Michigan Blueberry I.P.M. Update

July 3, 2007 Volume I, No. 12

Contents

The Blueberry IPM Update is a weekly publication produced by Michigan State University Extension. To receive a copy of this newsletter, send an email to masonk@msu.edu.
Also available online through blueberries.msu.edu and at:
www.isaacslab.ent.msu.edu/blueberryscout/blueberryscout.htm

Editor's Note:

We hope you find the information in this newsletter useful in guiding what to look for as you scout your own farm. The scouting data shown in the Disease and Insect Updates below are taken from four Michigan blueberry farms. As conditions are different from farm to farm, we must stress that the information in this newsletter should not be used as a substitute for scouting your own fields. Your spray decisions should be made based on what is seen on your own farm.

Please use this newsletter to determine when and how to look for certain pests, identify potential pest problems, and to get information on the biology of pests and other aspects of integrated pest management. See the Insect and Disease Updates below for descriptions of some scouting methods that can be used on your farm.

CROP STAGES

In Van Buren County, Jersey in Covert are at early fruit coloring. Blueray and Bluecrop are within a week or ten days of first harvest.

In Ottawa County, Blueray are at fruit coloring in Holland. Rubel and Bluecrop are also at fruit coloring in West Olive. These varieties are within two weeks of first harvest.

Blueray nearing first harvest at Holland.

DEGREE DAYS AND WEATHER NOTES

Weather Forecast: Chance of showers and thunderstorms Tuesday through Thursday with high temps in the low 80's. Temperatures will reach the upper 80's by Sunday. By 7-9 GDD_{50} will increase by ~165, and GDD_{42} will increase by ~220. Complete weather summaries and forecasts are at available enviroweather.msu.edu

GDD (from March 1)	Base 42	Base 50
	Van Buren County	
6-18	1606	1028
6-25	1788	1153
7-2	1954	1271
	Ottawa County	
6-18	1472*	915*
6-25	1657*	1044*
7-2	1845*	1177*

* enviroweather data for the West Olive station is missing some dates, so data from Hudsonville was substituted for missing values.

PEST OF THE WEEK

Fruit rot diseases

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

Anthracnose - *Colletotrichum acutatum* (fungus)
Alternaria fruit rot – *Alternaria fruit rot* (fungus)
Botrytis fruit rot – *Botrytis cineria* (fungus)

In previous issues we discussed all three of these common fruit rot pathogens separately. However, it is often beneficial to group them because like other fungi there optimal growth is at high humidity, furthermore, each can cause significant post harvest fruit losses. In Michigan, these pathogens can be seen as pre-harvest diseases; however, the majority of yield losses come after harvest and during storage. In terms of scouting for fruit rots, each of these pathogens can be distinguished from each other in the field and should be treated differently when applying control measures.

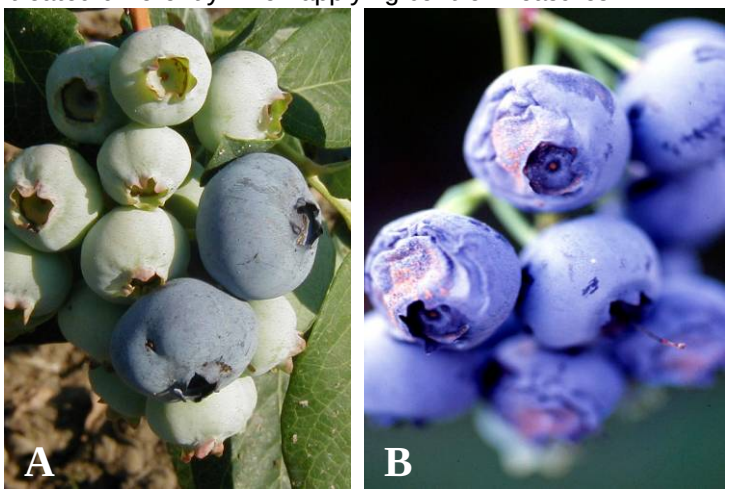

Figure 1. A) Growth stage of 25% Ripe. B) Sunken tissue and visible sporulation doesn't appear until later in the season (anthracnose) (photos by Mark Longstroth).

