Michigan Blueberry I.P.M. Update

May 20, 2008 Volume 2, No. 5

Next Blueberry IPM Twilight Meeting

When: May 28, 2008 *6-8PM*

Where: Carini Farms 15309 Port Sheldon Road, West Olive - Ottawa County west of US 31.

What: Timely updates for control of insect, disease, and weed control. This is a free meeting, with a light dinner served at 6PM. Spray credits available for attending.

Contents

CROP STAGES

Keith Mason

Department of Entomology, MSU

In Van Buren County, Jersey in Covert is at 50 to 75% bloom, and in Grand Junction, Blueray is at full bloom and Bluecrop is at early petal fall. In Ottawa County, Blueray in Holland and Rubel in West Olive are at 50% bloom, and Bluecrop in West Olive is nearing full bloom.

Bluecrop nearing petal fall in Grand Junction (left) and Blueray at 50% bloom in Holland (right).

WEATHER NOTES

Complete weather summaries and forecasts are available at www.enviroweather.msu.edu

Cool weather will continue through this week with high temperatures mostly in the fifties and sixties and lows in the lower forties. At the end of the week, warmer weather returns. Friday and Saturday's high temperatures will be near 70, and highs will approach 80 on Sunday and Monday. Little precipitation is expected over the next week.

DEGREE DAYS		
GDD (from March 1)	**Base 42**	**Base 50**
	Van Buren County	
5-12-08	530	284
5-19-08	613	327
Projected for 5-26-08	696	381
	Ottawa County	
5-12-08	435	213
5-19-08	510	248
Projected for 5-26-08	601	298

The next Michigan Blueberry IPM Update will be sent out on Wednesday May 28 due to the Memorial Day holiday.

PEST OF THE WEEK

Anthracnose fruit rot (Ripe Rot)
Colletotrichum acutatum (fungus)

Timothy Miles and Annemiek Schilder
Department of Plant Pathology, Michigan State University

Anthracnose fruit rot is the most common and widespread fruit rot disease of blueberries in Michigan and in the United States. The disease is caused by the fungus *Colletotrichum acutatum*. This fungus is responsible for substantial pre- and post-harvest losses in yield and fruit quality, including reduced shelf life and unappealing appearance of fruit. Pre-harvest crop losses may reach 10-20%, whereas post-harvest losses can be as high as 100% in severe cases. High levels of anthracnose fruit rot can also lead to unacceptable microbial counts in frozen processed fruit. Warm, wet seasons are particularly conducive to disease development.

Symptoms

Berries usually become infected while still green and immature. However, the infection remains latent and fruit rot symptoms do not appear until the berries ripen, hence the name "ripe rot". Berries show sunken areas and shriveling (Figs. 2a, 3a) and under humid conditions, support orange, gelatinous spore masses (Figs. 3a, b). After harvest, fruit can rot quickly (within 2-4 days) but rapid refrigeration delays rot development. In addition, *C. acutatum* sometimes causes blighting of blossoms and twigs which is difficult to distinguish from Phomopsis twig blight or Botrytis blossom blight. Cane cankers and leaf spots may also occur but are more sporadic.

Disease cycle

During spring, spores are released from dead twigs and buds during rainy periods and can initiate blossom blight and latent infections on green fruit. Once the spore lands on the fruit surface the fungus requires at least 12 hours of continuous wetness to initiate infection. The fungus will then proceed to colonize the tissue and sporulate on the fruit surface. Spores are spread by rain and irrigation water and can infect surrounding berries. Infections can also occur when healthy berries pick up spores from rotting berries or contaminated surfaces of harvesting and sorting equipment.

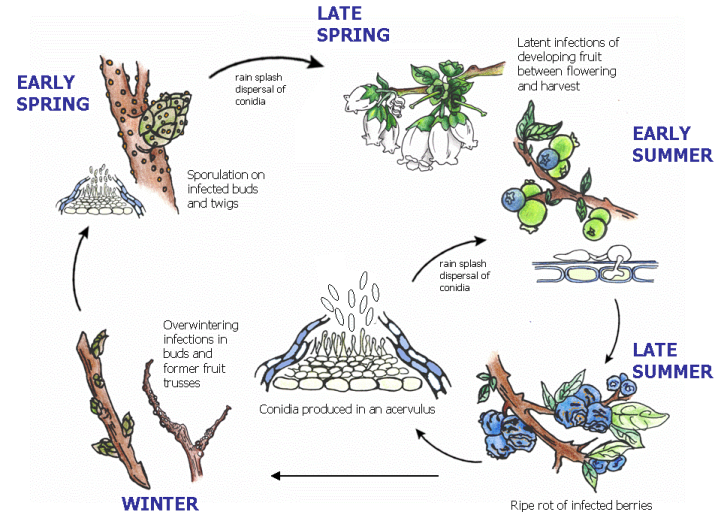

Figure 1. Disease cycle of *Colletotrichum acutatum* on blueberries. (illustrated by Jennifer Pagan)

Figure 2. A) Field symptoms of anthracnose. B) Salmon-pink spore masses of *C. acutatum* on a twig.

