Michigan Blueberry I.P.M. Update

May 28, 2008 Volume 2, No. 6

Contents

Next Blueberry IPM Twilight Meeting

When: TONIGHT!!! 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.

CROP STAGES

Keith Mason
Department of Entomology, Michigan State University

In Van Buren County, Jersey in Covert is just starting petal fall. In Grand Junction, Blueray is at 50% petal fall and Bluecrop is finishing petal fall. In Ottawa County, Blueray in Holland, and Rubel and Bluecrop in West Olive are at early petal fall.

Bluecrop at early green fruit in Grand Junction (left) and Bluecrop at early petal fall in West Olive (right).

WEATHER NOTES

Mark Longstroth
Michigan State University Extension

Complete weather data for your area can be found at enviroweather.msu.edu.

Last week's temperatures were cool with highs in the 60s and lows near 40. Warmer temperatures finally arrived Sunday with highs near 80 Sunday and Monday. Monday morning lows were about 60. This was our first warm night of the season. Rain showers fell Monday morning. Rainfall totals were a tenth to a third of an inch with a wetting period of about 6 hours with temperatures around 60F. Soils are beginning to dry out. We expect cool temperatures for the next couple of days and then back into the mid 70's by the weekend. There is a chance of rain this weekend. Our GDD totals are about ten days behind normal.

DEGREE DAYS		
GDD (from March 1)	**Base 42**	**Base 50**
	Van Buren County	
5-19-08	613	326
5-26-08	715	387
Projected for 6-2-08	830	455
	Ottawa County	
5-19-08	507	246
5-26-08	598	298
Projected for 6-2-08	714	366

Pest of the week – Tussock moth

Rufus Isaacs and Steve Van Timmeren
Department of Entomology, Michigan State University

The whitemarked tussock moth (*Orgyia leucostigma*) (WMTM) is distributed throughout eastern North America and can be a pest of blueberry fields in Michigan. This species feeds on hardwood and ornamental trees, and is found in native habitats. When this insect moves into blueberry fields, growers may experience damaging levels of leaf loss on young bushes and contamination of fruit at harvest can cause economic hardship in mature fields. The larvae also have irritating hairs that can cause dermatitis in hand pickers, so it is important to control this insect before harvest. Early detection of this insect is the key to preventing economic loss.

Life-stages: The egg mass is white-cream colored with numerous 1-2 mm diameter eggs nested within white foam. This is usually wrapped inside a blueberry leaf and attached to a stem, or it may fall to the ground. Over 100 larvae can hatch from one egg mass, and these change from a light brown color when newly-hatched to multicolored as they grow. Full grown larvae have a bright red head with a yellowish body, a pair of upright pencil tufts of black hairs on the prothorax, and four white to yellowish brush-like tufts of hairs on the top of the body toward the head. After the first instar, larvae have a conspicuous red dot on segments six and seven. The adult moths vary considerably between the sexes: the female moth is a ¼ inch long white furry moth without wings, usually found inside a leaf surrounded by the hairs from her pupal case. The male is ¾ inch across its wings that are mottled brown, and it has feathery antennae.

Timing of development: A recently-completed study has revealed the phenology of WMTM in Michigan blueberry fields. This insect has two generations in southern Michigan, with peaks of larvae on bushes in June and again in August, and peaks of moth activity in late June and late August. The WMTM overwinters in the egg stage within a large mass of eggs nestled in a hard foam that is wrapped inside a dry leaf. These are usually found on stems and are visible during pruning. The eggs hatch during bloom and larvae stay close to the egg mass at first, dispersing in the plant canopy after a few days. Larvae feed in the shady parts of the canopy until full grown in late June/early July. At this point they pupate on the bush and emerge in July as adult moths. The female moth is flightless and stays on the leaf she pupated in, mating and laying eggs in this same position. The foamy egg mass hardens and young larvae emerge in late July-August to feed on the mature foliage, growing during the period of blueberry harvest. These larvae are the ones that cause the conflict with pickers and harvest.

Development of WMTM can be predicted using growing degree days. During a two year project that included laboratory and field studies, we found that development of this pest was best predicted using a base temperature of 55 ^{o}F. Egg hatch of the first generation was found to start at 208 DD base 55 (from March 1) while egg hatch of the second generation was found to occur at about 1100 DD base 55. In both years, egg hatch of the second generation in early July was found to start at 300-350 DD base 55 after the first male moths were trapped in pheromone monitoring traps. We are currently working with the Enviroweather team at MSU to integrate the findings of this project into their degree day prediction capability.

