Michigan Blueberry Facts

MICHIGAN STATE UNIVERSITY

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Contents

Next Blueberry IPM Twilight Meeting

When: Tuesday June 24, 2008 *6-8PM*
Where: Carini Farms, 15309 Port Sheldon Road, West Olive, MI. 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. Hope to see you there!

CROP STAGES

Keith Mason
Department of Entomology, Michigan State University

In Van Buren County, Jersey in Covert is at early green fruit, and in Grand Junction, the green fruit on Blueray and Bluecrop, are increasing in size. In Ottawa County, Blueray in Holland, and Rubel and Bluecrop in West Olive are at early green fruit.

Blueray at green fruit in Grand Junction (left) and in Holland (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 weather was generally dry with highs near 80, and lows in the 50s and 60s. Scattered storms passed through the region over the weekend. These storms brought rain and hail in some areas. Rainfall totals from these storms were generally light, from a tenth to less than an inch. Soil moisture levels are falling and sandy soils are becoming dry. We expect cool temperatures for the coming week with highs in the near 70 and lows near 50. Our GDD totals are now about 3 or 4 days behind 2007.

DEGREE DAYS		
GDD (from March 1)	**Base 42**	**Base 50**
	Van Buren County	
6-9-08	1070	637
6-17-08	1289	793
Projected for 6-24-08	1466	906
	Ottawa County	
6-9-08	913	510
6-17-08	1117	649
Projected for 6-24-08	1274	773

INSECT UPDATE

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

The number of cherry fruitworm in traps decreased over the last week but the number of cranberry fruitworm moths in traps at our scouting sites continues to increase, with some traps at high pressure sites capturing 100+ cranberry fruitworm moths. Cherry fruitworm eggs were found at the Covert and Grand Junction farms, and single berry damage (indicative of cherry fruitworm feeding or early cranberry fruitworm feeding) was observed at all four farms. Cranberry fruitworm eggs were seen at the Grand Junction and West Olive farms and cluster damage (characteristic of advanced cranberry fruitworm feeding) was observed in Covert. Growers at all four farms have applied their second insecticide targeting fruitworms. We expect the number of moths in traps and the number eggs of both species to remain about the same over the next week. Growers and scouts should continue monitoring cherry and cranberry fruitworm traps, and berry clusters should be inspected for eggs and larvae. See below for scouting methods.

Traps were set for blueberry maggot. These traps should be checked at least once per week from now through harvest.

Aphids were found at the Grand Junction and West Olive farms. Mid-sized colonies (5 to 20 individuals) were seen. A parasitized aphid was seen at the Covert farm. Growers and scouts should be scouting for aphids, particularly on farms with varieties that are susceptible to shoestring virus. See below for scouting methods.

Some leafroller feeding was observed at the Holland farm. We expect leafrollers to be controlled by insecticides applied for fruitworms. No tussock moth larvae were observed, but growers and scouts should still be on the lookout for this pest.

MONITORING FOR FRUITWORMS AND APHIDS

Please see the insect update in the previous issue for how to monitor for these pests.

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	6-2	18	6	5%		
	6-9	78	6	10%		
	6-16	100	1	0%	set	
Grand Junction	6-2	2	4	0		
	6-9	43	5	25%		
	6-16	51	3	5%	set	
Ottawa County						
Farm	Date	CBFW moths per trap	CFW moths per trap	BBA % infested shoots	BBM adults per trap	JB per 20 bushes
Holland	6-2	21	3	5%		
	6-9	108	7	5%		
	6-16	168	3	0	set	
West Olive	6-2	1	7	10%		
	6-9	2	2	0%		
	6-16	8	3	5%	set	

DISEASE UPDATE

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

Shoestring Virus

This week all scouted blueberry plots were at the green fruit stage. One of the fields showed an increase in blueberry shoestring disease symptoms. This disease, which is caused by blueberry shoestring virus (BSSV), can be diagnosed by red streaks on green stems, strap-like, elongated leaves and/or the presence of a dark red oak leaf pattern on the leaves (Figure 1). It is spread by infected planting material and the blueberry aphid *Illinoia pepperi*. Virus diseases like BSSV can be controlled by planting virus-free planting material, removal of infected plants, and a well timed-insecticide program to control blueberry aphids starting in late May (based on field monitoring for aphids).