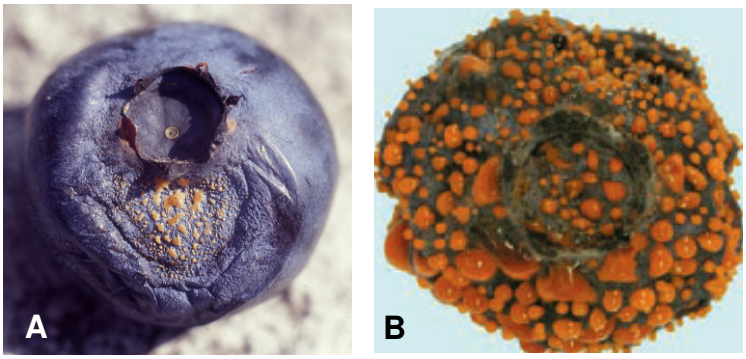

Figure 3. A) Late stage fruit rot symptoms seen in the field under high humidity. B) Post-harvest incubation of fruit under high humidity results in copious orange spore masses on the fruit surface.

Management

Since anthracnose does not manifest itself until close to harvest, preventative control strategies are necessary. This is especially important if the field has a history of anthracnose based on scouting or observations during harvest. Control measures should be aimed at making the environment less conducive for pathogen growth and development, e.g., by pruning bushes to create an open canopy (this will also allow better spray penetration), good weed control, and timing of overhead irrigation to allow rapid drying of leaves and fruit. Timely harvests and rapid cooling and processing of fruit can reduce post-harvest losses. A fungicide spray program from pink bud to harvest will prevent infection of blossoms and fruit. The E-154 extension bulletin lists several fungicides that are effective against anthracnose including Captan, Bravo, Pristine, Abound, Cabrio, and Switch. Bravo should not be used after bloom starts due to possible injury. Pruning out of old or infected canes and twigs can be effective at eradicating or reducing overwintering inoculum. Another option is to plant resistant cultivars, such as Elliott. Among the newer cultivars, Draper and Liberty are resistant and Aurora is moderately resistant to anthracnose fruit rot. More research is needed to investigate whether bud infections in the fall are a significant source of inoculum for fruit infections the following year.

INSECT UPDATE

Keith Mason and Rufus Isaacs
Department of Entomology, Michigan State University

Despite the continued cool weather we have seen the number of cherry fruitworm moths caught in traps increase over the last week. Cherry fruitworm was caught at the Grand Junction, Covert and West Olive farms. We also have caught the first cranberry fruitworm moths in the past week. These were trapped in Van Buren county (Covert and Grand Junction) but not yet in Ottawa county. We expect the number of both species of fruitworms caught to increase over the next week. Growers and scouts should have cherry and cranberry fruitworm traps set and continue monitoring these traps.

All farms were scouted for the presence of blueberry aphid, but none were observed. Growers and scouts should be looking for this pest particularly on farms with varieties that are susceptible to shoestring virus. See below for scouting methods for aphids.

Otherwise insect activity has remained low at all four farms. No leafroller, climbing cutworm or spanworm feeding was observed at the scouted farms. Growers and scouts should still be on the lookout for feeding by these pests. The flower feeding beetle *Hoplia trifasciata* was not seen at any of the four farms, and no feeding damage was seen.

SCOUTING FOR APHIDS

Begin scouting for blueberry aphids in early to mid May. Look at 2 shoots of new growth at the base of 10 bushes and check for the presence of aphids on the underside of the leaves. As the season progresses, you should look for parasitized aphids (mummies). Record the number of shoots with aphids on the 10 bushes – 2 shoots per bush (multiply by 5 to get % infested shoots). Do the same for aphid mummies. If aphids are found on varieties that are susceptible to shoestring virus, insecticides may be needed for control. For more info on blueberry aphids, see the insect section of the MSU Blueberry Facts website.