Monitoring: Early detection is important for management of WMTM so that the larvae are not full grown when attempting control. Using monitoring traps and bush scouting can help ensure that management actions are made at the best time to ensure a high level of control.

Using pheromone traps: Fields with a history of WMTM infestation should be monitored with two pheromone-baited traps, placed at the field edge and interior, and with regular scouting of bushes. This will allow growers to know where, when, and if a pesticide application is needed. To monitor, place traps in the region(s) of the farm with previous WMTM infestation during early June. Traps should be placed toward the wooded edge of a field if present and in the field center, and checked weekly. One pheromone lure can last all season, so no lure replacements are needed. Weekly catches of moths in the trap can be used to identify whether the infestation was controlled by the post-bloom insect management program, or whether there is still a population with the potential to cause problems during harvest. If high numbers of moths are still being trapped, fields should be carefully scouted for larvae during the pre-harvest period to determine whether chemical control is needed.

Scouting for larvae: To scout for larvae, look on the underside of leaves by turning over leaves with feeding damage and by looking in the center of the bush where the larvae prefer to hide. The large larvae are conspicuous due to their yellow, red, black and white coloration, but the smaller brown larvae may be more difficult to locate. Beware of the allergenic hairs and approach with caution!

Control: Because the first generation of larvae hatches during bloom, application of an effective fruitworm spray program during the early part of the season provides growers with good control of WMTM. Problems with WMTM tend to be worse in fields where no fruitworm sprays are applied, where they are applied without good coverage, or where the fields are weedy. Because larvae prefer the more dense and shady part of the bush, they can escape contact with insecticides if the fields are not effectively treated at the post-bloom timing.

WMTM are naturally controlled by a complex of parasitic wasps that attack the larvae and by diseases. These natural enemies cycle through the pest population and help to cause the typical increases and crashes seen in WMTM populations. In years where the pest population is amplified, these wasps and diseases cannot suppress the pest population and intervention is needed to prevent larvae contaminating the bushes and fruit during harvest. Selection of a moth-specific insecticide such as Confirm or Intrepid can help conserve the beneficial insects.

Insecticides that are active on other moth larvae are generally effective against WMTM larvae (Confirm, Guthion, Sevin, Lannate, Asana, Danitol, Mustang Max). We also expect the new insecticides Delegate, Intrepid, and Assail to be effective insecticides against this insect. Broad-spectrum insecticides such as Guthion, Lannate, Asana, Danitol, and Sevin will provide fast control of this pest, killing young larvae in 1-2 days. The growth regulators Confirm and Intrepid take a little longer since they disrupt the molting of the larvae, providing control of young larvae in 4-5 days. We expect Assail and Delegate to be intermediate in their speed of control.

Because the larvae are sensitive to a broad range of insecticides, applications made for other pests such as fruitworms, blueberry maggot, or Japanese beetle are often able to control WMTM. However, the coverage of the bushes and the spray timing must be sufficient to bring the larvae into contact with the residue. It is important to understand that the larger the larvae become, the more difficult they are to control. This is another good reason to make sure the first generation is controlled in fields with WMTM infestation. This avoids having to attempt control at harvest time when bushes are bigger and laden with fruit, pickers are in the field, and re-entry and pre-harvest intervals make control much more challenging.

Tussock Moth IPM Program

1. If the field had tussock moth problems last year, remove and destroy egg masses during winter pruning. Treat with a bee-safe insecticide at 300-500 DD base 55 ^{o}F (mid-late bloom).

2. Monitor tussock moth with a pheromone-baited traps placed in the field by early June. Check weekly and count tussock moths.