Fig 1. Strap-like leaves which are symptomatic of Blueberry Shoestring Virus (Holland, MI)

Twig Blight

Another important disease to scout for during this time of year is twig blight which can be caused by various fungi, including *Phomopsis vaccinii*, *Colletotrichum acutatum* and *Botrytis cinerea*. As the season has progressed the incidence twig blight has increased slightly in all the scouted plots. Twig blight symptoms can be readily seen as brown to black lesions on green twigs or tip dieback. Another typical symptom of twig blight can occur throughout the season as a sudden wilting of leaves and a blighting of flower and fruit clusters (Figure 2). At this point it may be late to prevent new infections, but if fields have a lot of twig blight, it may be useful to prevent cane infections through wounds created during mechanical harvesting with fungicides such as Cabrio or Pristine. Indar and Orbit are also effective but have a 30-day PHI. In addition, growers can time irrigation to overlap with natural dew formation so as to reduce the number of hours that plant tissues stay wet.

Fig 2. Twig blight causing the eventual death of a developing fruit cluster (Holland, MI)

Farm	Date	Average number of mummy berry shoot strikes*	Average number of blighted twigs per bush**	Blueberry Shoestring Virus***
Van Buren County				
Covert	5-30	2.1	2.2	0
	6-5	2.0	2.1	0
	6-12	1.0	2.3	0
Grand Junction	5-30	48.1	0.7	0
	6-5	50.3	0.7	0
	6-12	33.9	0.8	0
Ottawa County				
Holland	5-30	6.5	0.2	1/50
	6-5	18.1	0.1	1/50
	6-12	7.4	0.2	3/50
West Olive	5-30	10.3	0.2	0
	6-5	8.0	0.4	0
	6-12	6.2	0.5	0

*Average number was calculated for ten bushes.
**Blighted twigs may be caused by various fungi, incl. *Phomopsis vaccinii*, *Colletotrichum acutatum* and *Botrytis cinerea*.
***Number of bushes showing blueberry shoestring virus symptoms (50 bushes were scouted)

PEST OF THE WEEK – BLUEBERRY MAGGOT

Rufus Isaacs[1] and John Wise[2]
[1]Department of Entomology, [2]Trevor Nichols Research Complex, Michigan State University

MONITORING AND MANAGEMENT STRATEGIES FOR BLUEBERRY MAGGOT

The blueberry maggot goes through one generation per year, over-wintering as a pupa below the soil surface. Most pupae emerge one year after going into the soil, though depending on climatic conditions a small proportion will remain as pupae through another year or two before emerging. Adult emergence typically begins in mid to late June with adult flight continuing through August. First adult emergence can be predicted by using a Growing Degree Day (GDD) model, because adult fly emergence should begin at 750 DD base 50. Actual emergence can be delayed if the soils are dry, as pupae usually respond more readily to a moist environment. Thus, initial adult emergence often follows a rainfall event in late June and in July. After emergence, female flies require approximately 7-10 days to become sexually mature and mate, at which point they will begin laying eggs. Eggs are oviposited under the skin of ripening blueberries, with a single egg deposited per fruit. Eggs hatch in about 5 days, at which point the maggot begins feeding, completing their development within a single berry. Upon maturity, the maggot drops to the ground, burrowing up to several inches into the soil before pupating. In Michigan's climate, these pupae will not emerge until at least the following growing season.

Monitoring adult blueberry maggot flight is the foundation of an effective protection program for blueberries against this pest. Initial adult emergence is best monitored using yellow sticky boards baited with ammonium acetate (or ammonium carbonate) as a food attractant, because newly emerged females are actively feeding during this pre-oviposition period. These traps should be placed on a stake or hung on an upper branch of a blueberry bush in a perimeter row (south facing side of bushes) with enough foliage cleared from around the trap so leaves don't stick to it. Hang traps with the colored side down in a V-orientation (see photo). Traps should be deployed before first anticipated flight (late June), since most flies are expected to be immigrating from wild or non-sprayed hosts outside the commercial planting. If a resident fly population is suspected from previous infestation, a trap placed inside the field is a good idea to detect internal infestations. Traps optimally should be checked twice weekly starting at 700 GDD base 50 until the first fly is caught, triggering fruit protection activities.

Left to right: Monitoring trap with V-orientation for monitoring blueberry maggot, fly on trap with distinctive wing pattern, maggot on ripe blueberry.

After the pre-oviposition period is complete, female flies will begin actively searching for fruit to lay eggs in, and there is a trap available that mimics the visual stimulus of a fruit. A green sphere trap, baited with

synthetic fruit volatile lure can be used to monitor fly activity in fields. Again, these traps should be placed in perimeter rows of the field unless there is evidence of a resident population far in the interior.