Aphid colony on underside of leaf.
Jerry A. Payne, USDA ARS

Van Buren County						
Farm	Date	CBFW moths per trap	CFW moths per trap	BBA % infested shoots	BBM adults per trap	JB per 20 bushes
Covert	5-5	0	0	0		
	5-12	0	0	0		
	5-19	2	1	0		
Grand Junction	5-5	0	1	0		
	5-12	0	1	0		
	5-19	1	2	0		
Ottawa County						
Farm	Date	CBFW moths per trap	CFW moths per trap	BBA % infested shoots	BBM adults per trap	JB per 20 bushes
Holland	5-5	0	0	0		
	5-12	0	0	0		
	5-19	0	0	0		
West Olive	5-5	0	0	0		
	5-12	0	0	0		
	5-19	0	2	0		

DISEASE UPDATE

Timothy Miles and Annemiek Schilder
Department of Plant Pathology, Michigan State University

Shoot strikes strike back!

This week all scouted plots were at 50% bloom. As discussed in previous weeks apothecia have declined and were absent in many of our plots this week. However, shoot strike infections were found in each of the scouted plots (Figure 1). The number of shoot strikes varied among scouted plots. This week, the highest incidence of shoot strikes was observed in Grand Junction with an average of 6.8 shoot strike infections per bush. Since it takes 12-14 days from infection for symptoms to show, shoot strike numbers will still likely increase. Shoot strikes are the major source of infectious spores for fruit infection. Good pollinating weather increases the risk of fruit infection as bees serve as carriers of infectious spores when they move from infected shoots to susceptible flowers.

Since all of the fields were at least at 50% bloom, fungicide sprays to prevent fruit infection are recommended. Systemic fungicides such as Indar or Pristine are best, since we are trying to protect the flower stigma from infection. The spores germinate on the stigma and then the fungus grows alongside the pollen tubes through the pistil into the ovaries. Individual flowers are most susceptible right after they open and susceptibility decreases over time. Once the fungus reaches the ovaries, it colonizes in the developing berry. This infection is not noticeable while the fruit is still green but can be seen as white fungal growth once the berries are cut open.

Figure 1. Shoot strike symptoms observed at all of the scouted plots on 5-15-08. A) Covert, B) Grand Junction, C) Holland and D) West Olive.

Farm	Date	Average number of mummies on the ground per bush*	% Germinated mummies	Average number of apothecia on the ground per bush*	Average number of mummy berry shoot strikes*
Van Buren County					
Covert	5-2	2.4	8.3%	0.4	0.0
	5-9	1.9	5.3%	0.1	0.1
	5-15	-	-	0.0	0.8
Grand Junction	5-2	24.6	30.5%	11.2	0.0
	5-9	18.7	5.9%	1.4	0.1
	5-15	-	-	0.0	6.8
Ottawa County					
Holland	5-2	3.2	21.9%	1.0	0.0
	5-9	2.7	3.7%	0.2	0.0
	5-15	-	-	0.0	0.5
West Olive	5-2	7.1	28.2%	3.1	0.0
	5-9	9.0	8.9%	1.3	0.0
	5-15	-	-	0.7	3.4

*Average number was calculated for ten bushes.

TOPSIN M SECTION 18 REQUEST FOR BLUEBERRIES DENIED BY EPA

Annemiek Schilder, Plant Pathology

After 7 years of granting emergency exemptions for the use of the fungicide Topsin M (thiophanate methyl) as a replacement for Benlate (benomyl) in blueberries in Michigan, the Environmental Protection Agency (EPA) has not granted our emergency exemption request for the 2008 season. Of the Topsin M Section 18s originally issued to multiple states for blueberries, the only remaining applicant in 2007 and 2008 was Michigan, indicating that growers in other states had found alternatives among the currently registered products.

The reason for the denial of the Topsin M section 18 request this year was the need for a strong emergency rationale and avoided loss picture in light of the registration of a number of new fungicides directly labeled for the diseases of concern. This made it very hard to argue that this year's request could meet even the minimum requirements for significant economic loss (i.e., 20% yield or gross revenue loss, or 50% net operating revenue loss). The EPA did listen to our concerns for maintaining a resistance management program for the future, but to reasonably narrow the emergency exemption program to "urgent and non-routine" situations, the Section 18 program is geared only to cases of demonstrated fungicide resistance that result in significant economic losses. In addition, new data regarding the toxicological status of Topsin M did not favor this product in its review by the EPA. It is my understanding that if and when an emergency situation does develop, the EPA will reconsider our request.

