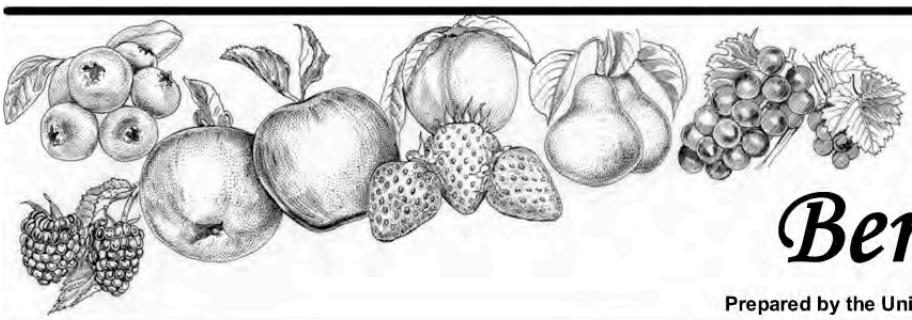

UMassAmherst EXTENSION

Berry Notes

Prepared by the University of Massachusetts Fruit Team

June 15, 2006 Vol. 18, No. 9

http://www.umass.edu/fruitadvisor/berrynotes/index.html

Massachusetts Berry Notes Underwriters:

NOURSE
Growers of the Finest Small Fruit Plants

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Crop Conditions

IN THIS ISSUE:

Strawberries: Harvest is well underway. Two-spotted spider mite populations may spike in coming weeks (see article below). Severe infestations may require pre-renovation miticide applications. Watch for potato leaf hopper infestations in new plantings. Remember to keep up with blossom removal on new plantings. **Blueberries** are approaching berry touch. Cranberry Fruitworm moths are active now. Check for infestations by looking for individual fruit that turn prematurely blue accompanied by webbing and frass. Blueberry maggot yellow rectangle traps should be put in place this week. Sphere traps can be placed about 1 week after the rectangle traps. Keep an eye out for aphids. Control as soon as you find them because they can transmit blueberry scorch virus into your planting. Control options include Provado. Look for and prune out phomopsis or fusicoccum twig blight. Last chance to get N-fertilizer on now before July 4th cutoff. Late nitrogen applications can lead to greater suceptibility to winter injury. **Raspberries** are in fruitset. Some plantings are showing winter injury with tip dieback and weak foliage (small, yellowing). But other locations show vigorous canes with heavy fruitset. Botrytis fruit rot management is still a primary issue. Tarnished plant bug can still cause some damage to later fruit. Watch for twospotted spider mites and potato leafhopper, especially in fall fruiting varieties. As with blueberries, final N-fertilizer applications can be made now. **Grapes** are in varying stages of bloom. Continue disease management programs for Phomopsis, Powdery Mildew, Downy Mildew, Botrytis and Black Rot. Other diseases (anthracnose, zonate leafspot, angular leafspot) may also be found following the very wet weather so far this growing season. Insects that will need attention now are Potato Leafhopper, rose chafer/Japanese beetle and Grape Berry Moth. Cluster thinning and shoot positioning should be underway. **Currants and Gooseberries** are near harvest for early varieties. Watch for two-spotted spider mite, potato leaf hopper, currant borer and gooseberry fruitworm. Powdery mildew can develop now, too. Time harvests before severe heat, if anticipated, to avoid fruit drop.

ENVIRONMENTAL DATA

The following growing-degree-day (GDD) and precipitation data was collected for a one-week period, June 8, 2006 through June 14, 2006. Soil temperature and phenological indicators were observed on June 14, 2006. Accumulated GDDs represent the heating units above a 50° F baseline temperature collected via our instruments since the beginning of the current growing season. This information is intended for use as a guide for monitoring the developmental stages of pests in your location and planning management strategies accordingly.

Region/Location	2006 GROWING DEGREE DAYS		Soil Temp (°F at 4" depth)	Precipitation (2-Week Gain)
	2-Week Gain	Total accumulation for 2006		
Cape Cod	79	472	68˚F	4.25"
Southeast	80	483	74˚F	2.75"
East	96	529	65˚F	2.75"
Central	71	443	55˚F	2.68"
Pioneer Valley	83	532	64˚F	0.32"
Berkshires	74	457	65˚F	0.91"
AVERAGE	80.5	486	65˚F	2.32"

n/a = information not available

(***Source**: UMass Extension 2006 Landscape Message #16, June 16, 2006*)

STRAWBERRY

Postharvest Handling and Storage of Strawberries

Jennifer DeEll, OMAFRA

Strawberries are one of the most perishable fruit crops and are essentially fully ripe at harvest. They have a high rate of metabolism and will destroy themselves in a relatively short time, even without the presence of decay-causing pathogens.

Maturity and Harvesting

The harvest date is determined based on berry surface color. All berries should be harvested near full ripe (>¾ red color), as eating quality does not improve after harvest. Appearance (color, size, shape, and freedom from defects), firmness, flavor (soluble solids, titratable acidity, and flavor volatiles), and nutritional value (vitamin C) are all important quality characteristics. For acceptable flavor, a minimum 7% soluble solids and/or a maximum 0.8% titratable acidity are recommended.

Strawberries have a relatively high rate of respiration (50-100 mL of C02 per kg per hour at 20°C) and thus are highly perishable. They produce very little ethylene (<0.1 ppm per kg per hour at 20°C) and do not respond to exogenous ethylene by stimulation of the ripening processes. Removal of ethylene from storage air may reduce disease development in all berries

Strawberries are usually hand harvested and field packed. Berries are harvested with the calyxes attached and must be held loosely in the hand to avoid bruising injury and discoloration. The strawberries must be handled with care and placed gently into the container, not dropped into it. Harvest should be as frequent as needed to avoid over-mature berries. Fruit should be sorted carefully, to discard any fruit with fungal lesions or injuries. Harvesting, sorting, and packing should be done simultaneously in the field. Packaging strawberries in the field has the advantage that berries are only handled once. Studies of fruit quality loss have shown that most damage occurs in the field during picking and packing. Therefore, minimizing berry handling is critical to good quality maintenance and postharvest life.