Symptoms

Immature blueberries are generally asymptomatic for any sort of fruit rot, however the fungal infection can still occur during this growth stage. The infection will then remain latent and fruit rot symptoms will not appear until the berries ripen. For anthracnose, berries will have sunken and shriveling regions (Figure 1B) and under humid conditions, support orange, gelatinous spore masses (Figure 2A). Alternaria however, will present itself as sunken areas near the calyx cup eventually leading to a dense amount of dark green fungal mycelium covering the fruit surface (Figure 2B). *Botytris cineria* or gray mold, is extremely uncommon in the field, however, it can be characterized by gray hyphae covering the entire surface of the berry (Figure 2C). After harvest, fruit can rot quickly (within 2-4 days).

Management

Since these diseases do not often manifest themselves until harvest, preventative measures are necessary. Cultural control measures usually involve reducing humidity by limiting the use of overhead irrigation. Furthermore, a

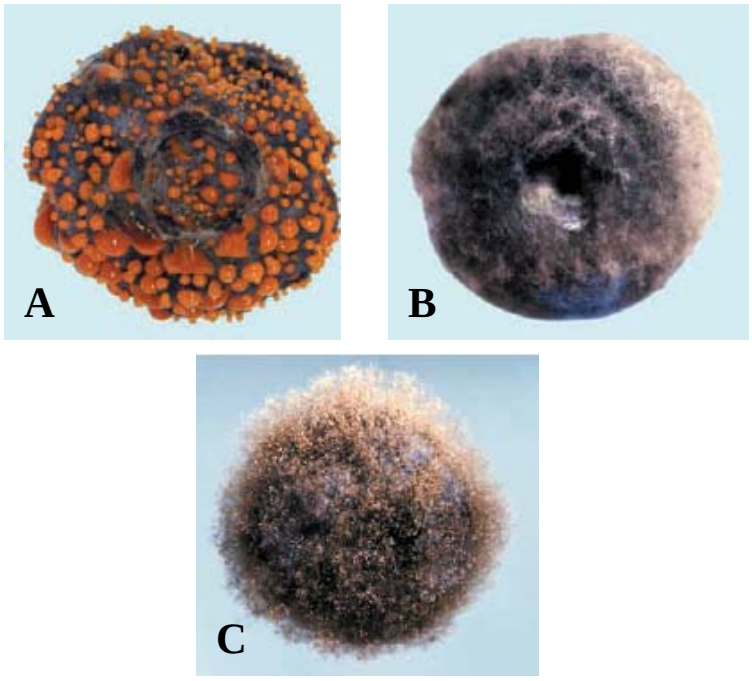

Figure 2. Advanced fruit rot symptoms rotted under high humidity. A) Anthracnose B) Alternaria fruit rot C) Botrytis fruit rot (photos by Phil Wharton.)

fungicide spray program from pink bud to harvest will aid in preventing fruit infections from occurring. For information on effective fungicides for each of the three fruit rot diseases consult the E-154 Fruit Management Guide.

Future Options

Currently, Michigan State University is developing a predictive disease model based on weather information, which can be used to determine when spores are being spread through a field. In the future, we hope that certain weather conditions will give growers an idea of when spores are being actively spread through a field so controls can be applied.

