Michigan Blueberry Facts

MICHIGAN STATE UNIVERSITY

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Contents

CROP STAGES

Keith Mason
Department of Entomology, Michigan State University

Harvest is going strong and the crop looks very good for this year. Some growers are estimating near record yields for some varieties. In Van Buren County, Blueray is between first and second harvest, and Bluecrop is undergoing third harvest in Grand Junction and Jersey in Covert is at first harvest. In Ottawa County, in West Olive, Bluecrop is ready for second harvest and Rubel is ready for first harvest, and Blueray is ready for the first picking in Holland.

Blueray ready for second harvest in Grand Junction (left), and Rubel ready for first harvest 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.

Weather has been seasonal with highs in the mid 80s and lows near 60s, with no significant rainfall. Soils are beginning to dry. Storms moved through the region Monday morning and left some much needed rain. Rainfall amounts were between a third and a half-inch, about enough water for two days. This wetting period (3 hours) was not long enough to be an infection period for many diseases. The forecast for the upcoming weeks is for cooler and dryer than normal conditions indicating that the lack of water will continue.

DEGREE DAYS		
GDD (from March 1)	**Base 42**	**Base 50**
	Van Buren County	
7-28-08	2426	1603
8-4-08	2661	1772
Projected for 8-11-08	2841	1897
	Ottawa County	
7-28-08	2213	1418
8-4-08	2425	1574
Projected for 8-11-08	2616	1710

INSECT UPDATE

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

Cherry fruitworm and cranberry fruitworm flight is over, no fruitworm moths were trapped at any of the four farms scouted, and traps can now be removed from fields. If traps are to be reused next season, be sure to write the fruitworm species on the trap and use that trap for the same species next year. Also make sure you store traps for different species separately during the winter to prevent contamination. Be sure to make a note of "hot spots" in areas where you saw fruitworm damage this season to help with planning your IPM program for next season.

No blueberry maggot flies were caught at any of the four farms, but captures of this pest are still being reported from other farms. Growers and scouts should continue checking blueberry maggot traps at least once per week from now through the end of harvest. See the June 24th issue of the Michigan Blueberry IPM Update for more information on Blueberry maggot fly.

All four farms were scouted for Japanese adults, and low numbers of beetles were observed at the Grand Junction farm. Many growers are reporting lower activity of this pest, although it has increased in a few regions. Very little evidence of Japanese beetle feeding on leaves or fruit was seen at any of the four farms scouted this week (see photos to the right). Growers and scouts should be checking fields for these beetles from now through harvest. See the July 1st issue of the Michigan Blueberry IPM Update for more information including scouting methods for Japanese beetles.

Aphids were found at all farms except in Covert, and mid-sized colonies (5 to 20 individuals) were seen. Parasitized aphids were seen in West Olive and Grand Junction. Continue scouting for aphids, particularly on farms with varieties that are susceptible to shoestring virus, and take appropriate management to control these insects in susceptible varieties where shoestring symptoms have been observed.

Leafroller larvae were observed at the Holland farm, and growers and scouts should still be on the lookout for these pests. Oblique banded leafroller flight is declining.

Tussock moth larvae were not observed, but fields with a history of this pest should be monitored through harvest.

Van Buren County

Farm	Date	CBFW moths per trap	CFW moths per trap	BBA % infested shoots	BBM adults per trap	JB per 20 bushes	OBLR moths per trap
Covert	7-21	0	0	0%	0	3	1
	7-28	0	0	0%	0	0	1
	8-4	0	0	0%	0	0	0
Grand Junction	7-21	0	0	25%	0	1	0
	7-28	0	0	25%	0	8	0
	8-4	0	0	5%	0	0	0

Ottawa County

Farm	Date	CBFW moths per trap	CFW moths per trap	BBA % infested shoots	BBM adults per trap	JB per 20 bushes	OBLR moths per trap
Holland	7-21	0	0	15%	0	5	1
	7-28	1	0	10%	0	0	1
	8-4	0	0	20%	0	0	0
West Olive	7-21	0	0	30%	0	0	4
	7-28	0	0	35%	0	0	1
	8-4	0	0	0%	0	0	2

DISEASE UPDATE

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

This week all scouted plots were between the 1st and 2nd harvest. In the previous issue, we discussed fruit rots and the different symptoms associated with them, specifically anthracnose (orange spore masses; caused by *Colletotrichum acutatum*) and Alternaria (dark-green spore masses; caused by *Alternaria* spp.). Over the past two weeks we have seen an increase in the number of fruit rot symptoms in the field. Anthracnose and Alternaria were seen in all four of the scouted plots (Figure 1 and 2). Also, we have noted that the 'Jersey' plot in Covert, MI has tended to be more susceptible to anthracnose then the other sites which are Blueray and Rubel. Anthracnose in particular is favored by hot, humid weather.