Cooling and Low Temperature

Good temperature management is the single most important factor in reducing strawberry deterioration and maximizing postharvest life. The best way to slow spoilage is to quickly remove field heat and to maintain the berries as close to 0°C

as possible. Deterioration of ripe strawberries is enhanced by high fruit temperature, which hastens metabolic activities, decay development, and internal breakdown. Any failure to maintain produce at low temperatures during handling, storage, and transportation will result in loss of quality and marketability. Berries held at 20°C have only ¼ to ½ the life expectancy of those held at 0°C and market life will be reduced to only a few hours if strawberries are held near 30°C, as may occur in the field.

Berries should be protected from warming when they remain in the field after harvest. Due to their dark color, strawberries in direct sun exposure will absorb heat and quickly warm to above air temperature. The amount of warming depends on the temperature difference between the berries and air, the duration of sun exposure, the amount of air flow (breezes) over the berries, and the presence of moisture in the air and/or on the fruit surface.

Precooling (rapid removal of field heat) of strawberries is essential within 1 hour of harvest. Cooling delays of 2, 4, 6, or 8 hours reduces marketability by 20, 37, 50, or 70%, respectively, after holding the fruit at 25°C. The most common method to precool berries is forced-air cooling, which is the most widely adaptable and fastest cooling method for small-scale operations. Cold air is forced to circulate rapidly through the containers (versus around the containers as in room cooling), allowing the cold air to be in direct contact with the warm berries. Pallets of strawberries are positioned so that the cold air must pass through the package openings and around individual berries. The most common design consists of a tunnel, which is formed by leaving space between two rows of loaded pallets, and covering the top and one end of the tunnel with a tarp. With the exhaust fan operating, air is removed from the tunnel and a slightly negative air pressure is created. Cold air from the room then flows through package openings and around warm berries to reach the tunnel. The cooling rate and efficiency of the system depend on a number of factors: 1) the temperature difference between the fruit and the cold air, 2) the air flow rate, 3) the accessibility of the fruit to the cold air, and 4) the dimensions of the air channel. An inefficient system will increase the cooling time, thus increasing the operating cost and reducing the marketable weight and quality of the fruit.

Storage Conditions

Optimum storage conditions for strawberries are 0°C and 90-95% relative humidity. In such conditions, strawberries can have 7-10 days of storage-life. However, storage-life is very dependent on the handling of berries during and after harvest. The highest freezing point is 0.8°C for strawberries, although berries with high soluble solids content are less likely to freeze. Generally, strawberries are not stored for extended periods of time. However, some temporary holding is often necessary to achieve orderly marketing. Holding berries under optimum storage conditions even during short marketing periods is beneficial to quality retention. Detrimental processes to berry quality are reduced at low temperatures, such as respiration, softening, moisture loss, and decay development.

Strawberries are subject to rapid water loss, causing them to shrivel and deteriorate, as well as causing the calyx to wilt and/or dry out. These symptoms will affect berry appearance before they affect eating quality. Water loss is governed by the vapor pressure deficit between the atmosphere and the product. The skin of a strawberry offers little protection to water vapor movement, and thus readily loses moisture to the surrounding air. Relative humidity of a storage room should be maintained at 90-95%, as strawberries will start to shrivel when stored below 90% relative humidity. However, excessive condensation of free water on the berries should be avoided.

Good sanitation of the storage and handling facilities is important to minimize contamination by decay pathogens. In addition, some molds growing in storage rooms can impart off-flavors to the stored berries. Therefore, any decayed or contaminated berries and containers should be removed and disposed of promptly, and storage rooms should be periodically cleaned and sanitized.

Modified Atmospheres

Modified atmosphere (MA) packaging or storage generally refers to enclosure within a sealed semi-permeable plastic film, in which the oxygen (O_2) is lower and/or the carbon dioxide (CO_2) is higher than the concentrations found in fresh air. Whole pallet covers or consumer packages for containment of the MA are commonly used. MA with 15-20% CO_2 and 5-10% O_2 reduces the growth of Botrytis cinerea (grey mold rot) and other decay causing organisms in strawberries. In addition, such MA reduces the respiration and softening rates of berries, thereby extending the postharvest life. However, exposure of strawberries to <2% O_2 and/or >25% CO_2 can cause off-flavors and brown discoloration, depending on cultivar, duration of exposure, and temperature.

The standard CO_2 treatment for strawberries is to completely enclose pallet loads of berries in sealed plastic bags, pull a slight vacuum, then add CO_2 to create a 12-15% CO_2 atmosphere within the bag and around the fruit. To prevent any accumulation of excess CO_2 by respiration, the amount of CO_2 produced by the respiring berries should balance with the bag permeability. Attention should be paid to avoid puncturing the bags during handling. It is important that the berries are thoroughly cold prior to treatment, as the plastic pallet cover will impede further cooling and condensation can form when the fruit are not fully cooled.

Diseases

Diseases are the greatest cause of postharvest losses in berries. Prompt cooling, storage at the lowest safe temperature, preventing physical injury to the fruit, and utilizing high CO_2 (10-15%) are the best methods for disease control. In addition, care should be taken to keep

diseased or wounded berries out of packages, as rot can spread from diseased to nearby healthy berries.

Gray mold (*Botrytis cinerea*) is the most common problem in strawberries. This disease can develop during storage if berries have been contaminated though harvest and handling wounds. The organism can also invade flower blossoms and remain dormant in the berry until ripening begins. Gray mold is most serious during rainy or foggy periods in the field. Surface mycelia from infected berries can directly penetrate adjacent healthy berries to produce a nest of rotting berries. This nest can continue to enlarge and may spread throughout the basket or flat. Avoiding mechanical injuries and good temperature management are effective control measures. This fungus continues to grow at 0°C, albeit growth is very slow at this temperature.

Rhizopus rot (*Rhizopus stolonifer*) can also be a problem in strawberries. Cooling the fruit and keeping them below 5°C is very effective against this fungus, since it will not grow at these temperatures. Therefore, good temperature management can make it a less severe problem during storage and marketing, but it may cause severe losses in the field. Infected berries are soft and watery, and the fungus may produce long, whiskery growth on berries under high humidity conditions. Similar to gray mold, rhizopus rot can spread from infected berries to adjacent healthy ones, producing a nesting effect.

