Sons Inc. are reported to have more than 15 acres each planted to black currants (9, 10), and are continually expanding.

Practical Ecology of White Pine Blister Rust

Understanding the life cycle and ecology of WPBR and the two hosts needed for its survival have led to management practices that are effective for controlling the disease. The disease is also controlled to some extent by environmental factors and even gnats that eat the fungus present on *Ribes* leaves.

Environmental Considerations

- Hot temperatures in the summer can actually kill the infections on *Ribes* leaves preventing further spread of the disease between *Ribes* plants and preventing the development of sporidia which infect pines.
  White pines have a 20% rate of resistance to WPBR in trees from unselected seed sources. This is increased to as much as 50-75% by selecting seeds from resistant trees. There are no known cases of WPBR overcoming the resistance genes in *Ribe*s. Resistance can be lost in pines, however.
- WPBR infections must have cool temperatures in the 60 to 70 ^{o}F range and moisture for 2 weeks to produce the telial columns which produce sporidia in the fall which can infect moist pine needles and become established on the trees. In a dry, warm year infection potential is less, and in a moist cool year infection potential is greater, and even possible in the summer.
- Climate zones have been defined where pines live. They are zones 1(least likely to be infected) to zone 4 (most likely to have conditions for pines to be infected in the Fall). Arborists say that planting of susceptible *Ribes* is least problematic for pines in zones 1 and 4 since in zone 4 they will not become infected, and in zone 1 pines shouldnt be planted due to the high probability that they will become infected from wild *Ribes*.

- Sporidia produced on telial columns on *Ribes* leaves travel from the *Ribes* to pines in Fall normally only travel about 1,000 feet maximum. Pine seedlings are the most at risk, and a border of 1000 feet free from susceptible *Ribes* plants is recommended for nurseries and Christmas trees.
- 99% of infections on pines take place on the lower 9 feet of the trees. Infections that develop at least one foot from the trunk cause death of the branch, but the cankers do not grow back to the trunk.
- Gooseberries seldom have infections that develop spores that can infect pines.

Management Practices to Protect Pines

- Plant a high population of pine seedlings and rust will rogue susceptible trees. Excess trees are thinned out later.
- Plant trees in microclimates less likely to have dew in the Fall. Plant in zones 1 and 4.
- Plant immune *Ribes* varieties and pines from seed selected from resistant trees.
- Plant trees in areas with overstories to avoid free moisture and infections.
- Plant *Ribes* at least 1000 feet from pines.

White Pine Blister Rust Management Trials in Geneva

Now that currants are back on the table, is WPBR still an issue? There are a lot of excellent currant and gooseberry varieties, but not all of them are rust immune. Although we didn't mention it above, WPBR is also devastating to the currant host. Planting highly rust susceptible varieties is still not allowed in NY, but even some of the resistant varieties get some WPBR infection. Over the past seven years, the Geneva experiment station has conducted WPBR management trials on currants and gooseberries across a range of susceptibility to WPBR. Early work focused on conventional pesticide programs and timing while more recent work focused on the management potential of organic and biopesticide programs. A bulleted results summary of our trials follows Highly rust susceptible currant varieties:

- Can be successfully managed using a 4-5 applications of DMI or QoI fungicides. Unfortunately, the 2ee for Nova 40W (DMI) is still in effect, but the 2ee does not apply to the replacement product Rally 40WSP. Cabrio EG is the remaining registered material for WPBR in currants.

- Can be managed to low level of infection using a 4-5 application program biopesticides and organic fungicides including materials such as Serenade Max, ProPhyt 4L, and JMS Organic Stylet oil.

Rust resistant to less susceptible currant and gooseberry varieties:

- Can be rust free using a 4 application program of DMI or QoI fungicides (Nova 40W and Cabrio EG see above).
- Can be rust free using a 4-5 application program biopesticides and organic fungicides including materials such as Serenade Max, ProPhyt 4L, and JMS Organic Stylet oil.

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THE BERRY BEST OF BERRY INTERNET

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Several internet resources are available for berry growers. Presented today is a quick preview of an updated version of the berry diagnostic tool slated for release in March 2009. Among new features added is a link from each diagnostic page to the corresponding management section in the electronic version of the Cornell Pest Management Guidelines for Berry Crops.