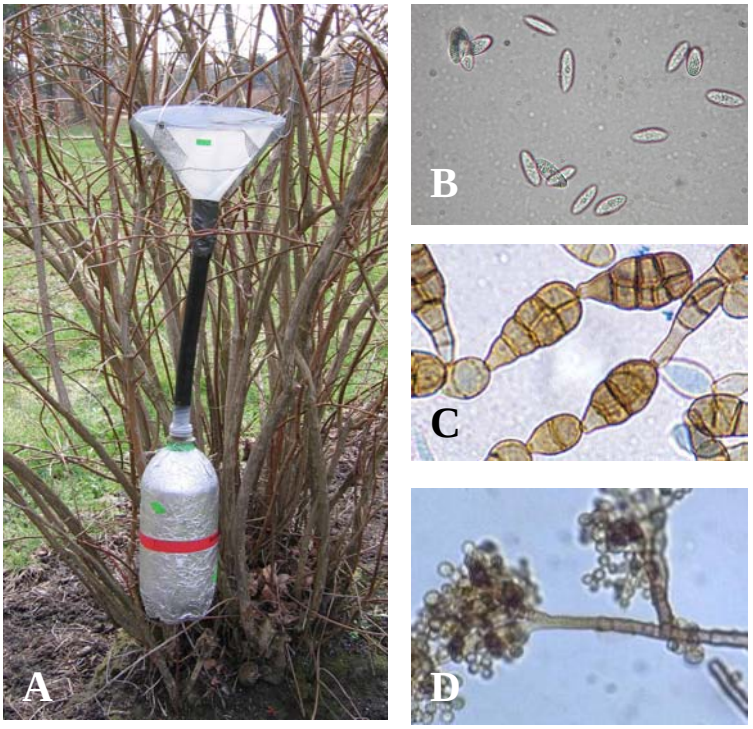

Figure 3. Fruit rot fungi are splashed dispersed by rain. A) At MSU, spore traps are often used to count to collect rain water, to measure spore levels throughout the season. These spores are then counted using a compound microscope. B) *Colletotrichum spp.* C) *Alternaria spp*. D) *Botrytis cineria*

DISEASE UPDATE

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

Fruit rots

This week all scouted plots were at a growth stage of fruit coloring to 25% blue. As acknowledged in earlier issues of the disease update, scouting for diseases during this time of year in blueberries is often difficult because immature blueberries are usually asymptomatic (Figure 1A). In Michigan, most fruit rots are primarily a post-harvest problem; in severe cases crop losses can reach as high as 100%. That said, it is still possible under humid weather conditions to see visible sporulation in the field (Figure 1B). Of note, berries tend to be more susceptible as the season progresses, meaning subsequent harvests of the same field tend to be more susceptible to infection. As fruit begins to ripen growers should scout for rotting fruit clusters, and visible signs of sporulation; and determine the best course of action to protect their crop.

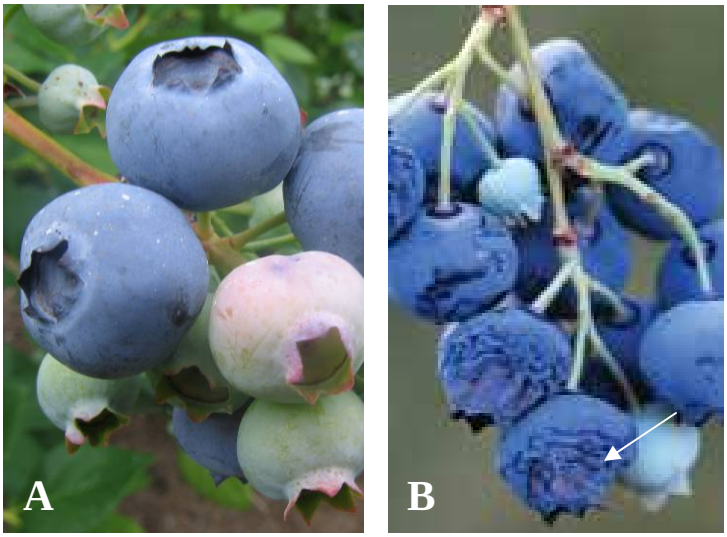

Figure 1. A) During the first harvest, fruit rots are extremely rare (Holland MI). B) Visible sporulation on a cluster of fruit well past the first harvest (arrow).