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(***Source**: Ontario Hort News, vol. 6, no. 13, June 8, 2006*)

There Might be Mites: Scouting and Management of Spider Mites in Strawberries and Raspberries

Pam Fisher, OMAFRA

Two-spotted spider mite outbreaks occur sporadically on strawberries and raspberries in Ontario. Because problems do not occur every year, or at every site, scouting really pays off for these pests. However, last week's heat wave was favourable for mite development. The time for one generation of mites to develop, from egg to mature adult, ranges from to 5 days at 24ºC to 3 weeks at 12ºC.

Figure 1: Two-spotted spider mite adults and eggs. (*Photo credit D. Handley, University of Maine*)

Damage first appears as flecking and stippling on the leaves. Because the mites overwinter near the base of the plant, older leaves closest to the ground are affected first. As populations build and leaves age or become damaged, mites move up the plant to newer, more succulent growth. Extensive feeding by mites causes leaves to turn yellowish or bronzed, and eventually dry and brittle. Fine webbing is evident on the lower leaf surface when populations are high.

Scouting technique: As you walk through the field, watch for early signs of damage from mites. Observe lower leaves for signs of flecking, stippling or off-colour. Stop every so often and examine leaves for mites. Use a hand lens and scan the lower leaf surface for mite adults, nymphs and eggs. Pay attention to the variety you are checking, populations may be building on some varieties more than others. Seascape strawberry and Autumn Britten raspberry are very susceptible to mites.

Sampling technique: If scouting indicates that mites are present, then sampling is required to estimate the population. Take a walk through the block and collect 50 leaves from the middle

of the plant canopy. Don't collect the newest, succulent growth, and don't collect the old leaves next to the soil. Don't mix two or more varieties into the same unless you know that mites are building up on both varieties. Examine the lower leaf surface for all stages of mites, eggs, nymphs, adults. Record the number of mites per leaflet, as well as the presence of beneficial insects such as syrphid larvae, ladybird beetle larvae, and predatory mites. A leaflet is one trifoliate of the entire leaf.

In strawberries, a presence /absence technique can be used to reduce sampling time for mites. If 25% of leaflets have mites, the population is approx. 5 mites per leaflet. If 50% of leaflets have mites the population is approx. 20 mites per leaflet.

Thresholds for control: Several thresholds have been suggested for mite control on berries, ranging from 5-20 mites per leaflet. Consider these thresholds and apply miticides if damage is evident, and populations are increasing from week to week. Beneficial insects reduce the need for miticides. There are several miticides available for strawberries and raspberries. Apply each product when most mites are at a susceptible stage for that product (Table 1). Use different products from year to year to prevent the development of resistance.

Figure 2: TSSM damage to raspberries. Note bleaching and drying of lower leaves

Biocontrol: Predatory mites which feed on spider mites are available from commercial suppliers, and have been used successfully on both strawberry and raspberry plantings. Amblyseius species are more likely to survive in field conditions. Persimillous is better in greenhouse conditions. Beneficial mites must be introduced before large populations of spider mites develop, but after insecticides for tarnished plant bug have been applied. Pyrethroids (Decis, Matador, Cymbush, Ripcord) and Thiodan are toxic to beneficial mites.

Table 1: Miticides for use on strawberries and raspberries in Ontario

Product	Stage of mite controlled	Comments	Crop specific registrations – Strawberries	Crop specific registrations - Raspberries
Apollo SC	Eggs, very young nymphs	Should be applied when most mites are in the egg stage. This miticide works best if applied early in the season, when generations tend to be most synchronous.	Use before harvest. Days to harvest interval =15 days	Use before harvest. Days to harvest interval = 15 days
Kelthane 50W	Nymphs	An older product. This miticide works slowly; do not expect rapid knockdown of mites, especially in cool weather Resistance to Kelthane has developed where it has been used repeatedly, but still works well on most berry crops.	Use before or after harvest. Days to harvest interval = 7 days	Use before or after harvest Days to harvest interval = 7 days
Agri-Mek 1.9% EC	Adults, nymphs	Translaminar (locally systemic). Absorbed best by new, expanding leaves.	Use after harvest only. Days to harvest interval = 300 days	Use after harvest only
Pyramite	Adults, nymphs	A contact miticide providing rapid knockdown of adults and nymphs.	Use before or after harvest. Days to harvest interval = 10 days	Use after harvest only.

(***Source***: *Ontario Hort News, vol. 6, no. 13, June 8, 2006*)

RASPBERRY

Monitor for Orange Rust in Brambles

Annemiek Schilder, Michigan State University

This is a good time to check blackberry and black raspberry plantings for orange rust. Red raspberries are immune. Characteristic symptoms are spindly shoots with clustered, misshapen, pale green to yellowish leaves, as well as bright orange, powdery blisters on the undersides of leaves. Before the blisters burst open, they look waxy or shiny, as if covered with lacquer. On black raspberries, the rusted leaves start to wither and drop in late spring to early summer. New leaves produced towards the tips of canes may appear normal, giving the impression that the plant has "grown out" of the disease. However, such canes will remain infected and will produce a mass of spindly shoots with no blossoms the following spring. The plant becomes systemically infected and remains so for the rest of its life. Orange rust does not usually kill plants, but it can significantly reduce vegetative growth and yield. The disease can be caused by either of two closely related fungi, *Arthuriomyces peckianus* or *Gymnoconia nitens*. The orange spores are spread by wind and can infect leaves of healthy plants with long periods of leaf wetness provided by rain or dew. Orange rust is favored by relatively low temperatures (50 to 70ºF). The fungus overwinters in the crown and roots of infected plants, leading to the production of new infected canes every year.

Cultural control

While there were no chemical control options for this disease in the past, we now have several excellent fungicide options. This does not mean that we should abandon cultural practices, such as establishing new plantings from disease-free nursery stock, which will also help in avoiding virus diseases. If any plants show signs of the disease during the spring in which they were planted, this means there were already infected at the time of planting. Upon inspection of plants each spring, any infected plants, which are economically worthless, should be dug up and destroyed promptly before rust pustules mature and spores are liberated. The location of those plants should be clearly marked, and any new suckers arising from root pieces left in the ground should be removed and sprayed with an approved systemic herbicide. It is also prudent to remove infected wild brambles in nearby wooded areas and fence rows. Management practices that improve air circulation, such as thinning out canes within the row, pruning out floricanes immediately after harvest, and effective weed control aid in disease control by reducing build-up of moisture in the planting. Some blackberry cultivars (e.g., Eldorado, Raven, and Ebony King) are reported to be resistant to orange rust, but no black raspberry cultivars are known to be resistant.