Figure 1. Anthracnose fruit rot symptoms in the field, notice the orange sporulation (arrow) (Covert, MI).

Fruit rots can cause significant pre- and post-harvest yield losses. Berries with high fruit rot levels also tend to have higher microbial counts. Healthy berries can get infected by *Colletotrichum* spores washing down from infected berries in clusters during rain events or overhead irrigation. Infections can even occur by infected berries or spores touching healthy berries on the harvester or sorting line. At this time, Alternaria spores are also ubiquitous in the air of blueberry fields. Pre-harvest Alternaria rot typically affects calyx end of the blueberry, but post-harvest Alternaria infections occur mostly at the scar, which provides moisture for infection. Ripe berries are very susceptible to infection by both anthracnose and Alternaria fruit rot. Before harvest, fruit rots can be controlled by proper timing and reducing the frequency of overhead irrigation as well as fungicide sprays programs. While fungicides cannot cure already infected berries, spraying Abound, Cabrio, Switch or Pristine at this time (even between harvests) can reduce the number of secondary infections and the incidence of post-harvest rot.

Figure 2. Alternaria fruit rot symptoms seen in the field; notice the dark green to black sporulation and shriveling around the calyx cup (Covert, MI).

Scouting for fruit rots in the field at this time can give an indication whether fungicide sprays are needed.

Farm	Date	Average of infected anthracnose clusters per bush*	Average of infected alternaria clusters per bush*
Van Buren County			
Covert	7-17	0.0	0.0
	7-25	0.1	0.3
	7-31	0.2	2.0
Grand Junction	7-17	0.0	0.0
	7-25	0.0	0.0
	7-31		
Ottawa County			
Holland	7-17	0.0	0.0
	7-25	0.1	0.0
	7-31	0.4	0.0
West Olive	7-17	0.0	0.0
	7-25	0.0	0.0
	7-31	0.0	0.0

*Average number was calculated for ten bushes.

PEST OF THE WEEK –Post-harvest issues: fruit rots and microbial contamination

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

Anthracnose - Colletotrichum acutatum (fungus)
Alternaria fruit rot – Alternaria tenuissima (fungus)
Botrytis fruit rot – Botrytis cinerea (fungus)
Microbes (yeasts, molds, and bacteria)

Fruit Rots and Storage life

The diseases of concern at this time of the year in blueberries are fruit rots, such as anthracnose (gelatinous orange spore masses) and Alternaria fruit rot (green velvety layer of spores) (Fig. 1). Botrytis fruit rot (gray mold) is usually not a problem in Michigan, but can occur, especially in wet years. While fruit rot is usually not visible until the berries ripen, it is prudent to assume you will have a fruit rot problem if you had problems last year. Often, berries look healthy at harvest, but start to rot soon after in the lugs while awaiting processing. Fruit rot levels tend to increase greatly from the first to the last harvest. Fruit rots are favored by high humidity and temperature. Fruit rot symptom development may be slowed down by refrigerated storage, but will resume on the supermarket shelves, lowering fruit quality and the overall storage life. Recently, the Small Fruit Breeding program looked at different cultivars and there overall storage life (Table 1). The most resistant genotypes to Alternaria were 'Aurora', 'Jersey', 'Toro', 'Nelson' and 'Draper'. This is the second year that 'Aurora', 'Jersey' and 'Draper' were in the most resistant class. The most resistant genotypes to Colletrotricum were 'Aurora', 'Nelson', 'Toro', 'Elliott' and 'Brigetta'; this is the second year that 'Aurora' and 'Brigetta' were in the most resistant class. Overall, the varieties with the least fungal rot were 'Aurora' 'Toro', 'Nelson', 'Elliott' and 'Brigetta'. The genotypes with the the longest storage life were 'Aurora' which lasted 9 weeks, followed by 'Draper' (7 weeks), 'Brigetta' (6 weeks) and 'Nelson' (6 weeks). 'Draper', 'Brigetta' and 'Nelson' were among the longest storers last year as well.