Farm	Date	Mummy berry fruit infections per bush *	Blueberry shoestring virus	Infected clusters of Anthracnose **	Phomopsis twig blight per bush
Van Buren County					
Covert	6-18	-	0	-	5.6
	6-25	-	0	-	5.7
	7-2	√ †	0	-	7.2
Grand Junction	6-18	-	0	-	7.5
	6-25	√ †	0	-	8.2
	7-2	√ †	0	-	9.5
Ottawa County					
Holland	6-18	-	5 (out of 50)	-	8.4
	6-25	√ †	5 (out of 50)	-	8.9
	7-2	√ †	6 (out of 50)	-	9.1
West Olive	6-18	-	0	-	10.2
	6-25	√ †	0	-	10.9
	7-2	√ †	0	-	10.0

* - Fruit infected with the mummy berry fungus (berries were scouted on the bush and surrounding it).
** - Number of infected clusters showing signs of sporulation (average infected clusters per bush).
† - √ indicates an incidence of mummy berry at a scouted site (average mummified berries per bush will be collected on 7-9-07).

Mummy berry inoculum

As stated in previous weeks there is very little a grower can do about preventing mummy berry fruit infections during this time of the growing season. However, being conscious of where the "hot spots" for mummified fruit are within a field, can give growers an idea of where the source of infections will arrive from in next years growing season. Management strategies can then be targeted towards those areas in the spring.

Figure 2. Infected fruit commonly fall on the ground (arrows), when scouting it is important to scout on the bush and the ground (West Olive, MI).

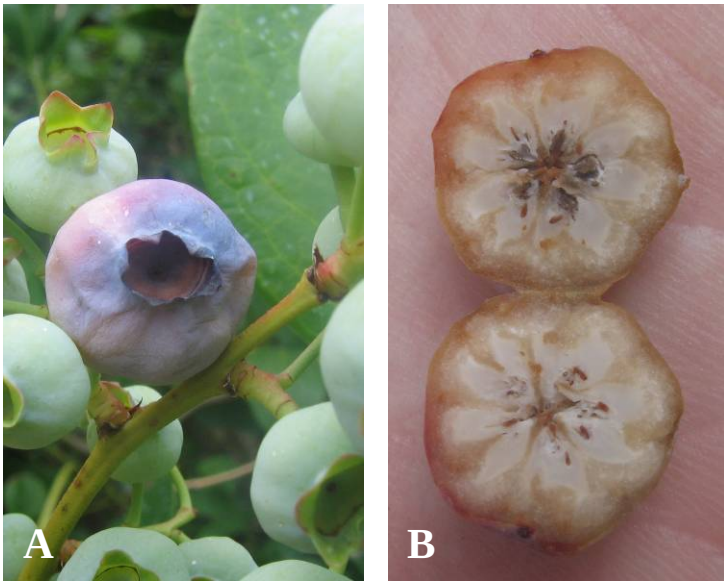

Figure 3. A) Newly forming mummified fruit often appears tan and sometimes pink. B) Cross section of mummified fruit from Figure 3B (Grand Junction, MI).

INSECT UPDATE

Top: Fruitworm entry hole. Note the characteristic darkening of the fruit.
Bottom: Cluster damage from Cranberry fruitworm.

FRUITWORMS

Cranberry fruitworm moth flight is almost over in both Van Buren and Ottawa Counties. All growers have sprayed twice for fruitworms. No cherry fruitworm moths were caught. No fresh Cranberry fruitworm or cherry fruitworm eggs were observed. Single berries with feeding damage were found at all farms and the amount of this damage is similar to last week. No live larvae were observed at any of the farms. Clusters with webbing and frass (cranberry fruitworm feeding damage) were found at the Covert, Grand Junction and Holland farms (see photo to the right). In the next week, we expect to see cranberry fruitworm flight end, and the amount of fruit with fruitworm feeding damage should decrease.