Fungicide options

The best fungicide options are Nova (myclobutanil), Pristine (pyraclostrobin + boscalid) and Cabrio (pyraclostrobin). While Abound (azoxystrobin) is labeled for use on brambles, it does not have orange rust (or any other rust for that matter) on the label. Nova may have a bit better curative activity than the others because of its greater systemicity, which would make it the material of choice during or after a rainy period with inoculum already being present. Each of the above-mentioned fungicides will also control various other cane, leaf and fruit diseases. Since Pristine has two active ingredients, it has the broadest spectrum of activity. None of these fungicides will cure an already infected plant. However, they can prevent healthy plants from becoming infected. Since infected plants will continue to be sources of inoculum over their lifetime, it is best to remove and destroy them altogether and replace them with healthy plant material from a reputable nursery. Apply fungicides upon first discovery of the blisters, preferably before they burst open and release spores. If the field has a history of the disease, sprays should be initiated before blisters appear. Since infections can also originate from wild brambles near the field, one should keep an eye on these as well if possible. (***Source**: Michigan Fruit Crop Team Advisory, Vol. 21, No. 8, May 30, 2006*)

BLUEBERRY

Phomopsis Cane Blight in Blueberry

Gary Pavlis, Rutgers University

Farm visits over the last couple of days have turned up a number of canes dying from what used to be called winter damage. We now recognize that this wilting and death of individual canes during the summer can also be due to Phomopsis. Under severe disease conditions, several canes may be affected on a single bush. This fungus overwinters in infected twigs and canes, and produces infective spores. The greatest number of spores are released during bloom and petal fall and enter twigs or canes through injury sites, particularly those caused by winter damage, mechanical harvesters or early spring frosts.

Samples have been taken from canes suspected of having Phomopsis at several farms. As expected, Phomopsis was confirmed however stem blight, Botryosphaeria, was also confirmed. Like Phomopsis, this fungus enters the plant through wounds and causes rapid death of individual canes and entire bushes. This disease is especially severe on 1 and 2 year old plants of susceptible cultivars. In the field, the most obvious symptom is called 'flagging', stems recently killed by the fungus do not drop their leaves. It should be noted that stem blight has recently been found most often in the 'Duke' variety.

Control of Phomopsis and Botryosphaeria depends largely on cultural methods. It is important to discourage late-season growth and promote early hardening off thus late-season fertilization, late-season weed cleanup and late-season irrigation should be avoided. Pruning to remove infected stems is the best method of reducing disease in established fields. Pruning serves two functions: 1) removes infections from bushes, preventing eventual death of the plant, and 2) reduces the number of spores released in the field by removing dead, spore bearing stems. Pruning can be done at any time infected stems are observed, but care should be taken to cut well below the infected area. After a stem is removed, examine the cut end of the remaining stem. If any brown areas are visible in this cross-section, a cut must be made further down the stem until all infected tissue is removed. (***Source**: Blueberry Bulletin, Vol. 22, No. 11, June 14, 2006*)

Don't Delay Blueberry Fruitworm Management Decisions

Rufus Isaacs and John Wise, Michigan State University

Checking monitoring traps for cherry fruitworm and cranberry fruitworm at three farms in Van Buren county yesterday (June 4) has revealed the expected increase in moth catches over the past week. Eggs of both species were also found during detailed scouting of the bushes, indicating that fruitworm pest development is progressing and blueberries are at risk from larvae penetrating the fruit. While many growers are already acting to protect the crop from fruitworms, those that have waited until bees are removed should consider some action in the light of our recent findings from monitoring and scouting for these pests.

For cherry fruitworm, which is the earlier developing species, traps have caught moths for the fourth week in a row with some sites having a significant increase in catches (15 moths) from the past week. Egg laying has been very high, with fourteen eggs detected at one farm during scouting for one minute on 30 bushes. This is the highest level of cherry fruitworm egg laying experienced in recent years in Michigan, making the early ripening varieties at particular risk from having larvae infesting fruit during harvest.

Cranberry fruitworm moths in traps have increased this week, with the maximum catch over the past week at sixty-six. This is also a high level of moth activity, and is coupled with the second week of finding cranberry fruitworm eggs during the bush sampling. This also provides some strong evidence that blueberry fields are at risk from fruitworm larvae infesting the fruit.

The levels of moths and eggs detected indicate that fields with infestation from either cherry fruitworm or cranberry fruitworm in the past should be considered for an application of *B.t.* or Confirm if bees are still present, or an application of a broad-spectrum insecticide if bees have been removed already. Our research sites in Ottawa Co. have not been scouted yet this week, but cherry fruitworm egg laying was detected there last week and cranberry fruitworm egg laying is expected to be underway.

For more information on the insecticide options available for fruitworm control, refer to the article from May 16 at www.ipm.msu.edu/cat06fruit/f05-16-06.htm#5. (***Source**: Michigan Fruit Crop Advisory Team Alert, Vol. 21, No. 9, June 6, 2006*)

Monitoring for Blueberry Maggot Flies

Rufus Isaacs , Michigan State University

The blueberry maggot fly is a primary pest of blueberry because its maggots develop inside the fruit, and there is zero tolerance for infestation. With the high soil moisture this spring and warm weather expected over the next few weeks, emergence of blueberry maggot flies is expected to start in the next two to three weeks.

To ensure that the first flies are detected, blueberry growers should deploy monitoring traps before the middle of June to ensure detection of the start of this pest's emergence.

Yellow Pherocon AM sticky boards are recommended for monitoring flies early in their activity season. These traps should be hung in a V shape in the top of the blueberry bush, with the yellow side facing downwards.

Twist ties can be used to hold the trap in this position, and leaves should be cleared from the area near the trap to prevent contamination and to allow flies easy access to the trap. Monitoring traps should be checked at least once per week. Any blueberry maggot fly caught on the trap should be counted, recorded and removed. These flies have an

inverted W pattern on their wing, and this should be identified before counting so only the pest insects are being counted.

For maximum effectiveness, Pherocon AM yellow boards must be recoated or replaced after three weeks of exposure. To increase fly attraction to traps, they should be baited with ammonium acetate or ammonium carbonate baits. The traps can be purchased with bait mixed into the sticky coating, or the regular yellow traps can have "superchargers" added to them (small yellow plastic containers) that release the odors to attract flies. A supercharger should be hung with each trap and should be replaced or refilled periodically to maintain their activity, according to the manufacturers' recommendations.