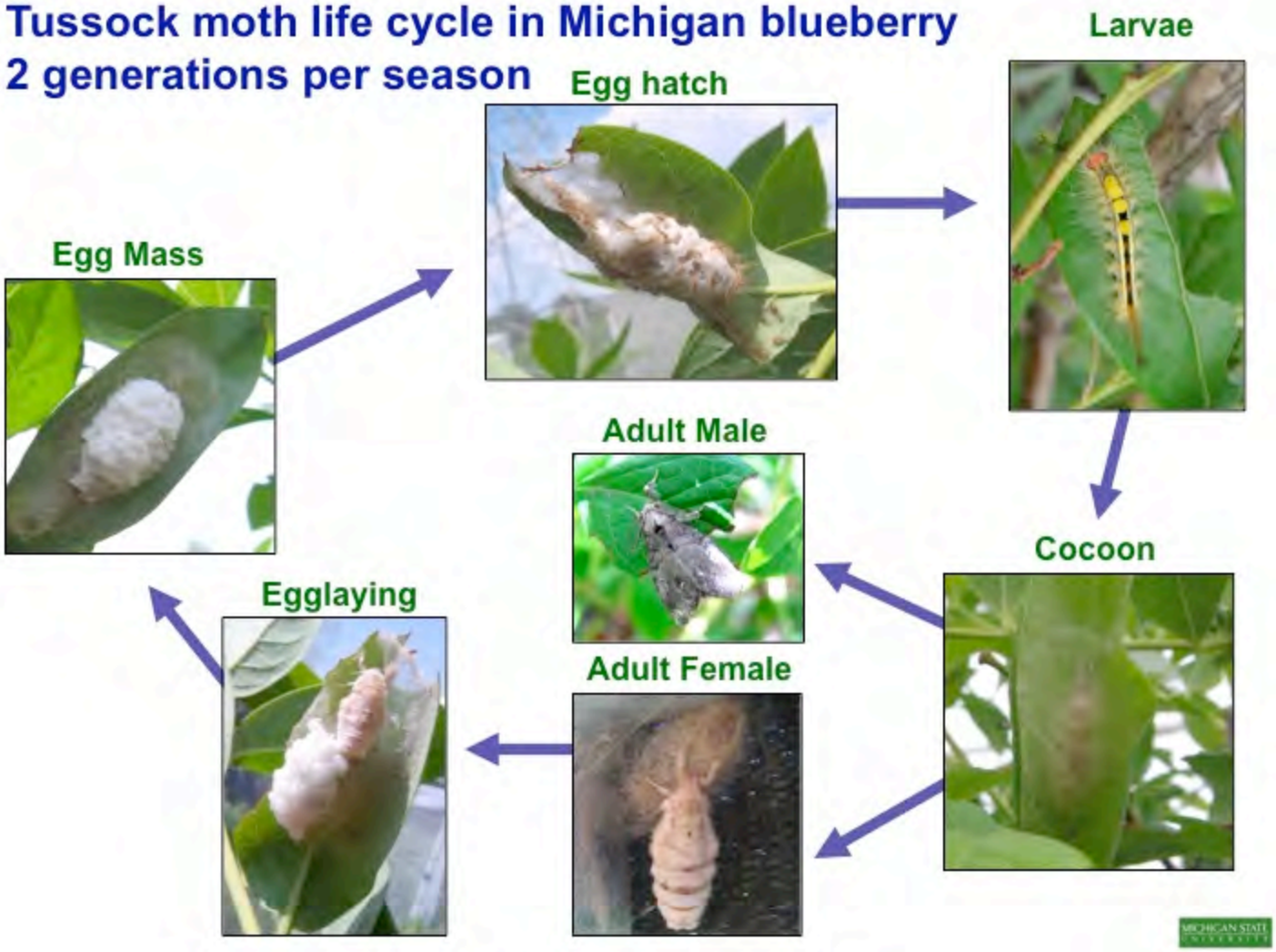
3. If high numbers of male moths trapped, especially in interior field traps, treat field at 400-500 base 55 after first consistent moth catch (early-mid July). Beware of PHI and REI restrictions.

4. Monitor bushes weekly from early July to harvest, to detect larvae while small (usually inside canopy).

5. If larvae detected near to harvest, apply an effective insecticide with short PHI and with good coverage of the whole bush.

We thank MBG Marketing and the Michigan Agricultural Experiment Station for support of our tussock moth research.

Tussock moth life cycle in Michigan blueberry
2 generations per season



INSECT UPDATE

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

The number of **cherry fruitworm** moths in traps at our scouting sites has increased in the past week, and low numbers of **cranberry fruitworm** moths were trapped at the Covert and Holland farms. All farms were scouted for the presence of fruitworm eggs and larvae, but none were seen. We expect the number of both species of fruitworms caught to increase over the next week, and we have set biofix for CBFW in Covert as 5/19. Egglaying by cherry fruitworm and cranberry fruitworm is expected to begin this week in Van Buren County, and see article in this issue about using degree days to predict timing for cranberry fruitworm sprays. Continue monitoring fruitworm traps, and after petal fall, berry clusters should be inspected for eggs and larvae. See below for methods for scouting for fruitworm eggs, larvae and damage.