BLUEBERRY APHID

Aphids were detected on all farms except in Covert. The percentage of infested shoots has generally remained steady, as has the size of aphid colonies (1-10 aphids). You should be scouting your bushes for the presence of this pest. If aphids are found on or near varieties that are susceptible to shoestring virus, the use of insecticides for control may be needed.

TUSSOCK MOTH

No larvae were observed.

BLUEBERRY MAGGOT

No flies were captured. However emergence has been reported at other sites in Allegan County. Continue to use traps to monitor this pest throughout the harvest period.

JAPANESE BEETLE

This pest has emerged and the number of beetles observed has increased. Some beetle feeding damage has been found on leaves and fruit. Continue to scout for this pest through out the harvest period. For insecticide control options see last week's (6-26-07) newsletter.

MONITORING FOR FRUITWORMS

After moths are caught and after petal fall (~5-15 or 5-30) bushes should be inspected for eggs and damage each week for a five minute sampling period. Working in a "hotspot," 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 JAPANESE BEETLE

Begin scouting for Japanese beetle in mid to late June. Visually scan the canopy of 10 bushes on the field border and 10 bushes in the interior of the field. Count the number of beetles observed. As beetles are very mobile, check for the presence of feeding damage on leaves and fruit to let you know if beetles have been active in the field recently.

Van Buren County						
Farm	Date	CBFW moths per trap	CFW moths per trap	Blueberry aphid % infested shoots	Blueberry maggot per trap	Japanese beetle per 20 bushes
Covert	6-18	0	0	0	0	
	6-25	18	0	0	0	1
	7-2	3	0	0	0	9
Grand Junction	6-18	7	0	20%	0	
	6-25	16	0	30%	0	2
	7-2	5	0	20%	0	1
Ottawa County						
Holland	6-18	34	1	30%	0	
	6-25	9	0	25%	0	0
	7-2	0	0	30%	0	5
West Olive	6-18	0	0	25%	0	
	6-25	0	0	15%	0	0
	7-2	0	0	40%	0	0

WATCH OUT FOR HARVEST-SEASON INSECT PESTS

Rufus Isaacs
MSU Entomology

With blueberry harvest underway, regular scouting of fields is critical to ensure that harvested berries are insect-free. Four key insect pests can infest blueberries during harvest and management of these should be the focus of insect IPM programs until harvest is complete. These insect pests are cranberry fruitworm, Japanese beetle, blueberry maggot, and tussock moth.

Cranberry fruitworm. This pest is usually out of the fruit before harvest of most fields, but early varieties are the most at risk. This is because larvae not controlled after bloom can still be developing in the fruit when these early varieties are harvested. Regular field inspections, especially alongside woods or tree lines, are recommended to avoid harvesting infested fruit. If any berries are detected with the characteristic premature color change, and especially if larvae are found inside, growers may consider skipping the edge of the field to avoid harvesting these berries. While the window for fruitworm management has passed for 2007, take good notes now and make sure fields that were not well protected from this pest are given extra attention in 2008.

Japanese beetle. Beetle emergence has begun early for 2007. Adult beetle densities are generally low still, but we expect more emergence over the coming weeks, especially after more rain. Preventing beetle contamination of blueberries is essential during harvest, so many growers adopt a cycle of management for this pest that follows the following sequence: harvest, irrigate, scout fields, apply insecticide only if needed. This is repeated through each of the harvests. There are a number of registered insecticides that provide very effective protection against Japanese beetle, and you can view last week's article (from 6-26-07) for detail on this topic.