For effective monitoring in commercial highbush blueberry operations, a minimum of two Pherocon AM boards are needed for every five acres. One trap should be placed in the field adjacent to wild host plants, and the other trap should be placed in the center of the five-acre block. This will allow detection of fly populations that move into the field versus those resident in the field.

If flies are trapped immediately after they emerge from the soil, there is a 7 to 10-day period before egglaying begins. Because of this, if flies are trapped the first insecticide treatments should be timed for within a week after the first fly captures. This maximizes the impact of the treatment against egglaying flies to prevent fruit infestation. Sticky green spheres may also be used for monitoring blueberry maggot fly. However, these traps are more effective later in the season when the majority of the flies have attained sexual maturity. Sticky spheres should be placed within the bush approximately six inches from the top of the bush and baited. . (***Source**: Michigan Fruit Crop Advisory Team Alert, vol. 19, No. 3, June 15, 2004*)

Too Few Leaves on my Blueberry Bushes!

Becky Grube, University of New Hampshire

Several blueberry growers around the state have been reporting that their bushes have fewer leaves than normal. The leaves did not fall off – they never formed to start with. In some cases, the entire bush may be affected, but it's usually only select canes. Those canes or bushes that have very few leaves tend to have abnormally heavy fruit set. Those with lots of leaves have comparatively few fruits.

What's going on?

During the growing season, the blueberry bush forms buds for the next year – in spring and early summer, it makes the buds that will be leaves, and in late summer it makes the buds that will become fruits. Heavy fruit set this year means that the bush made a lot of fruit buds last year. They do this when they have excess energy to go around, which many did last year because yields were light (in part due to the mummyberry disease) so they were not spending energy ripening fruit.

If a branch has lots of fruit buds from the previous year, it pours its energy into setting fruit, and NOT into producing leaves. Blueberry bushes preferentially pour energy into fruit rather than leaves. This is why we see branches that have either lots of fruit OR lots of leaves, but not both.

An aside: Pruning during the winter can bring the fruit and leaf buds into balance for the bush. One grower reported to me that they had left some of their 'Bluetta' bushes unpruned last winter. The bushes that had NOT been pruned have very heavy fruit set and very few leaves, whereas those that had been pruned had a better balance between fruit and leaves. Another complicating factor: winter injury can weaken canes slightly without actually killing buds. These weakened canes have less energy overall, so this problem may be more apparent on exposed canes or older canes that were more susceptible to winter injury.

Why is this a problem?

If a bush (or a cane) doesn't have very many leaves, it cannot produce the energy it needs in order to ripen the berries. So even though there are many berries, the berries will likely be undersized, and will not be very sweet, if they ripen at all. Further, the bush will not have excess energy to pour into either 1) next years' fruit buds or 2)the root system, strengthening it for the coming winter. This will stress the plant, or at the very least, the cane in question.

What to do?

The objective is to ripen and harvest as much of the current fruit set as possible. A couple of suggestions that may help:

Fertilization: Due to the amount of rain we had earlier in the season, some of the nitrogen applied earlier in the season may have leached away and was not taken up by the bushes. A soil application now of 50-75 lbs ammonium sulfate (10-15 lbs actual nitrogen) would ensure bushes have adequate fertility. Bill Lord, former UNH fruit specialist, says that he has had success stimulating leaf cover with two foliar sprays, 7-10 days apart, of LB urea at a rate of 3 lbs/100 gallons of water. **Caution:** *Foliar sprays should not be applied the day after a long period of rain or if air temperatures are over 80F, to avoid burning plants.*

Fruit removal: Depending on the severity of the problem, you may want to do some selective pruning to reduce the fruit load now, before the fruits get any larger. This may be

more important for young bushes (<3 years), where significant stress could limit future plant growth. Fruit removal will increase the quality of the berries you do have.

It will also reduce the stress on the plant, and increase potential yields next year. Judging how much is 'too heavy' is subjective, but it's probably too heavy if you are already seeing that berries are smaller than you would expect (or than on other canes). You will have to balance the labor required to remove fruit with the potential benefit in yield, both this year and next. It's important to remember that even though you are cutting off fruit, these fruits will not likely ripen properly, and so you will not be losing profits. If not removed now, these canes should certainly be removed in the next pruning cycle. **Caution:** *IF you decide to prune now, make sure to sanitize shears frequently (i.e. between bushes) with a 10% bleach solution or specialized nursery or greenhouse disinfectant to prevent transmission of viruses or other diseases!*

A caveat:
Too few leaves are a general sign that the bush is experiencing any number of stresses. One such stress is winter injury, but it could also be caused by nutritional problems, root damage, insects, diseases, improper pH, etcetera. Trying to determine the source of the underlying stress is important to help manage it in future years.

(*Reprinted from Massachusetts Berry Notes June 30, 2005*)

GRAPE

Shoot Thinning in Grapes

Bruce Bordelon, Purdue University

Annual pruning of grapes is necessary to balance the amount of fruit production with the amount of vegetative growth to insure economic yields of high quality fruit. Pruning severity is based on the strategy of 'balanced pruning,' which dictates the correct number of buds to retain, or 'crop load,' which determines the number of clusters to retain. Both methods are based on the vine's pruning weight or 'vine size', which is an indication of the vine's capacity to ripen the crop. Many growers prune vines lightly during the early spring to assure adequate bud number following winter injury, and in case of damage by a late frost or freeze. Now that the danger of frost and freeze is (mostly) over (we hope) and grape shoots are growing rapidly, growers should go back through the vineyard and determine if crop load adjustment is needed. The crop load is adjusted by removing shoots and/or clusters. At this time, shoot thinning is the most important practice. New shoots are easily broken off by hand without the need for pruners. Growers should pay close attention to the fruitfulness of shoots. Shoots from primary buds have full fruiting potential, whereas secondary buds and latent buds on older wood produce shoots with little or no fruiting potential, depending on cultivar. Ordinarily, all secondary shoots and shoots from older wood should be removed. Shoots should be spaced evenly along the trellis if possible and at a density of about four to six shoots per foot of row. Cluster thinning (removing one or more of the clusters on each shoot) should be delayed until later. Timing depends on desired results. Cluster thinning done before bloom results in the least yield reduction because the remaining cluster(s) generally set more berries. This is desired for seedless table grapes. However, on most wine grapes, and especially tight clustered cultivars, cluster thinning after bloom can result in looser, less rot susceptible clusters. Keeping records of average cluster weights and vine yields can help determine the appropriate amount of fruit to retain now. (***Source****: Facts for Fancy Fruit, Vol. 06, No. 03, May 18, 2006*)

Prebloom Foliar Nutrient Sprays

Alice Wise, Cornell University

There are some prebloom sprays useful in certain situations. Visual verification as well as petiole and soil analysis can be helpful in diagnosis of deficiencies. If possible, when applying foliar nutrients leave an untreated section of vineyard to compare treated and untreated vines. The most common sprays are discussed below.