Since we cannot use Topsin M this year and its fate regarding full registration for blueberries is unclear, we need to consider alternative fungicide options. Michigan blueberry growers have done very well in rotating different fungicide chemistries, which is important for fungicide resistance management. Topsin M has a different chemistry from all other fungicides in our arsenal. Therefore, we have to be careful to not overuse the remaining fungicides since both the strobilurins and sterol inhibitors are at risk of resistance development in target fungi.

Good alternatives for control of Phomopsis and mummy berry are Pristine (pyraclostrobin + boscalid), Indar (fenbuconazole) and Orbit (propiconazole), whereas Bravo (chlorothalonil), Ziram (ziram), and Captan (captan) have moderate efficacy as protectants. It is important to remember that Indar and Orbit belong to the same chemical class (sterol inhibitors) and have a 30-day PHI. Serenade (*Bacillus subtilis*) is also an option for mummy berry control. Alternatives for control of anthracnose fruit rot are Abound (azoxystrobin), Cabrio (pyraclostrobin), Pristine, Switch (cyprodinil and fludioxonil), Bravo, Captan, Captevate (captan + fenhexamid), and Ziram. Botrytis blossom blight is controlled well by Captevate, Elevate (fenhexamid), Switch, and Pristine.

Table 1. Effectiveness of Fungicides for Blueberry Disease Control.

Fungicide	Mummy berry		Phomopsis twig blight and canker	Fusicoccum canker	Alternaria fruit rot	Anthracnose fruit rot	Botrytis blight and fruit rot	Phytophthora Root Rot
	Shoot	Fruit						
Abound	+ / ++	+ / ++	++	?	++	++++	+	?
Aliette	0	0	+++	?	+++	+++	?	+++
Topsin M + Captan or	++	++	+++	+++	+	+++	+++	0
Ziram	+ / ++	+ / ++	++++	?	++	+++	+++	0
Bravo	++	+	+++	+++	+	+++	++	0
Cabrio	+ / ++	+ / ++	+++	?	++	++++	+	?
Captan	+	+ / ++	++	+	+	++ / +++	+	0
Captevate	++	++	++	?	?	++	++++	0
Elevate	+	+	+	?	0	0	+++	0
Indar	+++	+++	++++	?	+	0	?	0
Lime sulfur	++ / +++	+	++*	?	?	+ / ++	+	0
Orbit	+++	++	++++	?	?	0	?	0
Pristine	++	+++	+++	?	+++	++++	++++	?
Rovral	0	0	0	0	0	0	++++	0
Ridomil	0	0	0	0	0	0	0	++++
Serenade	++ / +++	++ / +++	+ / ++	?	?	0	?	?
Sulforix	+++	++	?	?	?	+	?	?
Switch	+	++	+ / ++	?	++++	+++	++++	?
Ziram (3 lb)	++	+	++	++	+*	++	+	0
Ziram (4 lb)	++	++	+++	++ / +++	++*	+++	++	0

0 = not effective, + = poor, ++= fair, +++ = good, ++++ = excellent, ? = not known. Ratings are based on published information and observations in Michigan and other states.

TIMING CRANBERRY FRUITWORM SPRAYS IN BLUEBERRY

Rufus Isaacs, Carlos Garcia-Salazar, and John Wise
Department of Entomology, Michigan State University

Cranberry fruitworm is one of the key insect pests of blueberry in Michigan, infesting the crop during and after bloom. Moths usually start flying during bloom, and this year is no exception. The first male moths have been trapped in the past few days in southern Van Buren county, coinciding with peak Jersey flowering.

Egglaying by this species often begins as soon as petals have fallen off young fruit. Larvae hatching from the eggs bore into the berries and feed inside, eventually webbing multiple fruit together. The aim of managing this pest is to minimize the number of larvae that bore into the fruit, but timing sprays for fruitworms has been challenging in some years. Recent research by MSU entomologists provides insight into when to protect berries from fruitworm infestation, using degree days to understand the stage of development of this pest. Using degree days to refine your spray timings is expected to improve the effectiveness of your insect management program. Implementing degree-day based management for cranberry fruitworm requires the following:

A) Monitoring traps to detect size and timing of moth activity
B) A method to track insect development

MONITORING TRAPS

We recommend the sturdy large plastic delta trap to monitor for fruitworms, because these withstand rain and irrigation intact, plus they can be used for multiple years. Place 1-2 traps per field near historical fruitworm hot spots or near deciduous woods. Place the trap baited with a lure containing the fruitworm sex pheromone in the top third of the bush. Traps should be in place by the start of Bluecrop bloom, and checked twice each week until moths are trapped. Regular checking will allow you to detect the *first sustained catch* of moths (biofix), the peak of moth activity, and how long moths are active. The first sustained catch, or biofix, is set when one or more moths are trapped in consecutive trap visits. This is the start point for counting degree days to time the first spray for cranberry fruitworm.