Figure 1. Fruit rotted at 100% humidity for 7 days post harvest. A) Anthracnose 'ripe rot' B) Alternaria fruit rot C) Botrytis fruit rot

Controlling Fruit Rots

If the first blueberries are starting to show rot, fungicide sprays can limit new infections of nearby healthy berries. It is important to take note of the pre-harvest interval (PHI) for the various fungicides. Most fungicides used at this time of the year have a 0-day PHI; however, Topsin-M has a 7-day PHI and Ziram has a 14-day PHI. Fungicide applications on blueberries before the first harvest may provide significant control during subsequent harvests. The strobilurins (Abound [azoxystrobin], Cabrio [pyraclostrobin], Pristine [pyraclostrobin + boscalid) are all systemic fungicides that are highly effective against anthracnose, with Pristine having the most broad-spectrum activity since it contains two different active ingredients. However, it is also the most expensive of the three. Both Switch (cyprodinil + fludioxinil) and Pristine provide good to Elevate (fenhexamid) is primarily controls Botrytis, whereas Captevate (fenhexamid + captan) controls Botrytis as well as anthracnose. In order to test fungicide efficacy against post-harvest fruit rot, treated fruit is harvested and allowed to rot for a period of 7-12 days at 100% humidity (Figure 2) or goes through "simulated commercial handling" (in a clamshell placed at 40ºF for 1 week, then at 70ºF for 3 days) before evaluation.

Microbial contamination

Frozen blueberry fruit for processing may undergo microbial tests mandated by buyers, who want to exclude human pathogens, such as Escherichia coli O157:H7, from their products. Coliform bacteria may occur on blueberries and are thought to originate primarily from irrigation with pond water. Standards for the number of such organisms set by buyers vary and are becoming increasingly stringent. Blueberries also contain natural populations of yeasts and molds that live on plant surfaces. These organisms are generally harmless and may even be beneficial as antagonists of fruit rot pathogens. However, high levels of yeasts and molds (fungi) are not desirable because they are thought to affect backing quality of products (e.g., muffins and pies) that are made with such blueberries or could contribute to moldy flavors in other products (e.g., yoghurt). Yeasts and mold counts naturally vary by location. However, high fruit rot levels, appear to contribute to high microbial counts. In fact, Colletotrichumacutatum sometimes is the main organism isolated from blueberry fruit surfaces, even if the fruit appears intact and healthy. In general, microbial counts increase over the harvest period, such that later harvests are at higher risk of exceeding microbial standards set by buyers. Methods to reduce microbial counts for blueberries are: 1) having a good fungicide program for fruit rot control prior to harvest, 2) timely harvesting, 3) rapid cooling, 4) timely processing of fruit, especially if it is of poor quality, 5) treatment of processed fruit with chlorine dioxide gas. Irrigation with well water is preferable over pond water.

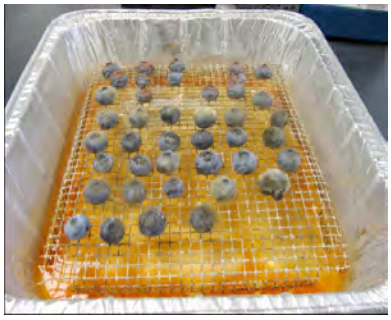

Figure 2. Fungicide efficacy testing at MSU is often done by placing healthy-looking fruit in a pan with 100% humidity an allowing the fruit to rot for a period of 7-12 days (Note - covered with plastic wrap during the test). Fungi are then identified based on their color and appearance.

Table 1. Storage life and rot resistance of fruit collected from cultivars and advanced selections at Grand Junction, MI in 2003. To determine storage life, four pints of fruit from each genoype were held at 2 C in plastic zip-lock bags and evaluated every 3 - 4 days for salability. To determine resistance to fruit rots, fifty fruit were randomly selected from four pints of each genotype and evaluated for rot after 10 days at room temperature. (authors Jim Hancock, Pete Callow, and Annemiek Schilder)

			Percentage of fruit rotted with different fungal species				
Genotype	Picking Date	Storage life (weeks)	*Alternaria*	*Botrytis*	*Colletotrichum*	Other	Total
Aurora	8/13	9	2	0	2	0	4
Bluecrop	7/16	5	13	0	26	3	42
Bluegold	7/23	5	9	0	31	0	40
Bluejay	7/16	5	5	0	6	4	15
Blueray	7/16	5	6	0	11	2	19
Bluetta	7/9	5	10	0	24	1	35
Brigetta	7/30	6	7	0	4	0	11
Draper	7/16	7	4	0	12	0	16
Duke	7/9	5	9	0	12	5	26
Elliott	8/13	5	7	0	4	0	13
Jersey	7/30	4	2	0	8	5	13
Legacy	8/6	5	9	0	24	1	34
Liberty	8/13	5	10	0	7	0	17
Nelson	7/23	6	4	0	2	0	6
Rubel	7/30	4	19	0	50	1	70
Spartan	7/9	5	12	1	9	3	25
Toro	7/23	6	2	0	2	0	4
LSD		2	6	0	2	5	10