Control of blueberry maggot has been achieved for many years using broad spectrum insecticides. These kill the adult fly on contact and prevent the insect surviving to the point of being able to lay eggs into the fruit. Guthion is highly active against blueberry maggot, with long residual activity and has a 7 day pre-harvest interval. The organophosphates Malathion and Imidan are also active, with shorter pre-harvest intervals and potential for use closer to harvest. Carbamates such as Sevin and Lannate and the pyrethroids Asana and Danitol are also active on adult fruit flies. As a general rule, our trials in fruit crops against maggot flies have shown lower activity from the pyrethroid chemical class than from the organophosphates.

There are several new insecticide products that include blueberry maggot on their labels. These include the neonicotinoids Provado and Assail that are also active on Japanese beetle and aphids. Small plot trials of these products have shown that they protect fruit from maggot infestation, and in large-scale trials over four years in Michigan blueberry farms we found no blueberry maggot infestation in fields treated with Provado during July and early August. The spinosyn-containing compounds SpinTor (non-organic formulation) and Entrust (organic formulation) are highly active on blueberry maggot adults when ingested, but are sensitive to wash-off. In field trials with high pest pressure and two week application intervals their performance has been rated as good (see table). Performance would be expected to be higher in fields with lower pressure and with less time between applications.

GF120 NF Fruit Fly Bait (spinosad) is registered for control of the blueberry maggot and is listed by the Organic Materials Review Institute (OMRI) for use in organic production. Because the primary route of entry into the insect is through ingestion, applying this product during the fruit fly pre-oviposition period is important for optimal performance. GF120 must be applied with specialized equipment, and is designed for low-volume application by air. Field efficacy data is encouraging, but we have limited experience with this novel formulation in large-scale trials in Michigan.

The use of SURROUND WP for fruit fly control is based on creating a protective barrier between the plant and the pest that 1) reduces host recognition of the pest, and 2) prevents adult oviposition (i.e.; egg laying). Because it is not toxic to adult flies like conventional insecticides, complete coverage of the plant is critical. Multiple applications are typically needed to attain initial coverage; further sprays may be necessary to respond to wash-off from rain or excessive wind. Field trials indicate that when adequate coverage is maintained that excellent fruit protection can be achieved, although the white residue makes this not suitable for fruit destined for the fresh market.

Compound Trade Name	**Chemical Class**	**Optimal Spray Timing for BBM**	**Residual Activity**	**Effectiveness rating****
Guthion, Imidan	Organophosphates	Within 7 days of the first fly being captured	14+ days	E
Malathion	Organophosphates	Within 7 days of the first fly being captured	5-7 days	G
Lannate, Sevin	Carbamates	Within 7 days of the first fly being captured	5-7 days	G
Asana, Danitol	Pyrethroid	Within 7 days of the first fly being captured	7-10 days	G
SpinTor, Entrust*, GF120 NF*	Spinosyns	Immediately after the first fly has been captured	7-10 days	F-G
Provado, Assail	Neonicotinoid	Within 7 days of the first fly being captured	10-14 days	G-E
Surround WP*	Particle Film Protectant	Multiple applications before fly emergence	As long as thorough coverage of the canopy is maintained	G

* OMRI approved for organic production

** Effectiveness rating of insecticides Fruit Management Guide; E – excellent, G – good, F

MID-SEASON WEED CONTROL OPTIONS FOR BLUEBERRIES

Eric Hanson and Bernie Zandstra
Department of Horticulture, Michigan State University

Spring-applied herbicides do not always provide adequate weed control through the harvest season. Summer flushes of annual grasses (crabgrass, fall panicum) or broadleaves such as pigweed often are problems. Some Michigan blueberry areas received large amounts of rain in early June, and this may reduce the effectiveness of preemergent herbicides by leaching materials below the weed seed germination zone. Easily leached herbicides are soluble materials that are held less tightly to soil particles. The leaching potential is hard to predict exactly for all soils, but common blueberry materials might be ranked as follows:

Increasing leaching potential →
Solicam < Karmex = Princep < Sinbar < Velpar

This means that weed control from Sinbar and Velpar is more likely to be reduced by heavy rains than perhaps Solicam. Unfortunately, herbicide options for use in mid-season are limited by label restrictions, primarily pre-harvest intervals. The label restrictions for preemergent materials are:

Solicam: 60 days PHI
Karmex DF: "before germination and growth of weeds"
Princep Cal-90: "not when fruit are present"
Sinbar: "during early seedling stage of weed growth"
Velpar: "before budbreak"
Chateau: Do not apply after bud break through final harvest.
Callisto: Do not apply after onset of the bloom stage.