Nitrogen - First and foremost, N fertilization should be addressed via ground application whether using a dry product or dripping in liquid N. The vast majority of research trials have found little or no benefit to foliar applied N. If vines are N-deficient, however, there might be a response. Some growers feel foliar N helps sluggish early spring growth; others feel it helps to maintain a green canopy. There are many different products from which to choose including organic options. At the research vineyard, we use an organic liquid fish product for several foliar N applications during the season. Note also that some phosphorous acid products contain nitrogen.

Zinc - Considered essential for proper cluster development, berry set and normal shoot growth. Deficiency is seen early summer. New leaves are smaller, distorted and may be

chlorotic with darker green veins. Straggly clusters and shot berries may also occur. Soil application of Zn is less effective because Zn can be tightly bound in soil (though past recommendations for our vineyard were soil applications of zinc sulfate). Zinc sulfate, zinc oxide and chelated Zn are used as foliar sprays; follow label for rates and timing. Rely on your soil and petiole analyses to gauge the need for this nutrient.

Boron - Deficiency is seen as stunted zigzag growth and death of shoot tips, poor set with shot berries, often flattened or oblong. Soil treatment is effective since boron (B) moves with the soil water, however this is best applied in the fall or with the spring herbicide. For foliar sprays, use 0.2 lb./a actual B in 1 or 2 prebloom sprays. Common boron products include Solubor, Borosol and Bortrac which also contains N. Because of repeated grower experience with phytotoxicity, it is usually recommended that there be a minimum of 10 days between sprays to minimize the chance for phytotoxicity. Boron toxicity can easily cause leaf scorching/distortion (one or two cupped leaves with very rounded margins) followed by tiny, pale leaves on the same shoot. We've seen phyto locally where soil uptake is increased: unevenly spread product, young vines with roots near the surface, older vines with root systems limited by a hardpan, vines at the ends of the row where the tractor slows down. Boron interferes with the dissolving of water-soluble packets used for certain pesticides. When tank mixing, dissolve the packet thoroughly in the spray tank and then add B to the spray mix.

Manganese - Deficiency is seen mid-late summer starting as interveinal chlorosis on basal leaves. A herringbone pattern is characteristic. At soil pH's >6.0, e.g. properly limed soils, Mn availability in the soil is relatively low. Where a deficiency is confirmed by petiole analysis, foliar applications of manganese sulfate (2-3 lbs./100 gal.) are recommended as a corrective measure. Other manganese products used at label rates may also be effective. Foliar manganese oxide materials are considered to be less effective. (***Source**: Long Island Fruit & Vegetable Update, No. 12, JUNE 2, 2006*)

Early-season Grape Berry Moth Management

Rufus Isaacs, Michigan State University

Grape berry moths have been trapped in vineyards across southwest Michigan over the past three weeks. These male moths in traps indicate that the overwintering generation of this pest has started to emerge, but no egglaying has been detected yet and eggs are not expected until the primary buds begin blooming. This year, as growers aim to trim costs, it will be important to focus insecticides where they are needed most. As part of our research to improve control of this pest, we are working with researchers in New York and Pennsylvania to develop a degree day model to predict important events in the life cycle of grape berry moth. The model is being tested this growing season, but from previous years results, we can see that berry moth development seems to be closely tied to the development of the vine, perhaps because they use similar base temperatures for development.

Our research has tracked the dates of important development stages in the first generation of grape berry moth in commercial vineyards over recent years, and the results are presented in Table 1. One important thing to note is that there is a long time (typically about 4 weeks) between the first moth and the first eggs laid or the peak eggs laid. Looking across the table, it is clear that the start of egglaying in this pest coincides with bloom in juice grapes, and peak egglaying coincides with the 10-day post bloom timing used by many juice grape growers for their first insecticide targeting grape berry moth. This emphasizes that an immediate post-bloom insecticide is generally the most effective timing for controlling the young larvae of this pest.

Table 1. Timing of grape berry moth development in Michigan vineyards (2002-5). These dates are averages, and the exact dates will vary from year to year.

Event	Average calendar date
First moth	May 5
Peak of moths	June 2
First egg	June 8
Peak of eggs	June 21
Start of Concord bloom	June 8

Treatments applied earlier than the post-bloom timing can be washed off or degrade before most of the egglaying and are unlikely to protect the clusters from feeding by berry moth larvae. Because of this, insecticides to control the first generation of berry moth are typically timed for the 10-day post-bloom timing. If growers are aiming to reduce costs in vineyards where a crop is expected, scouting clusters just after bloom can be used to determine the level of infestation by this pest and whether an insecticide is warranted at the post-bloom timing. Although there is no formal threshold developed for first generation berry moth, if only a small proportion of clusters have larvae or if the level of feeding is low, there will be minimal effect on yield. Since clusters set only about a third of the potential berries produced, clusters can withstand some feeding and this is worth considering when weighing up the cost of a spray.

If a spray is required, an insecticide targeting the first generation can help reduce pest pressure later in the year. When selecting an insecticide, there are many options for berry moth control. Some of these are selective for this pest, while others will also provide control of leafhoppers, rose chafer and other insects that can occur at bloom. The organophosphate Imidan, carbamates Sevin and Lannate, and pyrethroids Danitol and Capture are all highly effective against grape berry moth. Some regions of southwest Michigan have leafhopper populations with resistance to carbamates, so Sevin and Lannate should be avoided in those regions if leafhopper control is needed. Capture is a relatively new insecticide with an annual limit of 6.4 oz/acre. MSU research trials have found excellent activity of this product at 3.2 oz, leaving the option of a later-season use of this product if a 3.2 oz rate is used after bloom.