Other berry internet resources are listed below for your convenience with a brief description and the url for each site:

URL	Description
New York State Berry Growers Association web site http://www.hort.cornell.edu/grower/nybga/	Information for New York Berry Growers – member ship includes listing in an on line berry "Find-a –farm".
2009 Pest Management Guidelines for Berry Crops http://ipmguidelines.org/berrycrops	An on-line version of the print publication.
Cornell Fruit Resources Website Berries page http://www.fruit.cornell.edu/berry.html	A clearing house for electronic berry resources and production information and as well as label updates and a calendar of berry-related events.
New York Berry News http://www.nysaes.cornell.edu/pp/extension/tfabp/newslett.shtml	An on-line small fruit newsletter featuring berry–related news, views, and research information.
Cornell Small Fruit Nursery Guide http://www.fruit.cornell.edu/Berries/nurseries/	A comprehensive list of small fruit cultivars and the nurseries that sell them
Berry Diagnostic Tool http://www.hort.cornell.edu/diagnostic	A pictorial aid to diagnosing physiological disorders and pest problems of berry crops
Tree Fruit and Berry Pathology Website http://www.nysaes.cornell.edu/pp/extension/tfabp/	The latest on tree fruit and small fruit disease management.
New York State IPM Program http://www.nysipm.cornell.edu	Provides IPM methods, knowledge, and technology to the farms and agricultural production operations of the state.
New York State Pesticide Product Registrations http://pmep.cce.cornell.edu/pims/	Site that provides a listing of currently registered products in NYS, NYS product labels, pesticide applicator information and information on other pesticide related topics.
IPM Fact Sheets for Berry Crops http://www.nysipm.cornell.edu/factsheets/berries/	Fact sheets on berry disease and insect pests.
Food Safety http://www.gaps.cornell.edu/	Practical steps that a grower can take to minimize the risks of bacterial contamination of produce.
National Clonal Germplasm Repository for Berry Crops http://www.ars.usda.gov/main/site_main.htm?modecode=53581500	World's largest collection of varieties and selections of berry crops.
Wildlife Management Information Web Site http://wildlifecontrol.info/Pages/default1.aspx	The Wildlife Damage Management Program allows management experts to address numerous wildlife damage concerns, and coordinate research projects with an education and information dissemination program that reaches extension specialists, growers, nurserymen, and homeowners throughout New York State and the northeast.

Using Webcasting for Field Educator Training
The Berry Crops Internet Seminar Series used web conferencing technology to provide research-based information to help train Cornell Cooperative Extension educators who have berry crops responsibilities. The topics of training were determined by surveys to this audience and also the Board members of the NYS Berry Growers Association.

Adobe Connect is user friendly software that allows the presenter or host to control the flow and format of the training. The Cornell license and network allows up to 80 participants at each session. Presenters need a microphone and/or camera, but participants need only have an Internet web browser and fast and reliable internet connection. Adobe Flash player must be installed.

Information to connect to the conference is sent to the registered participants one week prior to the event so that they may test their connection. Access to the web conference site that hosts the Internet seminars is free of charge. Standard Internet connection charges still apply.

The interactive nature of the seminar provided opportunities to ask questions in a real time venue. Each presentation was broadcast for an hour, with a bit of leeway for Q&A. The broadcasts have been saved and may be viewed by visiting: http://www.fruit.cornell.edu/berries/webinar.htm.

This technology is not meant to replace in-person training, yet in an age of shrinking budgets Webcast training will help Cooperative Extension bridge the gap between research generated information and its application.

VIRUS DISEASES OF SMALL FRUIT: TIPS FOR AVOIDING AND ASSESSING PRESENCE OF VIRUSES IN BLUEBERRIES AND RASPBERRIES

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Blueberry and Raspberry Viruses in New York

In recent years, there have been several outbreaks of berry virus diseases in NY occurring as far north as Oswego County to as far south as Tioga County. Moreover, our program at NYSAES has received more suspected berry virus samples in 2008 than any of the previous seasons. The majority of suspected berry virus disease samples were for blueberries and raspberries, which is understandable since they are both perennial crops. Fortunately, the majority of the samples received were clearly not virus diseases and represented miscellaneous isolated horticultural anomalies. Such samples provided a clear impetus for more extension education on virus problems to address producer concern. At the same time, there have been two severe berry virus outbreaks that we will use as the basis for this education.