All farms were scouted for the presence of **blueberry aphid**, and one aphid was found at the Covert farm. A parasitized aphid was seen at the West Olive farm, but no live aphids were seen. 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.

Other insect activity has increased over the past week. Low numbers of **leafroller** larvae were seen at the Holland and Grand Junction farms, and the first young **tussock moth** larva was observed at the Holland farm. Climbing cutworm or spanworm feeding was not observed at the scouted farms. Likewise, the **three-lined flower beetle** *Hoplia trifasciata* was not seen at any of the four farms, but some growers are reporting low levels of continued feeding on flowers by this pest. Growers and scouts should still be on the lookout for feeding by all these early season pests during weekly crop scouting.

MONITORING FOR FRUITWORMS

After moths have been trapped and after petal fall (late May-early June) bushes should be inspected for eggs and damage each week for a five minute sampling period. Working in historical hotspots or regions of highest moth captures, look at as many fruit clusters as possible on 10 to 20 bushes along the field border. Looking at the fruit clusters can help you find eggs in calyx cup, larval entry holes and damage. When inspecting the fruit grasp the cluster and view with the sun over your shoulder. Carefully turn the clusters over and inspect the bottom of the fruit as well as the top for entry holes and/or frass. Record the number of cranberry fruitworm and cherry fruitworm eggs and the number of berries with damage. Click here for more info and photos of cranberry and cherry fruitworm.

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, and consult the MSU Fruit Management Guide (E-154) for insecticide recommendations.

Farm	Date	CBFW moths per trap	CFW moths per trap	% shoots with BBA	BBM adults per trap	JB per 20 bushes
Van Buren County						
Covert	5-12	0	0	0		
	5-19	2	1	0		
	5-27	1	2	5%		
Grand Junction	5-12	0	1	0		
	5-19	1	2	0		
	5-27	0	6	0		
Ottawa County						
Holland	5-12	0	0	0		
	5-19	0	0	0		
	5-27	1	4	0		
West Olive	5-12	0	0	0		
	5-19	0	2	0		
	5-27	0	7	0		

BLUEBERRY CHEMICAL USE SURVEY THIS JUNE

The USDA National Agriculture Statistics Service, in cooperation with Michigan State University Extension, will be conducting a survey of chemical use and IPM practices used in blueberries during the 2007 growing season. This survey will gather information that is essential for supporting the need for new registrations, section 18 labels, and for tracking pesticide use trends in this industry. This kind of information is used by EPA when making decisions related to blueberry, and it is also valuable to the MSU Blueberry Team when competing for funding to support research and extension projects. The survey will be conducted during June, and if your farm is selected a NASS representative will contact you to arrange a 30-45 minute interview. Gathering chemical application information can be made faster by having a photocopy or printout of the spray records from a representative field when the NASS representative visits. Please help represent your industry in this important effort.

DISEASE UPDATE

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

Bushes on strike!

This week all scouted plots were at 75% bloom to full bloom. Mummy berry apothecia were not observed in any of our scouted plots this week. However, shoot strike infections were found at much higher levels then previous weeks, with the highest incidence being observed at Grand Junction averaging 34.1 shoot strike infections per bush (Figure 1). Flower strikes were also observed in some of our plots but at extremely low levels (~1 or 2 per site). Gray sporulation was visible on the infected tissues. Research has shown that bees are attracted to shoot strikes and it is possible for them to physically move the spores from infected shoots to the stigma of an open flower. Once spores reach the stigma they will germinate and then the fungus grows alongside the pollen tubes through the pistil into the ovaries. Flowers are most susceptible on the day that they open and then their susceptibility declines over the next four days. Good pollinating weather can mean that a considerable amount of fruit infection occurs despite low shoot strike incidence. Management using a fungicide spray program is important during this period to protect the flower stigma from infection. Systemic fungicides, such as Indar, are the most useful.