Berry moth larva in a cluster during bloom

In the selective insecticide group, Intrepid 2F is an effective insecticide for control of grape berry moth. This works on the molting system of the larvae, disrupting normal development, and trials at 8 and 12 oz/acre have provided control of first generation berry moth. Another selective insecticide to consider is B.t. (Dipel, Javelin, Deliver etc.), which only targets the larvae of berry moth. Both of these selective insecticides need to be eaten to be effective, so their activity is greatest when temperatures are above 70°F. Intrepid is highly rain-resistant providing 10-14 days of activity, whereas B.t. formulations degrade under ultraviolet light, providing 3 to 5 days of activity. When applying any insecticides to control grape berry moth, target sprays at the clusters to maximize control.

The take-home message for berry moth management is to scout clusters regularly from just before bloom onwards to understand where the pest pressure is greatest, so sprays can be targeted only where they are needed. This will also provide information on when the pest is developing, and will allow management costs to be focused at times when it makes the most economic sense. (***Source**: Michigan Fruit Crop Team Advisory, Vol. 21, No. 8, May 30, 2006*)

Potato Leafhopper in Grapes

Alice Wise, Daniel Gilrein, Cornell Cooperative Extension

Potato leafhopper (PL) is starting to show up in vineyards. Light damage is evident in some blocks. PLH nymphs are pale yellow-green and walk sideways like a crab. The more slender lime green adults may also be present. This insect does not overwinter on Long Island, but rides warm air masses from the south. The constant migration means all stages may be present at any one time in early summer and repeat invasions in the vineyard may occur. In some seasons, PL infestations have unfortunately persisted well into August.

PL injects a toxin when feeding, causing chlorosis (yellowing) and even browning of the leaf edge, known as hopperburn. Leaves are sometimes cupped, especially on shoot terminals which can also be stunted. In vineyards, it is notoriously difficult to scout for PL due to the extremely high mobility of this pest as well as time constraints (we're in the midst of one of the busiest times of the season). Many managers visually estimate damage and do an informal "trellis shake" to help gauge the severity of infestation. In apples, a threshold of 1 nymph per leaf is used, out of 50 - 100 leaves counted per orchard block. Vines can tolerate some injury as damaged terminals are often hedged off. Moderate to severe injury on both terminals and laterals however will impair the vines' ability to photosynthesize. The general health of vines and need for control of grape berry moth and Japanese beetle are also factors in deciding the timing and frequency of treatment. Note that young vines are potentially more affected by PL so that intervention might be sooner vs. mature vines.

Options for treatment include Assail (12 hr reentry interval, 7 days to harvest) Danitol (24 hr, 21), Sevin (12 hr, 21), Imidan (24 hr, 14 * see below), Provado Solupak (12 hr, 0), Lannate (7 day reentry, 14) and azadirachtin, products based on a neem seed extract [Aza-Direct and Neemix 4.5 (both 4 hr, 0)], JMS Stylet Oil (4 hr, 0) and insecticidal soaps such as M-Pede (12 hr, 0). Notes on each:

- Assail, a reduced risk product, is a neonicotinoid as is Provado. The 70 WP formulation is being phased out in favor of the 30SG. The 70WP has leafhoppers but a

supplemental label is required for Japanese beetles. JB and leafhoppers are both on the 30SG label.

• Danitol and Lannate are federally restricted-use and toxic to predator mites, although Danitol is also a miticide. Valent recommends no more than two applications of Danitol/season due to concerns about the development of resistant PL and ERM populations, although more are allowed on the label depending on rate. Lannate has a 7 day reentry interval.

• Another restricted use material. Dr. Dick Straub and Peter Jentsch (Hudson Valley apple researchers) tested lower-than-label rates of Provado 1.6F in apple (Provado Solupak is labeled for grape) for potato leafhopper control and found in this trial application frequency (3 applic @ 10 day int.) was more important than rate in controlling injury. Growers might experiment with reducing the rate (perhaps 0.5 oz/A; lower-than-label-rate applications in agriculture are permitted in NY) as long as re-application is made when leafhoppers again start to build.

• Sevin is also toxic to some predator mites and there are concerns for flaring mites with use, so watch for infestations if using.

• Imidan is labeled for grape leafhoppers. Field experience with Imidan indicates that it will knock back PL, however the period of residual control is usually no more than a week. Note that Imidan is classified as a restricted use material in NYS. Note that the new Imidan label has a 14 day reentry. There should be old material still in circulation but this label amendment will make it a less desirable option in the future.

• Azadiractin materials primarily act as insect growth regulators. In a trial at LIHREC in 2004, Aza-Direct did not work as well as Danitol or Assail. PL pressure was only moderate throughout the season suggesting that Aza-Direct would not be the material of choice for heavy infestations. Given its primary use (against nymphs), it might have a fit early in the infestation cycle. In fact, both Aza-Direct and Neemix labels specify the materials are most effective vs. immature stages (PL nymphs).

• Though labeled for leafhoppers, Stylet Oil typically is not used specifically for PL control. It likely will knock back but not control moderate to heavy infestations (comment based on intuition, not field or research experience). Grower experience with soaps against PL has been disappointing. Caution is advised with soaps and oils phytotoxicity is a concern with temperatures ≥85oF. Also, there are a number of products that are not compatible with (either as tank mixes and/or sprayed in close proximity to) soaps and oils - see labels for details.

• For those interested in OMRI approved materials, the choices are JMS Stylet Oil (organic formulation), AzaDirect and Neemix. Though not OMRI approved, Assail is a reduced risk material. References: Scaffolds newsletters Vol. 10 No. 15, 6/10/01 and Vol. 8 No. 15 6/28/99. (***Source**: Long Island Fruit & Vegetable Update, No. 14, June 16, 2006*)

Upcoming Meetings

Jun 21, 2006. Vegetable and Berry Twilight Meeting, Ricker Hill Orchards, Turner, ME. For more info, contact David Handley at (207) 933-2100.

June 30, 2006 High Tunnel Workshop, UNH Cooperative Extension at Woodman Farm in Durham, NH. 9:30 am – 4:00 pm. Cost $40. For information and directions, contact Cheryl Estabrooke at 603-862-3200.