DEGREE-DAY BASED DEVELOPMENT OF CRANBERRY FRUITWORM

Over the past 4 years, we have carefully monitored cranberry fruitworm development in west Michigan blueberry farms. This has revealed some patterns in the timing of their development based on growing degree days. These are shown in **Table 1**, using degree days accumulated above 50 ^{o}F. The monitoring traps are used to set biofix, and the timing of the first spray should be aimed at the eggs/young larvae when they are first hatching, which our study predicts to start 85 degree days after biofix. This often occurs during bloom, so if a pesticide is warranted, use only bee safe insecticides. This includes Dipel, Javelin and other B.t. containing insecticides, or the insect growth regulator insecticides Confirm and Intrepid. Follow label directions regarding bee safety. A follow-up spray may be needed, with the timing of this depending on the residual control provided by the first spray, the amount of new petal-fall since the first application, whether bees are still in the field, amount of rain, etc.

Table 1. Events in the development of cranberry fruitworm, predicted by growing degree days, base 50^{o}F

Event	Degree-Days $_{\text{base 50}}$ (since March 1st)	Degree-Days $_{\text{base 50}}$ from Biofix
First male	375 ± 20	0
First eggs	460 ± 20	85 ± 20

SMALL PLOT TRIAL RESULTS, 2007

Last year, we conducted a spray trial to test the performance of sprays timed at different numbers of degree days after biofix. Confirm was applied at 100, 200, or 300 degree days after biofix with a follow-up spray 7 days after the first in each treatment. This was compared to a Guthion application immediately after bloom with another 14 days later. The results (**Figure 1**) show the value of making an application close to the timing that coincides with the emergence of larvae from eggs if a Confirm application is being made during bloom (100 degree days after biofix).

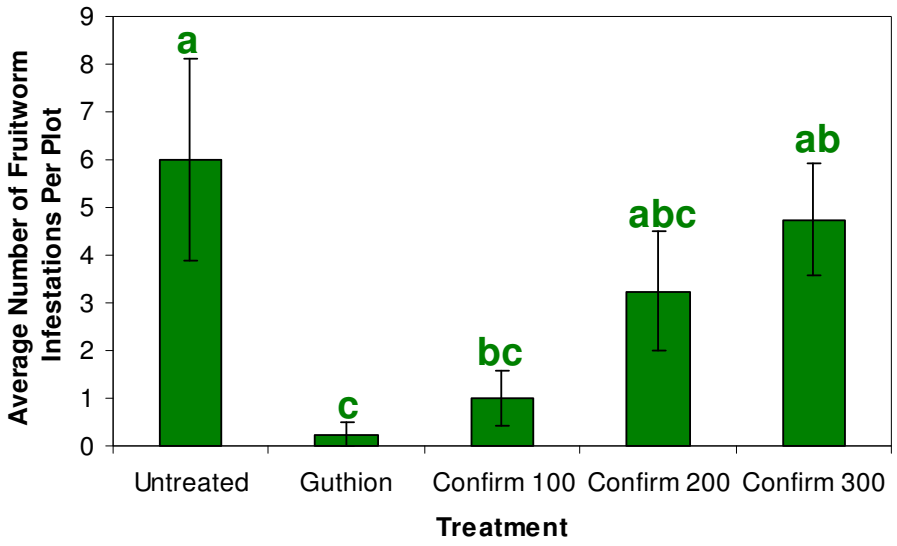

Figure 1. Results of a 2007 trial comparing Guthion at 1 lb/acre postbloom (+14 days) against Confirm 2F applied 100, 200, or 300 DD50 after biofix (+ 7 days). Bars with the same letter are not significantly different.