Figure 1. Mummy berry symptoms observed in Grand Junction: A) Shoot strike, B) Flower strike. Note the gray sporulation on upper leaf veins and the flower petiole, which is characteristic for mummy berry blight.

Figure 2. Bees and other insects can visit the shoot or flower strikes and carry the mummy berry spores to open flowers.

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*	Average number of blighted twigs per bush**
Van Buren County						
Covert	5-9	1.9	5.3%	0.1	0.1	-
	5-15	-	-	0.0	0.8	-
	5-22	-	-	0.0	1.3	2.0
Grand Junction	5-9	18.7	5.9%	1.4	0.1	-
	5-15	-	-	0.0	6.8	-
	5-22	-	-	0.0	34.1	0.5
Ottawa County						
Holland	5-9	2.7	3.7%	0.2	0.0	-
	5-15	-	-	0.0	0.5	-
	5-22	-	-	0.0	1.8	0.1
West Olive	5-9	9.0	8.9%	1.3	0.0	-
	5-15	-	-	0.7	3.4	-
	5-22			0.0	8.5	0.2

*Average number was calculated for ten bushes.
**Blighted twigs may be caused by various fungi, incl. *Phomopsis vaccinii*, *Colletotrichum acutatum* and *Botrytis cinerea*.

USING DEGREE DAYS TO PREDICT TIMING OF EGGLAYING BY CRANBERRY FRUITWORM

Rufus Isaacs
Department of Entomology, Michigan State University

The cranberry fruitworm is a key pest of blueberries, active during and after bloom. Moth flight starts during bloom, and egglaying often begins as soon as petals have fallen off you young fruit. Larvae that hatch from the eggs bore into the berries and feed inside, eventually webbing multiple fruit together. We have been studying the development of cranberry fruitworm in blueberry, to develop a better understanding of when to expect moth flight and when eggs are laid on the fruit. This is expected to improve control of this insect, and lead to more judicious use of insecticides.

One of the main tools used to better time insecticide sprays is a *Degree Day Model*. This allows blueberry growers, consultants, scouts, etc. to keep track of pest development and time sprays based on when cranberry fruitworm egglaying and egg-hatch are predicted. By keeping track of how many *degree days* have accumulated since moths started being trapped, the timing of egglaying can be predicted without requiring time-consuming and difficult searches for eggs. Implementing a degree-day based management program for fruitworms requires the following:

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

MONITORING TRAPS

Place the trap baited with a lure containing the fruitworm sex pheromone in the top third of the bush. Traps should be installed by the start of Bluecrop bloom, and checked once or twice each week. 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 more than one moth is trapped in consecutive trap visits. This is the start point for counting degree days to time the first spray for fruitworms.

COUNTING DEGREE DAYS

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

[(maximum temp. + minimum 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.

There are also regular updates from MSU Extension educators on the progression of degree days, reported in their weekly updates and also in the Fruit CAT Alert. Detailed degree day information is provided at MSU's Enviroweather website, available for free at www.enviroweather.msu.edu. This reports information on current weather, degree days, overnight lows, etc. from stations across Michigan. It will soon contain a degree day model for cranberry fruitworm.

By keeping track of degree days after biofix through any one of these methods, the date on which egglaying by fruitworms starts can be more accurately predicted.

USING DEGREE DAYS FOR CRANBERRY FRUITWORM MANAGEMENT

Over the past 4 years, we have 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. The base temperature for their development is 50 ^{o}F. Using this, we have developed predictions of when some key events in the fruitworm life cycle will happen, based on degree days. These are shown in the table below. By using the monitoring traps to set biofix (starts the 'clock' running from 0 DD), the timing of the first spray aimed at the eggs when they are first laid (85 DD after biofix) can be predicted, and this is usually during bloom.