TIME TO COLLECT LEAF SAMPLES FOR NUTRIENT ANALYSIS

Eric Hanson
Department of Horticulture, Michigan State University

Leaf analysis is the best way to monitor the nutrition of blueberry plantings. This procedure provides a direct measure of the nutritional health of plants; soil tests only provide an estimate. Leaf analyses can be used to diagnose nutritional problems and to identify developing problems before growth or yield is affected. Sample young plantings every 1-2 years and established plantings every 2-4 years. The whole farm can be sampled every 3-5 years, or portions sampled more frequently.

1. Define sampling units. Divide the farm into sampling units or areas that have uniform soil types, management history and variety. Farms with variable soils or history will require more sampling units to provide an accurate picture of the nutritional health. If the farm is very uniform with large blocks of the same bush age and varieties, define units no larger than 10-15 acres.

2. Sampling. Sample leaves in late July to early August. Collect at least 50 leaves from different bushes throughout the sampling unit. Select healthy leaves from the middle of this year's shoots. If the leaves are dusty, rinse them briefly in tap water, then lay them out on a table top until they are dry to the touch.

3. Submitting samples. Package leaves in clearly labeled paper bags, and send them to a reputable laboratory.

4. Diagnosing nutritional problems. If you wish to diagnose a suspected nutritional problem, collect one sample from plants beginning to develop symptoms of the problem, and a second from nearby healthy plants. These samples can be collected at anytime during the season.

Interpreting results. Deficient, normal and excessive levels for blueberries are well defined for some nutrients (N, P, K) but these ranges for other nutrients (most micronutrients) are not well defined because deficiencies and excesses have not been documented in fields.

Nutrient	Deficient	Normal	Excessive	% deficient samples*
Macronutrients (%)				
Nitrogen (N)	< 1.7	1.7 to 2.1	> 2.3	42
Phosphorus (P)	< 0.08	0.1 to 0.4	??**	38
Potassium (K)	< 0.35	0.35 to 0.65	> 0.8	18
Calcium (Ca)	< 0.13	0.2 to 0.6	> 0.8	<1
Magnesium (Mg)	< 0.1	0.15 to 0.3	??	2
Micronutrients (ppm)				
Boron (B)	< 15	20-60	> 80	<1
Copper (Cu)	??	5 to 20	??	
Iron (Fe)	??	60 to 200	??	
Manganese (Mn)	??	50 to 350	??	
Zinc (Zn)	??	8 to 30	??	

* based on over 1,900 samples from Michigan blueberries, 1991-2001.
** inadequate information to determine.

Some reputable labs:

MSU Soil and Plant Nutrient Lab, A84 PSSB, MSU, East Lansing, MI 48824 (517 355-0218)
A & L Great Lakes Laboratories, Fort Wayne, Indiana (www.algreatlakes.com, 260-483-4759)
Brookside Labs in New Knoxville, OH (419-753-2448, www.blinc.com).

IS THAT HERBICIDE DAMAGE?

Carlos Garcia-Salazar
Michigan State University Extension

There are some issues related to blueberry plant health resulting from the intensive rains that we had in the past. Fields that were flooded for several days are showing plants with die-back and intensive defoliation. Leaves on affected bushes showing brown spots that later on become necrotic (see picture 1). Damaged plants are located in sandy soils and the symptoms follow a pattern along the rows. New growth in affected plants shows deformed leaves and sparse foliage. The most damaged bushes are completely defoliated (see picture 2). So far, tissue samples have been sent to de MSU lab for identification but some preliminary reports indicated that no plant pathogen is associated with these symptoms. Thus, we are leaning to believe that the damage could be herbicide related. Because of the intensive rains and flooding it is possible that pre-emergent herbicides applied early in de season could have been translocated to the root zone and absorbed by the plant. However, we are waiting for the grower's herbicide application records in order to make better determination.

Picture 1. Blueberry leaves in affected bushes.

Picture 2. Blueberry bush with intensive defoliation.

MEETINGS AND ANNOUNCEMENTS

The final Blueberry IPM Update for 2008 will be published on August 19.

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

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