Since 2006, the majority of the outbreaks in NY blueberries have been *Tobacco ringspot virus* (TRSV) and *Tomato ringspot virus* (ToRSV) epidemics restricted to the field in which they occurred. When contracted these viruses are quite devastating to the planting. TRSV and ToRSV compromise fruit production considerably and can lead to plant death as the infection becomes systemic. The disease spreads fairly slowly as the vector of both viruses is the ($1/16^{th}$ inch long) soil-borne dagger nematode, *Xiphinema americanum*. Although this nematode migrates best in sandier soils with large pore sizes, it is not uncommon to find it already distributed across a mature planting due to the fact that it can feed on numerous plant species, including fruit trees, small fruits, vegetable, ornamentals and weeds.

In NY raspberries we have only observed two virus outbreaks in recent years: one outbreak of crumbly berry and one of *Raspberry bushy dwarf virus* (RBDV). Crumbly berry is also caused by ToRSV and transmitted by the same nematode vector as in blueberries. Infected raspberries can range from slightly stunted to completely healthy looking. The most striking and diagnostic symptom of the virus is the production of small fruit, which crumble apart when touched. ToRSV infection prevents the maturation of fruit druplets, which is the reason for druplet disassociation on contact. Recently, an outbreak of RBDV was reported and confirmed in NY. This disease typically causes stunting and shoot proliferation in red raspberries, hence the name bushy dwarf. Virus infection can cause aborted druplets and a crumbly berry symptom in some varieties, but will not hinder pollen production. What

makes this disease exceptionally harmful is the fact that RBDV is pollen borne and seed transmitted, meaning that nearby healthy plants can become infected during pollination. Because of this mode of transmission, this virus can spread much more rapidly than ToRSV in raspberry plantings.

How to distinguish viruses from other problems

Because of the devastating nature of virus diseases in plants and the fact that there is no cure in a fruit planting, it becomes important to be able to distinguish virus problems from other subtle but similar looking horticultural problems. The reason that viruses look so similar to horticulatural problems is due to the fact that virus infection primarily upsets the plant physiology in similar ways to a nutrient deficiency or toxicity. For example, if a virus infection and nutrient deficiency disrupts chloroplast production, they would both cause affected regions of leaves to appear discolored. This being said, there are several things one can look for to see if virus infection is a likely culprit of the symptoms problem. Below is a list of considerations regarding virus development in a fruit planting:

1. Number of shoots and leaves expressing virus-like symptoms: Do not be alarmed by the presence of a few crumbly bramble fruits, or interveinal or patterned chlorosis on one or two leaves or shoots on a cane or bush. Indeed, symptom distribution can be patchy throughout an individual plant, but only one or two strange looking leaves or shoots is not cause for alarm all by themselves.
2. Intensity of virus-like symptoms: Although virus infected plants can be asymptomatic, poor fruit production, or lack thereof is not reason enough to suspect a virus infection. In the infected plantings that were visited, symptoms were spectacular enough as to be certain to the untrained eye.
3. Timing of symptom appearance: Virus tissue titers are often greatest during the height of plant tissue production at spring time, and as such, virus symptoms will be most readily apparent during peak biomass production. Hence, the sudden appearance of bizarre symptoms at the end of the summer during the beginning of senescence is not likely to be a virus problem. Young tissue that failed to mature during the season due to poor nutrition can look quite spectacular.
4. Symptom distribution pattern: Viruses are usually patchy in distribution during their initial inception. This is due to the restricted movement and habitation patterns of the virus.
5. Symptom distribution pattern across varieties: Varieties vary in susceptibility and response to virus infection. Symptoms are usually clustered or differentially expressed in different varieties. Uniformly distributed symptoms across plants, blocks, and varieties are more likely to be due to abiotic causes like a nutrition regime, unless every plant is already virus-infected at planting.

How to avoid and get rid of viruses

Since viruses are absolute parasites, there are no chemical pesticides that can be applied to control them. Even if there were effective chemical controls, the viruses are protected within the host tissue. The best defense is to avoid them. Unfortunately, vectors are less avoidable but they can be sampled and treated for prior to planting in the case of nematodes. More unfortunately, planting stock can arrive at your doorstep already infected with viruses. Hence, it is most important that one only purchases planting material from established nurseries in areas where virus certification programs are implemented.

Once, a plant has a virus, it has the virus for life. The only way to get rid of the virus from your planting is to remove and destroy the infected plants. You cannot just remove the symptomatic plants as the neighboring plants may be recently infected, but do not have high enough virus titers to display symptoms. For most virus diseases of blueberries and raspberries, it may be important to remove the entire block or planting to make sure you get rid of the problem. It is risky to your continued operations and neighboring operations to leave the crop in the ground in the hope of getting another harvest.