Several post-emergent herbicides can potentially be used in the summer. Some can still be used before harvest, but others cannot be applied until after harvest. Each herbicide has different characteristics that need to be considered when making choices.

Aim, Gramoxone, and Rely are burn-down materials. Pre-harvest intervals are listed on the labels for Aim (1 day) and Rely (14 days) but the Gramoxone label indicates it should not be applied after growth begins. These herbicides kill treated plant parts, but do not move within the plant. As a result, perennial weeds are usually not killed because the chemical does not move to the roots. Rely may move slightly in plants, because it often provides a little better control of some herbaceous perennials, such as dandelion. Aim is relatively inexpensive, but does not control grasses. Rely is much more expensive but controls broadleaves and grasses. All three herbicides kill green bark and leaves of blueberries so take care to keep spray off blueberries.

Fusilade and Poast are selective grass killers; they have no effect on bloadleaf weeds or blueberries. Poast has a PHI of 30 days, and Fusilade is only for non-bearing plantings. These products would not be effective if applied in the summer because grasses are too old. Grasses must be treated when they are 4-8 inches tall in the spring. If grass is taller, control is poor.

Glyphosate (Roundup) products have a PHI of 14 days so they can still be applied to most fields. Glyphosate is the most effective postemergent herbicide for blueberries, but also the most hazardous because it is absorbed by green tissues and moves throughout the plant. Perennial weeds are killed because the chemical moves to below-ground plant parts. Translocation is a two-edged sword. Glyphosate applied to blueberry branches moves within the bush, and can kill large canes or whole bushes. The most effective time to treat perennial weeds is late in the summer because absorbed glyphosate tends to move down to the roots. This timing is also most hazardous for blueberries. Use extreme care to avoid contact with blueberry tissues.

IRRIGATION FOR BLUEBERRIES

Eric Hanson[1] and Mark Longstroth[2]
[1]Department of Horticulture, Michigan State University; [2]MSU Extension-Southwest

Irrigation is vital for maintaining high yields in commercial blueberries in Michigan. Blueberries grow best in moist soils. Many Michigan Blueberry plantings are located in areas with a high water table so the bushes have ready access to water located close to the surface. But, blueberries are shallow-rooted and sensitive to drought stress, and most Michigan plantings are on sandy soils that hold very little water. Drought prior to harvest reduces berry size and yield, but drought stress anytime in the summer or fall also reduces bud set for the following year. Severe drought events reduce returns for several years. Most fruit in Michigan is not irrigated but 70% of the Michigan blueberries are irrigated. Irrigation is particularly critical for young plantings. Because roots are shallow (12 inches), more frequent irrigation is needed than for older plants. Good soil moisture levels optimize vegetative growth on young plants by reducing or avoiding moisture stress during the growing season. For established plants, the goal is to optimize fruit production for current and subsequent seasons. Irrigate to prevent moisture stress during the June-July fruit development period, when drought stress will reduce berry size and yields. Drought in August/September reduces bloom during the next year, so avoid stress after harvest when fruit buds are formed.

Comparison of irrigation systems options for Michigan blueberries.

System	% of Mich. acreage[1]	Advantages	Disadvantages
Overhead sprinklers	36	High uniformity & rates Frost protection	High installation/operation costs Large water supply needed
Drip-trickle	16	Low cost to install & operate High uniformity Small water supply	Rates too low to 'catch up' Can't frost-protect Limited root zone coverage
Traveling gun	14	Moderate initial cost	Poor uniformity Can't protect from frost High operating costs
Sub-irrigation	4	Variable initial cost Low operating costs Canopy is dry	Not suited for all sites Can't protect from frost
No irrigation	30	No cost	High risk

[1]Michigan Department of Agriculture; Michigan Fruit Inventory 2006-2007

Irrigation Systems

Overhead sprinklers are best where the water supply is adequate and spring frosts are likely. Trickle systems are best if your water supply is limited they apply water directly in the row with little evaporation. Traveling guns are economical, but may apply excessive water rates and have poor uniformity.

The soil water reservoir depends on texture and rooting depth (Table 1). Assume the rooting depth is 12 inches for young plants and 18 inches for older plants or excavate beside bushes to determine exact depths. Sandy soils may hold less than 1 inch of available water in the root zone, and half of this can be lost in two warm summer days. Many blueberry fields have slightly elevated areas that dry out quicker than other areas. Hardpan or a shallow water table may limit rooting in other areas of fields. These variable characteristics complicate scheduling. As a rule, irrigate to maintain drought-prone areas of your field.