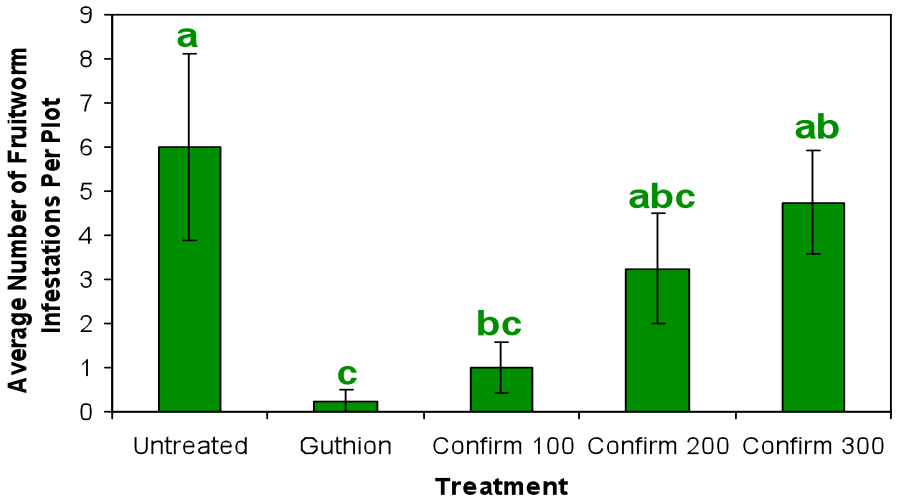
Events in the life history of Cranberry Fruitworm predicted with Degree Days (Base 50° F)

Event	Degree-Days (since March 1st)	Degree-Day accumulation from Biofix
First CBFW moth	375 ± 20	0
First eggs	460 ± 20	85 ± 20

DOES IMPROVED TIMING = IMPROVED CONTROL?

A spray trial conducted in 2007 compared different timing of fruitworm sprays during bloom (Confirm) with Guthion after bloom. Applications at different timings after biofix clearly show the value of making an application of Confirm close to the timing that coincides with the emergence of larvae from eggs (100 degree days after biofix).

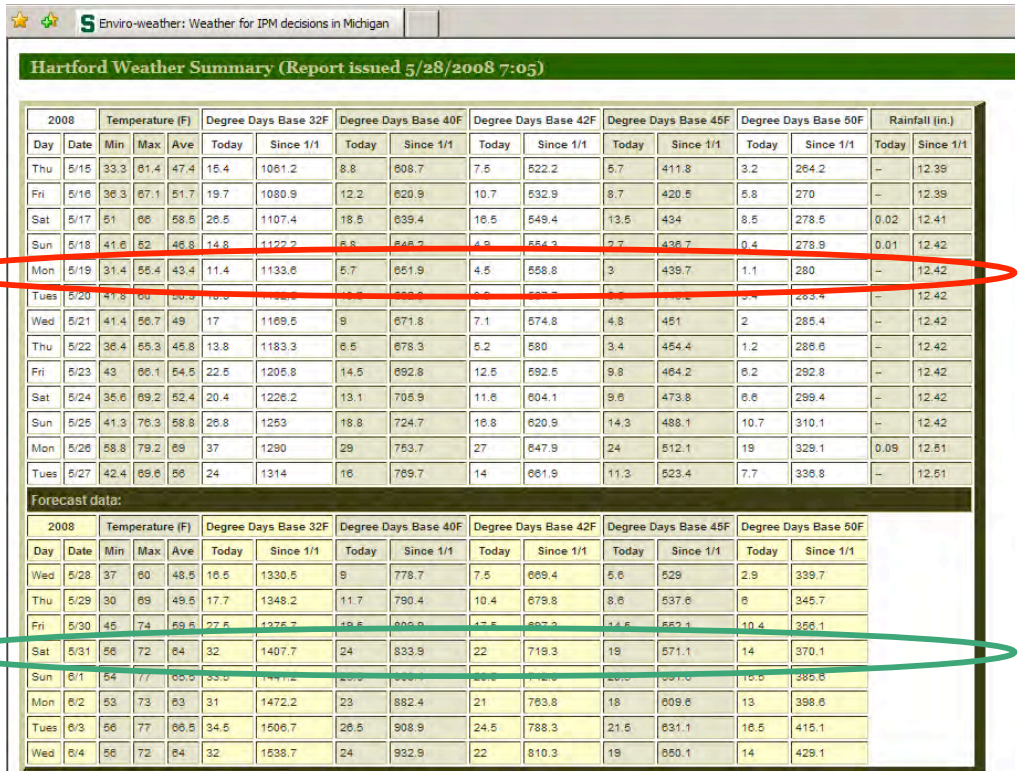
2007 trial at TNRC compared Guthion at 1 lb/acre postbloom (+14 days)



PUTTING IT ALL TOGETHER FOR THE 2008 SEASON

From the fruitworm moths we have trapped in Covert in the past few weeks and the degree days accumulated (and predicted), we are expecting egglaying by cranberry fruitworm to start late this week or early next week in Van Buren Co. Here's how we use the degree day model and Enviroweather to get this prediction:

1. Looking at the moth captures (see Insect Update above), biofix was set at 5/19 for cranberry fruitworm.
2. Looking at www.enviroweather.msu.edu for the Hartford weather station there were 280 DD at base 50 on 5/19
3. Adding 85 DD to this gives us 365 as the predicted timing of first egglaying by CBFW
4. Look down the table to the DD predicted based on the weather, and 365 DD will be reached on Saturday 5/31.