How can NYSAES help berry producers?

NYSAES has the infrastructure, equipment and expertise to conduct virus testing for any number of berry crops and viruses. Given the prevalence of ToRSV in NY, it would be pertinent to conduct a statewide survey of blueberries and raspberries for viruses. Such survey could be conducted as a collaborative effort between growers, Cornell extension specialists, IPM coordinators and plant pathologists at NYSAES. With the equipment and infrastructure on hand, the only necessary support would consist of resources for sample collection and processing and test reagents.

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HIGH TUNNEL BLACKBERRIES AND RASPBERRIES

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The price of raspberries and blackberries doubles during the off season as fruit must be imported from the Southern Hemisphere to meet demand. However, new technology is allowing local growers to realize higher prices for blackberries and raspberries produced as late as November.

We have examined 3 strategies for producing these fruits beyond the normal season using high tunnels. In all cases, fruit quality in the tunnel has been much improved compared to the outside where percent marketable fruit can be 20 – 40% higher.

1) Grow primocane-fruiting raspberries and blackberries under late-covered high tunnels to extend the fruiting season into the fall.

Primocane-fruitng raspberries and blackberries are grown throughout the season in an uncovered tunnel. Some plants are pinched in June when they are about 3 feet tall in order to delay flowering. In late August or early September, the tunnel is covered. Plants begin fruiting then. Outside plants succumb to frost in early October, but those within the tunnel continue fruiting for another 4 – 5 weeks. If plants experience extreme cold under the tunnel, they can be covered with row cover for one or two nights until temperatures warm again.

Yields from fall-crop-only raspberries has been quite high, between 2,000 – 3,000 half-pints per 30 X 96 ft. tunnel. Canes are mowed to the ground after harvest and the cycle repeats. Heritage, Caroline, and Josephine have performed well in this system. We are currently examining the performance of Prime-Jan primocane-fruiting blackberry, with the intention of producing these fruits in September and October.

2) Accelerate primocane-fruiting raspberries by growing them under a continuously-covered tunnel.

We grew Heritage raspberries under a continuously-covered tunnel. In addition, we covered individual rows with row covers or small plastic hoops for a short time in early spring to provide even more heat. Production was compared to uncovered plants.

We found that, although some treatments accelerated flowering and fruiting, the difference with field-grown plants was not that dramatic. Yields were mostly unaffected between the various covering treatments and with field-grown plants. Mite populations were very high in the tunnel, however, and probably reduced potential yield. The other difference with field-grown plants was that primocanes grew exceptionally tall in the covered tunnels, so tall that they were difficult to harvest.

Since these canes were so tall, we did not remove them after fall harvest, but overwintered them to obtain a spring crop on what were then very long floricanes. These floricanes produced significant yield, about 30 – 40% of what the previous fall crop produced. Yield potential was even higher, but new primocanes interfered with the harvest of floricanes. In addition, mites were still a problem on these canes, and berries were smaller with the summer crop. However, it could be worth keeping primocanes through the winter to obtain a summer harvest.

3) Overwinter tender blackberries and black raspberries under a continuously-covered tunnel.

Many caneberries cannot tolerate the winters of Upstate New York. Blackberries with excellent flavor exist, but they often are not fruitful in our climate. We have found that blackberries and black raspberries grow and fruit exceptionally well under tunnels. Despite the fact that temperatures fluctuate more inside than outside a tunnel, and that temperatures within are just as cold as those outside, the plants tolerate this quite well. This is likely due to less desiccation from cold, dry winter winds within a tunnel. Blackberries and black raspberries are much more tolerant of mites and hot temperatures than red raspberries, so they grow exceptionally well under tunnels.

Yield differences between outdoor and covered blackberries have been dramatic. Although we get very little production from most blackberries grown outdoors, it appears that we have full crops inside the tunnels. Doyle, Ouachita, Triple Crown and Chester have performed well for us. Black raspberries responded less than blackberries to the tunnel environment.

A detailed description of high tunnel berry production can be found at:
http://www.fruit.cornell.edu/Berries/bramblepdf/hightunnelsrasp.pdf.

SOIL MANAGEMENT FOR OPTIMAL BLUEBERRY PRODUCTION

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Demand for fresh blueberries has grown considerably over the past 50 years, and is showing no sign of slowing down. Studies associating consumption of blueberries with health is contributing to this demand, as is the consumer's desire to purchase locally-grown fruit. To respond to this increased demand, growers are starting to plant blueberries on soils that are less than ideal.