Blueberry maggot. The rain in the past few weeks has brought flies out from their overwintering stage, and monitoring traps are catching them in many parts of southern Michigan. Using yellow sticky traps baited with attractive odor is a key component of blueberry IPM, as this allows growers to decide whether there is any risk to the field from blueberry maggot. Traps should be checked a few times each week through harvest so decisions can be made to not treat or treat depending on the number of flies detected. It is critical that accurate identification is made of flies trapped, and the photo below helps show the differences between blueberry maggot (fly on the left) and the native cherry fruit flies that can be around blueberry fields on wild cherry (fly on the right). The cherry fruit fly does not infest blueberries and its wing pattern is different from blueberry maggot. Most insecticides that are active on Japanese beetle will also control blueberry maggot.

Tussock moth. In early July the eggs from the second generation of tussock moth hatch and the larvae crawl into the bushes to feed on leaves, preferring the darker, shady parts of the bush. As they grow, these larvae move higher in the canopy and can become mature, large, colorful (yellow, white, black, and red) larvae as the later ripening varieties mature. The key to preventing problems with this pest at harvest is good management of the first generation; tussock moth tend not to be a pest in fields that receive good control of fruitworms around bloom time when the early tussock moth generation larvae are out. If larvae are present now there are many broad-spectrum (Imidan, Sevin, Asana, Lannate) insecticides that will control this pest. Various selective insecticides can work too if they are applied early enough: B.t (Dipel, Javelin) or the growth regulator, Confirm are effective at controlling younger larvae of tussock moth. Larvae must eat these insecticides for them to work, so covering the inside of the bush is essential. This goes for the broad-spectrum products too - because the larvae can be down in the bush canopy getting product to the center of the bush is needed if tussock moth is to be controlled.

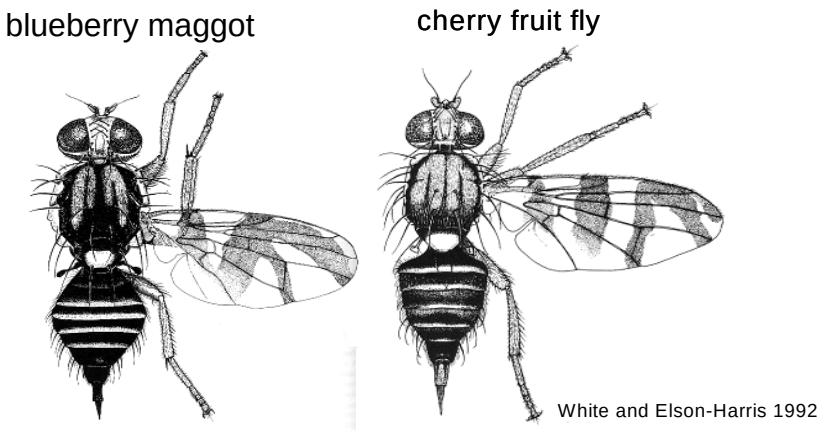

Figure 1. *Rhagoletis* fruit flies that may be caught on yellow sticky traps

WATER NEEDS AND SCHEDULING FOR BLUEBERRIES

Eric Hanson, Department of Horticulture, Michigan State University
Kyle Mead, Groundwater Technician, Van Buren County Conservation District, Paw Paw, MI

Commercial blueberries in Michigan should be irrigated. Most plantings are on sandy soils that hold little water. They are shallow-rooted and sensitive to moisture stress. Leaves do not respond quickly to stress, and tend to continue losing water as soil levels are depleted. Importantly, a drought event can reduce returns for several years. Drought prior to harvest reduces berry size and yield, but stress anytime in the summer or fall also reduces bud set for the following year.

Irrigation is particularly critical for young plantings. Because roots are shallow (12 inches), more frequent irrigation is need than for older plants. The goal is to optimize vegetative growth so young plants reach full production quickly. Avoid moisture stress throughout the growing season. For established plantings, the goal is to optimize fruit production for current and subsequent seasons. Irrigate to prevent moisture stress during the June-July fruit development period; stress will reduce berry size and yield. Also avoid stress after harvest, as drought in August/September will reduce bloom during the next year.