Enviro-weather: Weather for IPM decisions in Michigan

Hartford Weather Summary (Report issued 5/28/2008 7:05)

2008		Temperature (F)			Degree Days Base 32F		Degree Days Base 40F		Degree Days Base 42F		Degree Days Base 45F		Degree Days Base 50F		Rainfall (in.)	
Day	Date	Min	Max	Ave	Today	Since 1/1	Today	Since 1/1	Today	Since 1/1	Today	Since 1/1	Today	Since 1/1	Today	Since 1/1
Thu	5/15	33.3	61.4	47.4	15.4	1061.2	8.8	608.7	7.5	522.2	5.7	411.8	3.2	264.2	–	12.39
Fri	5/16	36.3	67.1	51.7	19.7	1080.9	12.2	620.9	10.7	532.9	8.7	420.5	5.8	270	–	12.39
Sat	5/17	51	66	58.5	26.5	1107.4	18.5	639.4	16.5	549.4	13.5	434	8.5	278.5	0.02	12.41
Sun	5/18	41.6	52	46.8	14.8	1122.2	6.8	646.2	4.9	554.3	2.7	436.7	0.4	278.9	0.01	12.42
Mon	5/19	31.4	55.4	43.4	11.4	1133.6	5.7	651.9	4.5	558.8	3	439.7	1.1	280	–	12.42
Tues	5/20	41.8	60	50.9	15.9	1149.5	9.5	661.4	8.2	567.1	6.2	445.9	3.4	283.4	–	12.42
Wed	5/21	41.4	56.7	49	17	1166.5	9	671.8	7.1	574.8	4.8	451	2	285.4	–	12.42
Thu	5/22	36.4	55.3	45.8	13.8	1183.3	6.5	678.3	5.2	580	3.4	454.4	1.2	286.6	–	12.42
Fri	5/23	43	66.1	54.5	22.5	1205.8	14.5	692.8	12.5	592.5	9.8	464.2	6.2	292.8	–	12.42
Sat	5/24	35.6	69.2	52.4	20.4	1226.2	13.1	705.9	11.6	604.1	9.6	473.8	6.6	299.4	–	12.42
Sun	5/25	41.3	76.3	58.8	26.8	1253	18.8	724.7	16.8	620.9	14.3	488.1	10.7	310.1	–	12.42
Mon	5/26	58.8	79.2	69	37	1290	29	753.7	27	647.9	24	512.1	19	329.1	0.09	12.51
Tues	5/27	42.4	69.6	56	24	1314	16	769.7	14	661.9	11.3	523.4	7.7	336.8	–	12.51

Forecast data:

2008		Temperature (F)			Degree Days Base 32F		Degree Days Base 40F		Degree Days Base 42F		Degree Days Base 45F		Degree Days Base 50F	
Day	Date	Min	Max	Ave	Today	Since 1/1	Today	Since 1/1	Today	Since 1/1	Today	Since 1/1	Today	Since 1/1
Wed	5/28	37	60	48.5	16.5	1330.5	9	778.7	7.5	669.4	5.6	529	2.9	339.7
Thu	5/29	30	69	49.5	17.7	1348.2	11.7	790.4	10.4	679.8	8.6	537.6	6	345.7
Fri	5/30	45	74	59.5	27.5	1375.7	19.5	809.9	17.5	697.3	14.5	552.1	10.4	356.1
Sat	5/31	56	72	64	32	1407.7	24	833.9	22	719.3	19	571.1	14	370.1
Sun	6/1	54	77	65.5	33.5	1441.2	25.5	859.4	23.5	742.8	20.5	591.6	15.5	385.6
Mon	6/2	53	73	63	31	1472.2	23	882.4	21	763.8	18	609.6	13	398.6
Tues	6/3	56	77	66.5	34.5	1506.7	26.5	908.9	24.5	788.3	21.5	631.1	16.5	415.1
Wed	6/4	56	72	64	32	1538.7	24	932.9	22	810.3	19	650.1	14	429.1

Report from the Hartford weather station, accessed on May 28, 2008.