Criteria exist for blueberry soils, and if these criteria are not met, then it is difficult to establish a successful blueberry planting. The first criterion is that the soil be composed of a significant amount of sand to allow for good drainage and pore space. Sands, loamy sands and sandy loams are acceptable. Silts and clays are generally not conducive for blueberry root development because they lack pore space of an appropriate size. Blueberries have extremely fibrous roots that do not penetrate heavier soils and small pores. Blueberry roots require a large pore space in order to lengthen and develop. Despite the fact that blueberries can tolerate wet soils, root growth is far better on well-drained soils. Clay and silt soils can become compacted, whereas sandier soils tend to be more resistant to compaction and drain better.

A second criterion is low pH. An optimal pH for blueberries is 4.5, with a range between 4.2 and 4.8. At a lower or higher pH, certain essential nutrients become unavailable. One of the most common problems in blueberry plantings is high pH. When pH exceeds 5.0, the availability of iron becomes limiting and chlorophyll production ceases, leading to interveinal yellowing of leaves and poor growth. Other nutrients also become unavailable at a high soil pH. If the soil pH is slightly higher than desired, sulfur can be added to lower it. The amount of sulfur is dependent on the current pH, the soil type and the cation exchange capacity. Sandier soils require less sulfur to modify than clayey soils.

A third criterion is calcium content. Blueberries do poorly when soil calcium levels exceed about 2,000 lb/A, probably because calcium interferes with the uptake of other nutrients. Even if soil pH is 4.5, blueberry plants will not grow well if the calcium level is high. Unfortunately, growers cannot preferentially remove calcium from the soil. They can inadvertently add calcium, however, if they irrigate blueberry with high lime water.

To summarize, a blueberry soil should be lighter than a loam, have a pH less than 5.0, and have a calcium content of less than 2,000 lb/A. The pH can be changed whereas the other two factors are fixed.

Once there criteria are met, then other modifications can be made to enhance blueberry performance. For example, blueberries can be grown on raised beds to improve drainage. Organic matter can be added to improve moisture and nutrient holding capacity. Ammonium forms of nitrogen can be used to fertilize plants as these forms provide N in a source that blueberry plants can use directly, and ammonium uptake contributes to soil acidification.

Blueberries also have a symbiotic relationship with endomycorrhizal fungi in which nitrogen and phosphorus uptake are improved through this association. High organic matter and low fertilizer rates contribute to the growth of these beneficial fungi.

Should supplemental nutrients be required before planting, avoid chloride (muriate) forms of fertilizer. For example, if the soil tests low in potassium, apply potassium sulfate rather than muriate of potash (potassium chloride). Certain ions (e.g. nitrate, chloride) are toxic to blueberry roots.

Incorporated cover crops can provide organic matter prior to planting. Once plants are established, most growers applied wood chips and/or sawdust under plants. This mulch can improve soil moisture, suppress weeds and supply organic matter.

Without the foundation of a good soil, a blueberry planting will not be successful. Planting blueberries in inappropriate soils is one of the most common problems that we are seeing among berry growers.

MANAGING FRUITWORMS AND MAGGOTS IN BLUEBERRIES

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Introduction

In comparison to a fruit crop like apples, blueberries in NY are not afflicted by a large number of serious arthropod pests. However, there are a few species that can be very problematic in some locations and in some years. Our presentation today will focus on two of these pests, fruitworms and blueberry maggot. There will be three sections to this tag team talk. Molly will start by providing an overview of their biology and then she will summarize a survey she conducted at 10 blueberry farms in the southern tier for fruitworms and blueberry maggot. Greg will finish with a discussion of the different control options for these pests.

Pest Biology and Damage

There are two species of fruitworm that attack blueberry fruit in our area: cranberry fruitworm and cherry fruitworm. In the south-central region of NY, cranberry fruitworm seems to be the major problem, with cherry fruitworm a minor contributor. Both of these pests are moths as adults that emerge in the spring and lay eggs on the fruit right around petal-fall. Eggs hatch and the larvae burrow into the green fruit. Cranberry fruitworm makes a mess while it feeds, tunneling between berries in a cluster, webbing them together, and leaving sawdust-like frass in globs outside the berries. Cherry fruitworm is much more subtle, living in one or two berries and not leaving much evidence of its whereabouts on the outside of the fruit. However, when a berry is infested with either larva, it will turn blue earlier than all the neighboring berries, and growers can see pretty easily how much damage they have by scouting the planting for clusters that are blue before the first healthy berries start to change color. There is only one generation per season for both species of moths. Michigan State Extension has a very nice website with fact sheets containing much more life cycle details on these and many other blueberry pests. See http://www.blueberries.msu.edu/.