Water holding capacity of soils varies depending on texture and rooting depth (Table 1). Blueberry soils are sandy and variable, which complicate irrigation scheduling. 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 soils are complexes (e.g., Au Gres-Saugatuck, Pipestone-Kingsville) with slightly elevated areas knolls and ridges that dry much more rapidly than lower areas. Hardpan may limit rooting depth in specific areas of fields. Many areas have a shallow water table that also limits rooting depth. Plants may benefit from capillary ascent of water from saturated zones, but the volume of water supplied by capillarity is not understood. These variable characteristics all complicate scheduling. As a rule, irrigate to maintain the most drought-prone areas of your field.

Rooting depth varies considerably. Where the summer water table is shallow, roots may be confined to the top 12 inches. In well-drained soils without physical obstructions such as hardpan, blueberries may root to 24 inches or deeper. For irrigation purposes, assume rooting depths of 12 inches for young plants and 18 inches for established plants, or excavate beside bushes to determine exact depths.

Table 1. Available water in a blueberry rootzone 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 - .5
Loamy sand	.07	.8 - 1.3
Sandy loam	.13	1.6 – 2.3
Loam	.17	2.0 – 3.1

Allowable soil moisture depletion is generally assumed to be 50% of available water, but this has not been studied adequately for blueberries. This means that irrigation should be applied before 0.2 to 0.6 inches of water is lost from sands and loamy sands, or 0.8 to 1.5 inches are lost on sandy loam or loam soils.

Evapo-transpiration (ET) is 0.18 to 0.24 inches per day during the summer in the blueberry region of Michigan. Daily Potential ET values for Michigan blueberry areas (Grand Junction, Fennville, South Haven, West Olive) are available on the Michigan Automated Weather Network (MAWN) (http://www.agweather.geo.msu.edu/mawn/). For now, the MAWN Potential ET values are the best estimates of water use in blueberry fields. We have begun to study how actual water use in blueberries may vary from these Potential ET values.

How much water to apply? Irrigate enough to recharge the root zone. For example, the root zone of established plants (18 inch rooting depth) on a loamy sand soil (0.07 inches water per inch of depth) can hold 1.3 inches of available water:

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

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

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

If your system delivers 0.15 inches water per hour, 0.6 inches would be pumped in 4 hours. However, 20-30 % of water from overhead sprinklers may be lost to evaporation, so operating time may need to be increased because of this inefficiency. Also, most irrigation systems do not approach uniformity; 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 would need to be increased by 20% to account for evaporation losses, plus 30% due to non-uniformity. So, operation time would need to be increased by 50% to 6 hours to ensure all areas receive 0.6 inches.

Additional Resources

Highbush Blueberry Production Guide. Northeast Regional Agricultural Engineering Service Bulletin NRAES-55. Cornell University.

Ley, T. 1994a. Soil water monitoring and measurement. In K Williams and T. Ley (eds.) Tree Fruit Irrigation. Good Fruit Grower. Yakima, Wash.

Ley, T. 1994b. Irrigation system evaluation and improvement. In K Williams and T. Ley (eds.) Tree Fruit Irrigation. Good Fruit Grower. Yakima, Wash.

MSU BLUEBERRY TEAM

Horticulture - Eric Hanson
Plant Pathology - Annemiek Schilder
Entomology - Rufus Isaacs
Trevor Nichols Research Station - John Wise
Van Buren Co. - Mark Longstroth
Ottawa Co. – Carlos Garcia
Berrien Co. - Greg Vlaming
Southeast Michigan – Bob Tritten

For more information, see our website at blueberries.msu.edu

This newsletter is produced by the MSU Blueberry Team with support from MSU Extension and the EPA's Region 5 Strategic Ag. Initiative Program

Michigan State University Extension programs and materials are open to all without regard to race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, marital status, or family status.