KEEPING TRACK OF DEGREE DAYS

The simplest method used to estimate the number of degree-days for one day is called the averaging method:

[(max temp. + min temp.)/2]-developmental threshold = DD

For example, suppose on May 13, 2008 in Grand Junction, MI, maximum daily temperature and minimum daily temperatures were 75 and 45° F. Using 50° F for the lower development threshold for cranberry fruitworm, degree days accumulated would be:

(75 + 45)/2 - 50 = 10 DD.

With a simple max-min thermometer, daily degree day accumulation can be tallied after biofix until the target spray timing of 85 degree days are reached.

Degree days are also tallied electronically by MSU's Enviroweather program, with the reports available online at www.enviroweather.msu.edu. This system has weather stations across Michigan, and provides a daily summary of degree day totals and also predicted degree days for each weather station. This can allow growers and consultants to look at when the target degree day accumulation is expected to be reached, helping to plan sprays ahead of time.

If you have not used degree days in your pest management program before, there are some useful resources online to explain them. One is at: www.ipm.ucdavis.edu/WEATHER/ddconcepts.html Your local MSU Extension agent will also be able to help with how to monitor degree days on your farm, or how to access information from the nearest weather station.

NITROGEN FERTILIZATION FOR OPTIMAL BLUEBERRY PRODUCTION

Eric Hanson, MSU Small Fruit Specialist
Mark Longstroth, MSUE District Extension Educator

Most Michigan blueberries require nitrogen (N) annually for good production, but using the right rate is important. Too little N reduces blueberry vigor and yield, whereas too much can do the same as well as increase winter injury. Careless use of N wastes money and can pollute groundwater or streams and ponds. So, how do you know you are applying the right amount?

First, start with the recommended amounts in the table below. Second, apply N properly. This is best done by applying half the N a couple weeks prior to bloom and half at the end of petal fall. Avoid fertilizing early in the spring (plants can't use it) or in the late summer or fall (may reduce hardiness). Third, collect leaf samples in the middle of the summer and have these analyzed for nutrient content. Leaf N levels will then tell you whether rates for your specific fields need to be adjusted up or down. Leaf N below 1.7% indicates rates should be increased; reduce rates if levels are higher than 2.3%. Sample at least 50 leaves from different bushes in late July to early August. Collect Select healthy leaves from the middle of this year's shoots. If the leaves are dusty, rinse them briefly in tap water, spread them on a table top until they are dry to the touch, package them in paper bags, and send thee bags to a reputable laboratory.

Recent increases in N fertilizer costs have changed may make some organic sources of N economical. Conventional N fertilizers cost about $0.50 (urea) to $.75 (ammonium sulfate) per lb of N. By contrast, composted poultry (2-3% N) and dairy (1% N) manure may cost $0.70-1.60 per lb of N. Compost costs more to spread, and only about half of the N is available in the year of application, but they contain other nutrients and organic matter, and may benefit overall soil health. Fresh manure is usually an even cheaper source of N, but this may be a source of microbial contamination of fruit if it is applied in the spring or early summer.

Another concern in choosing N fertilizers is the soil pH of your field. If the soil pH is less than 5 then urea is a good choice. If the soil pH is above 5, then ammonium sulfate is a more acidifying fertilizer and will help lower the soil pH.

Nitrogen Recommendations for Michigan Blueberries (lb/acre).

Age (years)	N	Urea	Ammonium sulfate
2	15	35	75
4	30	70	150
6	45	100	215
8	65	150	300

MEETINGS AND ANNOUNCEMENTS

2008 Blueberry IPM Twilight Meeting Schedule:
All meetings held from 6-8PM
May 28: Carini Farms, Ottawa County
June 11: Cornerstone Ag, Van Buren County
June 24: Carini Farms, Ottawa County

These meetings are hosted by MSU to update growers on insect, disease, and weed control as the season progresses. They are completely free, with a light dinner served at 6PM. For more information, contact Paul Jenkins (517-432-7751, jenki132@msu.edu).

For more information visit our website at Blueberries.msu.edu

IN NEXT WEEK'S ISSUE…

Tussock Moth
Blueberry Grower Survey
Post-bloom disease management

MSU BLUEBERRY TEAM

Eric Hanson, Horticulture
Annemiek Schilder, Plant Pathology
Rufus Isaacs, Entomology
John Wise, Trevor Nichols Research Complex
Matt Grieshop, Organic Pest Management
Paul Jenkins, Small Fruit Education Coordinator
Mark Longstroth, Van Buren County Extension
Carlos Garcia, Ottawa County Extension
Bob Tritten, SE Michigan Extension