The blueberry maggot adult is a medium-size fly with characteristic markings on the wings. These flies overwinter as pupae in soil and start to emerge as adults in the middle of the summer when the fruit is turning blue. Adults will mate and lay eggs over a period of a month or so, starting in July. They lay their eggs just under the skin of the berry and the tiny maggots burrow into the fruit and gorge themselves until they're full grown (about three weeks), at which time they exit the berry, drop to the ground, pupate, and wait until next summer to emerge as adults. A berry with a maggot in it looks nearly identical to a healthy berry, and therein likes the problem. When the berries are picked and used, the maggots have a nasty habit of floating to the top of jams and crawling out into breakfast cereal. Although blueberry maggot has only one generation per season, emergence is not very synchronous and as a consequence, new flies can appear from July until late August. Again, see Michigan's excellent fact sheet on the blueberry maggot life cycle at http://www.blueberries. msu.edu/.

Monitoring for Fruitworms and Blueberry Maggots

We set out traps for cranberry fruitworm, cherry fruitworm, and blueberry maggot on 10 farms located in Tioga, Tompkins, Cortland, Chemung and Schuyler counties. Each farm got at least one trap for cranberry fruitworm and one for cherry fruitworm, and at least two for blueberry maggot. The traps for the fruitworms were baited with sex pheromone and therefore captured male moths. The traps for blueberry maggot were yellow cards covered with sticky material and baited with a food odor/feeding stimulant.

We found that in the Southern Tier of NY, the populations of these insects were spotty. Only one farm had cherry fruitworm present. Six of the ten farms had cranberry fruitworm, with the highest trap count for the season being 447 at a location in the Finger Lakes, while several regional farms had zero moths trapped. Two of the ten had blueberry maggot. Population distributions didn't seem to follow a recognizable pattern. Sometimes one farm happened to have them while the farm down the road did not. Many farmers have had variable insect pressure over the years—one year they may be bad at a certain location, while the next year they could be almost non-existent.

Since these pests aren't present at every farm, and since they show up at slightly different times each year because of weather variations, monitoring for their presence makes sense. Knowing what's going on with the insects can save insecticide sprays and can improve spray effectiveness by allowing the timing to be more precise.

Who Benefits from using Traps?

We found that three types of farms in particular would benefit from setting out traps to monitor for these insects:

1. *Growers who spray every year assuming they'll have a problem, but who never see insect damage in the harvest.* Two growers in this group realized that they could use the traps to decrease their insecticide applications, and maybe eliminate insecticides all together when adults were not present in the traps.
2. *Growers who have variable levels of damage, and would spray if in a particular year a high number of moths were trapped.* There were three growers in the study in this group. They had enough damage from cranberry fruitworm in the past that if the adults showed up in high numbers in their traps (this "high number" is arbitrarily set by the grower, there is no established threshold), then they will spray an insecticide for control. But if few moths are in the traps, they will not spray and they'll tolerate a low level of damage in the harvest.
3. *Growers who do not spray insecticides at all, no matter the extent of the damage.* Whether it's for personal safety reasons or philosophical convictions, they will not apply insecticides. There were five growers in the study in this group, and while it was useful for them to monitor for the insects for one year to learn their life cycle, it wouldn't be worth their while to trap for years to come because the results would not affect their management decisions.

Learning How To Use The Traps

There are two fact sheets that will help growers learn how to use the traps to make management decisions. First, read about the life cycles of the pests from the Michigan State Extension website (http://www.blueberries.msu.edu/). It's important to understand the pests' life cycles before trying to control them. Second, the trapping instructions and other information can be downloaded from our Tioga county extension website (http://counties.cce.cornell.edu/tioga/tcag.php) or you can ask for a copy to be mailed to you by calling Molly Shaw at 607-687-4020 x 319 or e-mailing her at meh39@cornell.edu. The fact sheets provide details about where to buy supplies, how to set the traps in the field, and what to look for in the traps.