July 27th, 6:00 PM - Second Annual Celebration of Women in Agriculture - Cheryl Rogowski, owner of W. Rogowski Farm in Pine Island, NY and MacArthur Foundation Genius Award recipient will speak. Dinner provided. Location: Whatley Town Hall. Please reserve your space by calling CISA at 413-665-7100 or emailing coordinator Therese Fitzsimmons at therese@buylocalfood.com. Registration preferred by July 24.

July 12, 2006. Tree Fruit Twilight Meeting, Windy Ridge Orchard, North Haverhill, NH. The NH Fruit Growers' Association is sponsoring this commercial tree fruit growers' twilight meeting with University of Vermont. UVM and UNH Cooperative Extension Specialists will be discussing pest management options and orchard management. For more info, contact Tom Buob at (603) 787-6944. PAT credits.

July 14, 2006. Massachusetts Fruit Growers Annual Summer Meeting. UMass Cold Spring Orchard Research and Education Center. Full day program available soon at www.umass.edu/fruitadvisor. For more information, contact Jon Clements clements@umext.umass.edu.

July 18, 20 6. University of Maine - Highmoor Farm Field Day. Monmouth, ME. For more info, contact David Handley at (207) 933-2100.

July 20, 2006. Fruit & Vegetable Twilight Meeting, Perkins Farm, Plymouth, NH. For more info, contact Tom Buob at (603)787-6944. PAT credits**.**

July 25, 2006. Grower to Grower Meeting, Four Corners Farm, South Newbury VT. This meeting, hosted by Haygrove Tunnels, will emphasize strawberries and raspberries. For directions, contact 866-HAYGROVE.

Aug 9, 2006. Tree Fruit Twilight Meeting, UNH Woodman Horticultural Research Farm, Durham, NH. Topics will include assessing damage for crop insurance claims and cultural practices to reduce risks. For more info, contact George Hamilton at (603)641-6060.

Aug. 10-13, 2006. NOFA Summer Conference. Amherst, MA. To see detailed program information or to register online, visit www.nofa.org or contact Deb Pouech at nofasc@herbsnhoney.com or 860-684-0551.

August 22-24, 2006 North American Strawberry Growers Association Summer Tour, Pourtland Maine. For more information visit, www.nasga.org.

Renewable Energy for Farms and Greenhouses - A Series of Twilight Meetings

Sponsored by The University of Massachusetts Extension Agriculture and Landscape Program, Community Involved in Sustaining Agriculture (CISA) and Donald Campbell Associates

We will be exploring renewable energy systems for farms and greenhouses this summer and fall through a series of twilight meetings. Plan to join us for one or all meetings to learn how alternative energy sources might fit into your business. These meetings will provide information on funding opportunities and feature vendors and experts with a wealth of knowledge and experience. For more information, including opportunities for sponsorship, or to pre-register, contact Tina Smith, Extension Floriculture Program, 413-545-5306, tsmith@umext.umass.edu or Ruth Hazzard, Extension Vegetable Program, 413-545-3696, rhazzard@umext.umass.edu.

Solar Energy
Wednesday, July 26, 2006
4:00 pm – 7:00 pm
Riverland Farm, Sunderland, MA
Host: Scott Reed

Riverland Farm grows 11 acres of organic vegetables and U-pick cut flowers on the banks of the Connecticut River in Sunderland, MA. This past winter, Riverland installed solar panels (photovoltaic modules, also known as PV) as an awning to generate solar electricity to power their coolers and farmstand, as well as to provide a dry, shady area for customers. Other local farmers will be present to discuss their use of PV to power remote water stations, electric fences and drip irrigation.

Additional Speakers:

Mike Kocsmiersky of Kosmo Solar installed the system and will share his expertise.

Bruce Howden, Howden Farm, Sheffield - Howden Farm currently uses a 1.1 kilowatt solar electric system to power drip irrigation for growing fruits and vegetables on their farm

Elizabeth Smith, Caretaker Farm - Caretaker Farm uses stand-alone solar power systems to pump water for their livestock and to supply power for electric fencing.

Don Campbell, Consultant, Donald Campbell Associates - Don will talk about the process of fitting a farm's needs to the types of renewable energy systems currently available including solar hot air systems to supplement heat for greenhouses.

Wind and Solar Energy
Thursday, September 7, 2006
3:00 PM – 6:00 PM
Lion Spring Farm, 236 Dedham, St. Dover, MA
Host: Bob Loebelenz

Lion Spring is a small diversified farm, now engaged in the breeding of Massachusetts Thoroughbred horses. The farm also grows vegetables and herbs for local gourmet restaurants and have a collection of chickens who supply farm fresh

eggs for retail sales. On site there is a 4.8 kilowatt photovoltaic system and 3.1 kilowatt wind turbine all feeding a battery bank.

Additional Speakers:

Henry Dupont, Lorax Energy Systems on licensing and choosing turbines

Warren Leon, Renewable Energy Trust on state funded opportunities for renewable energy

Don Campbell, Consultant, Donald Campbell Associates

Don will talk about the process of fitting a farm's needs to the types of renewable energy systems currently available

Field Corn Biomass for Heating Greenhouses

Wednesday, October 4, 2006
3:00 PM – 6:00 PM
Kosinski Farm, Westfield, MA
Host: Mike Kosinski, Kosinski Farm

Kosinski Farm grows 140 acres of blueberries, apples, grain corn, vegetables and tobacco. Five greenhouses provide flower and vegetable plants for retail sales at their farm stand and use in the field. Blueberries, apples and butternut squash are major wholesale crops.

Mike began heating one greenhouse with his own corn three years ago and has been expanding his use of corn for heat each year. This year he is installing two larger stoves with automated auger stoking systems. Field corn fits well into his vegetable rotation. The corn is dried off-site and trucked back to the farm. His production costs are about $60-$65 per ton of corn, which is about one-third of the cost of heating oil ($2.45 per gal.) based on energy costs per BTU.

Additional Speakers:

Rob Rizzo, Mt. Wachusett Community College - Rob uses a variety of renewable energy sources including wood chips, wind and solar power and has reduced the energy costs at the college by 5%.

Bill Llewelyn, Five Point Farm, Northfield - Bill grows and sells corn for energy use. This season he harvested 1,000 tons of corn.

Christine Serrentino, From Field to Table - Christine will talk about the science and economics of burning corn.

Don Campbell, Consultant, Donald Campbell Associates - Don will talk about the process of fitting a farm's needs to the types of renewable energy systems currently available