Evapo-transpiration (ET) is the evaporation from the field, plus the amount of water lost by the plant (transpiration). Blueberry fields in southwest Michigan lose 0.18 to 0.24 inches per day during the summer. Daily Potential ET values are available on the Michigan Automated Weather Network (MAWN) (http://www.agweather.geo.msu.edu/mawn/). The potential ET is part of the report given for daily data. MAWN sites include Grand Junction, Fennville, South Haven, and West Olive. These MAWN Potential ET values

are the best estimates of water use in Michigan blueberry fields. The Et will over estimate water use early in the year before the canopy is fully leafed out and underestimate water use when the canopy is fully leafed out and conditions are hot and dry. Maximum water use during the preharvest fruit growth stage is probably 0.20 to 0.25 inches.

Table 1. Available water in a blueberry root zone as affected by soil texture and rooting depth.

	Available water (inches)	
Soil texture	Per inch of depth	In root zone (12-18 inch depth)
Sands	.03	.4 - .6
Loamy sand	.07	.8 - 1.3
Sandy loam	.13	1.6 – 2.3
Loam	.17	2.0 – 3.1

Allowable soil moisture depletion in blueberries is generally considered to be 50%, so irrigate when half of the available water is used. This means that irrigation should be applied before 0.2 to 0.6 inches water is lost from sands and loamy sands, or 0.8 to 1.5 inches are lost on sandy loam or loam soils.

Irrigation scheduling allows water to be applied when it is needed. This reduces costs, the amount of water used and loss of nutrients. You need to how much water the soil can hold. You should irrigate when half the available soil water has been used. If you know how much water the plants are using, you can irrigate when the plant has used half the availble water. For example, a root zone of 18 inches on a loamy sand soil (0.07 inches water per inch of depth) holds 1.3 inches of available water:

(18 inches) x (0.07 inches water/inch) = 1.3 inches water

If the root zone were depleted by 50%, you would need to apply 0.65 inches:

(0.5 depletion) x (1.3 inches) = 0.65 inches to apply

If the ET for the last several days was 0.25 inches you would need to irrigate every 2 days; for 0.2 inches every 3 days and if the plants were only using 0.1 inches then you would need to irrigate every 6 days.

The evapotranspiration rate varies during the year depending on the amount of leaves on the plant s and the weather condition, heat and relative humidity. The temperature is the most important factor, increased heat increases ET much more than increasing humidity decreases ET.

Estimated Blueberry Water Use in Michigan Blueberries (inches)			
Month	Monthly Use	Weekly Use	Daily Use
May	0.48	0.12	0.02
June	2.87	0.72	0.10
July	5.09	1.26	0.17
August	2.13	0.53	0.07

Sprinkler Systems

The amount of water applied by sprinkler systems is determined by the size of the nozzle and the water pressure at the nozzle. For example a 9/64-inch nozzle at 45 psi will deliver about 0.15 inches an hour. If the system delivers 0.15 inches water per hour, 0.6 inches would be pumped in 4 hours. However, about 20 to 30 % of water from overhead sprinklers may be lost to evaporation, so increase the operating time accordingly. Also, irrigation systems are not completely uniform; they apply more water in some areas than others. The uniformity of sprinkler systems can be measured (Ley, 1994b), but are usually only 70% uniform. This means that to recharge all areas of the field, 30% more water than calculated would need to be applied. In our example, operating time should be increased by 20% to account for evaporation losses, plus 30% due to non-uniformity. So, increase operating time of 4 hours by 50% to 6 hours to ensure all areas receive 0.6 inches.

Trickle Irrigation

The application rate for lower volume trickle systems (48" spacing, 0.42 gph emitters) is about 0.17 inches/hr. The more common moderate flow systems (24" spacing, 0.42 gph emitters) deliver about 0.3 inches/hr. Since evaporation and uniformity are not significant in trickle systems we do not need to increase the application time. We would need to run the lower volume system twice as long to apply the same amount of water. These systems should be run at one to two hours every day to replace the water used by the plants.

MEETINGS AND ANNOUNCEMENTS

2008 Blueberry IPM Twilight Meeting Schedule:

June 24, 6-8PM, 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

MSU BLUEBERRY TEAM

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IN NEXT WEEK'S ISSUE…

Alternaria fruit rot
Japanese beetles are coming!

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