Control Decisions

Michigan State recommends using the traps for the cranberry and cherry fruitworms to determine when to start scouting for eggs laid on the fruit, and to *scout for eggs* in order to determine the optimal spray time. Scouting for eggs provides more reliable spray timing than trap counts alone. At one farm that had a history of high cranberry fruitworm damage we did scout for eggs and found that nearly 30% of the clusters had eggs on them. Scouting for eggs is not as hard as it sounds. With a little practice you can even tell which eggs are just about ready to hatch, since they change color as they mature. Determining when the eggs are ready to hatch pinpoints the optimal first spray coverage timing. However, this same grower had been using the traps for the past few years to help time his sprays without ever scouting for eggs, and he still got satisfactory control. In a u-pick situation (like we have for the most part in NY but unlike the wholesale markets in Michigan where berries are mechanically harvested), using the traps alone may be good enough, because growers generally tolerate some level of damage at harvest. By just using

the traps this grower found out that he could start his sprays later than his usual late bloom timing (and therefore apply one less spray that season) and still get satisfactory control of the fruitworms.

There are a number of different insecticides that can be used against fruitworms in blueberries. Some important characteristics to consider are efficacy, spectrum of activity, length of residual efficacy, impact on pollinators or natural enemies, and worker safety. We will discuss some of these aspects during the talk as well as highlight some of the new materials recently labeled in New York.

Blueberry maggot is no fun to deal with in terms of control. Since flies emerge over a two-month period and lay eggs on ripening fruit, spraying for maggot control involves multiple sprays with a low residual/short days-to-harvest product. The recommendation is to apply the first spray within a week after the first sustained catch of flies on the traps ("sustained" means several flies per week, not just one or two flies), and to continue spraying according to the label directions. The sprays target the female fly as she tries to lay an egg in a berry, so the insecticide has to be present on the berry surface to work. During the presentation we will summarize characteristics of the different insecticides labeled for use against blueberry maggot as well as other management approaches.

Chemical control: Cranberry Fruit Worm

Pesticide	Restricted Use	Bee Safe (Y/N)	Nat Enemy Impact	Vulnerable Stage	DTH (days)	REI	COST PER ACRE
azinphons-methyl [Guthion, others]	Y	N	H	Larva	7	7 d (30 d public)	$14.10
phosmet [Imidan]	Y	N	M	Larva	3	3 d	$10.67
carbaryl [Sevin 80S, others]	N	N	M	Larva	7	12 hr	$16.67
fenpropathrin [Danitol]	Y	N	H	Larva	3	24 hr	$20.16
acetamiprid [Assail]	N	N	L-M	Larva	1	12 hr	
***Bacillus thuringiensis [Bt]**	N	Y	L	Larva	0	4 hr	$12.67
tebufenoxzide [Confirm, IGR]	Y	Y	L	Egg, Young Larva	14	4 hr	$22.12
pyriproxyfen [Esteem, IGR]	N	Y	L	Egg, Young Larva	7	12 hr	$16.80
spinosad [Spintor, *Entrust]	N	N	L	Young Larva	3	4 hr	$30.54/$45.62
spinetoram [Delegate]	N	N	L	Young Larva	3	4 hr	$39.24

**Organic option*
Compiled by G. Loeb, Cornell University, NYSAES, Geneva (most prices based on 2008 retail, using high label rates).

Chemical control: Blueberry Maggot

Pesticide	Restricted Use	Nat Enemy Impact	Vulnerable Stage	DTH (days)	REI	COST PER ACRE
azinphons-methyl [Guthion, others]	Y	H	Adult	7	7 d (30 d public)	$14.10
phosmet [Imidan]	Y	M	Adult	3	3 d	$10.67
malathion [Malathion]	N	M	Adult	1	12 hr	$9
carbaryl [Sevin 80S, others]	N	M	Adult	7	12 hr	$16.97
fenpropathrin [Danitol]	Y	H	Adult	3	24 hr	$13.43
acetamiprid [Assail]	N	L-M	Adult	1	12 hr	
imidacloprid [Provado]	Y	L	Adult	3	12 hr	$24.96
pyrethrin [*Pyrenone]	N	L-M	Adult	0	12 hr	
spinosad [*Gf-120 bait]	N	L	Adult	0?	4 hr	

**Organic option*
Compiled by G. Loeb, Cornell University, NYSAES, Geneva (most prices based on 2008 retail, using high label rates).

DESIGNING A BETTER SPRAYER FOR PESTICIDE APPLICATION IN STRAWBERRIES

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A number of strawberry growers find it difficult to obtain good disease and insect control when using conventional boom sprayers. Many growers are getting poor coverage of undersides of leaves, lower leaves, and on the fruit when the strawberry plant is in full canopy. This results in high levels of disease and insect activity translating to consumer rejection of poor quality fruit.