5/19 = biofix, first sustained catch of CBFW

.

.

.

.

Add 85 DD until predicted first egglaying = 365 DD

.

.

.

.

5/31 = egglaying by CBFW expected to start

IS IT A VIRUS, DISEASE, OR SOMETHING ELSE? A FEW POINTERS.

Annemiek Schilder
Department of Plant Pathology, Michigan State University

This is the time of year that virus symptoms become apparent, particularly in blueberries. A cool spring and slow growth also brings out symptoms more than warm weather. Virus and virus-like diseases in plants manifest themselves in several ways and can be easily confused with abiotic disorders like nutrient deficiencies and herbicide injury. Viruses are tiny pathogens that are only visible with an electron microscope. Their simple make-up, a strand of genetic material covered by a protein coat, belies the damage they can cause. Think of viruses as miniscule hijackers of plant cells. Once they enter a plant cell, they force that cell to multiply the virus particles and thereby derail the cell's normal functions. Once a plant becomes infected, the virus spreads throughout the plant tissues including the roots. This is called a "systemic infection" and the plant is infected for life.

Symptoms that may indicate a virus disease include: yellowing or reddening of leaves, mosaic or mottling, crinkling or malformation of leaves and other plant organs, stunting, poor fruit set, generally poor growth, and plant death. Some of these symptoms can also occur when the plants are malnourished or the root system is compromised (e.g., by root rot or nematode damage). The recent cold weather has also induced some reddening in plants due to limitations on nutrient uptake. Symptoms caused by herbicides, such as Round-Up or 2,4-D may also include stunting and malformation of leaves: 2,4-D is especially tricky because it can volatilize and affect plants some distance away from the application site. Herbicide drift from another crop (e.g., Dicamba from corn or soybeans) can also affect nearby non-target crops. Here are a few pointers that may help you decide whether symptoms that you are seeing may be due to a virus or another cause:

1) Are the symptoms present in a few scattered plants or in many plants over a large area? If present uniformly over a large area and also affecting weeds, it is more likely to be caused by herbicide injury, some nutritional disorder or soil condition. Have soil and plant tissue analyzed for nutrients. Some

herbicide residues can be detected if samples are taken soon after the application occurred but this is rather expensive.

2) Did the symptoms show up suddenly or have they been worsening over the season or the past couple of years? If the symptoms showed up suddenly in an otherwise normal year, herbicide injury is a possibility, especially if many plants are affected. Symptoms caused by virus diseases usually worsen over time.
3) Does the disease seem to be spreading? If so, it may be a virus disease. Virus diseases vectored by nematodes usually spread in a more-or-less circular pattern in a field, whereas viruses vectored by aphids spread more readily down the row.
4) Did you apply Round-Up last fall? This herbicide may get transported into the roots and may not show symptoms until the following spring.
5) Are symptoms showing here and there in a newly planted field? Consider your source of plants. Did you buy virus-tested planting stock? If not, you may have imported a virus disease with the planting material.
6) If you suspect a virus disease, send a plant sample to the MSU Plant Diagnostic Lab. The best time to send samples in is in the spring, when young plant tissues (leaves and/or flowers) are most likely to contain virus particles. Samples have to be fresh for virus indexing, so send them on ice in express mail or hand-deliver the cooled sample.

Just as in people, virus diseases in plants are difficult if not impossible to cure, so prevention is the best method of control. Buy virus-tested planting stock whenever possible: it is definitely worth the investment, especially when planting a perennial crop. If you see suspicious symptoms, rogue out and destroy affected plants quickly before they become a source of inoculum and practice good insect control. When planting into a field that had a nematode-transmitted virus disease previously, fumigate the soil before replanting or grow non-host cover crops (e.g., rye or mustard) for a couple of years.

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…

Viruses and virus-like diseases
Blueberry scorch, shock, and sheep pen hill virus
Post-bloom fruitworm 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

This newsletter is produced by the MSU Blueberry Team with support from Project GREEEN, North Central IPM Center, MSU Extension and the EPA's Region 5 Strategic Ag. Initiative Program