In the 2008 growing season two prototype hoop sprayers were built at Cornell University and fitted to the sprayers belonging to two cooperating growers in early May. The hoop sprayers were connected to the existing plumbing system. The targeted hoop design allows growers to change from three to five nozzles, as the canopy develops..

Deposition onto the crop was measured by adding Pyranine fluorescent tracer into the sprayer tank. Leaves were picked from the top, middle and bottom part of the canopy. Three leaves from each area were placed into plastic bags and sealed. 10 plants per treatment were selected, there were five replicates. Samples were collected from 2 farms, on two separate occasions, in May and in June.

Data concerning biological effectiveness is currently being analysed and will be available at the conference.

In an excellent growing season, spray volume was increased as the season progressed. Results, to date, are varied, showing how variety and growth structure can affect deposition, particularly in the bottom of the crop canopy.

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Strawberries 2008 Final Tables

Farm D May 2008 Average Fluorescence per Area		
Location of Leaves within the Plant	**Boom Fluorescence/Area (square cm)**	**Hoop Fluorescence/Area (square cm)**
Top	8.753	4.544
Middle	2.364	2.496
Bottom	0.693	1.14

Farm J May 2008 Average Fluorescence per Area		
Location of Leaves within the Plant	**Boom Fluorescence/Area (square cm)**	**Hoop Fluorescence/Area (square cm)**
Top	12.497	6.557
Middle	4.113	3.051
Bottom	1.25	1.408

Farm D June 5, 2008 Average Fluorescence per Area		
Location of Leaves within the Plant	**Boom Fluorescence/Area (square cm)**	**Hoop Fluorescence/Area (square cm)**
Top	17.109	14.621
Middle	3.814	7.739
Bottom	1.867	4.784

Farm D June 6, 2008 Average Fluorescence per Area		
Location of Leaves within the Plant	**Boom Fluorescence/Area (square cm)**	**Hoop Fluorescence/Area (square cm)**
Top	5.03	3.49
Middle	0.697	1.388
Bottom	0.352	0.406

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WEED CONTROL UPDATE FOR NEW YORK STRAWBERRIES

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Over the past couple of years some new herbicides have become available to commercial strawberry growers in New York State. These products offer new versatility for growers and can set new standards for weed control. To date, little research data has been compiled in New York to understand the most effective use patterns of these new tools.

A field trial was initiated in the spring of 2008 to evaluate older herbicides used under new use patterns, newly registered herbicides, and potential new herbicides for use in perennial strawberry culture. The trial consisted of sixteen treatments, which included five unregistered products, two soon to be registered, and four currently registered herbicides. Plots consisted of a double-row of 'Jewel' transplants planted (6/4) in a matted-row system. Applications occurred 30-days prior to transplanting, pre-transplant, post-transplanting, and 3- and 6-weeks post-transplanting. Strawberry plants were evaluated for visual injury and plots were evaluated for weed control.

Plants showed initial stunting to virtually all products tested, but out grew this stunting by later-July in all but three of the treatments (Chateau 30DPRETP, Chateau PRE-TP, and Bandur PRE-TP). Though it should be noted that this planting eventually had a very serious outbreak of verticillium wilt, and some of this later season observed injury could be in part due to this. Subsequently, this planting will not be taken to yield in 2009.

Weed control ratings occurred at two dates (6/16 and 7/2) and a timed handweeding occurred at 7/25. On the first observation date, all products tested showed superior weed control (>90%) with the exception of Kixor and Bandur both of which are new products. Both Kixor and Bandur showed weakness in controlling L. crabgrass and Bandur also did not control C. purslane. Sinbar was applied in three micro-rates (1.6 oz/A) to reduce potential injury while extending weed control longevity. By early July (7/2) control of C. purslane, L. crabgrass, and H. nightshade had ceased and was dominating plots. Princep 90, a product currently working its way through the IR-4 system for strawberries, was also applied in three micro-rates (0.5 oz/A) and offered above average (>85%) control through 7/2 and had the lowest handweeding time on 7/25. As compared to a higher rate applied 30D PRE-TP, micro-rates of Princep offered better weed control. Chateau offered the best weed control of virtually any product regardless of rate and application timing. Dual Magnum, another product in the IR-4 pipeline, showed superior weed control (>90%) through July and a significant reduction in handweeding time from most products regardless of rate. Lorox, an unregistered product, offered superior weed control and crop safety and will be tested in future field studies.