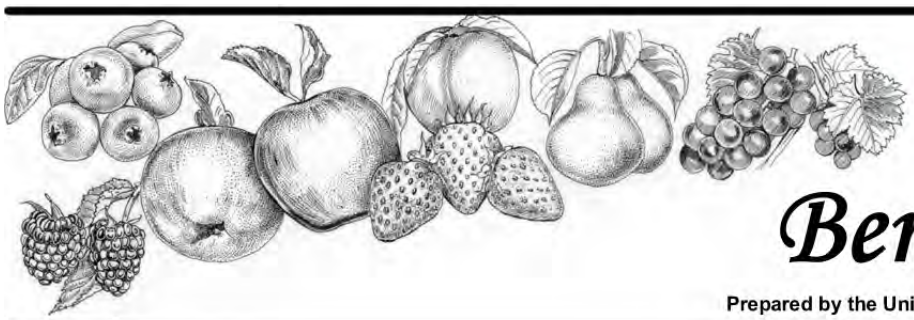

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Berry Notes

Prepared by the University of Massachusetts Fruit Team

June 2010 Vol. 22, No. 6

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

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IN THIS ISSUE:

Current Conditions:

Strawberries are nearing the end of harvest. See information in this issue on recommended strawberry renovation steps. These should be followed as soon as possible after harvest is complete. Remember to keep fields well irrigated after renovation to support regrowth of the canopy. Fertilization is also important for good canopy regrowth. Watch for root weevil infestations and renovate or plow down promptly if feeding is observed. This will reduce populations significantly. Sprays may still be needed. Also watch for cyclamen mite and potato leafhopper infestations, especially in new fields. Pull blossoms and set runners on new plantings. **Raspberry** harvest is beginning for early varieties. Intermittent rain can cause increases in fruit rot during harvest. Be on the lookout for Orange Rust on black raspberries and blackberries. More info in this issue. Watch for twospotted spider mites and potato leafhopper, especially in fall fruiting varieties. Also keep an eye out for symptoms of fireblight in raspberries. Also more info in this issue. Conditions have been very favorable for Fire Blight in apples this season and this may also be true for raspberries. Primocanes may show flagging from infestation by cane borers. These should be cut out below any sign of tunneling. **Blueberry** harvest has started on early varieties. Blueberry maggot is active now and can be monitored using sticky traps. See more below. Also, be aware of aphid infestations which can lead to virus infections. More below. **Grapes** are in final stages of bloom or past bloom now, depending on variety and location. This is a critical period for the foundation of disease management that will carry through the remainder of the season. Good coverage with effective materials prior to bunch closure is critical to control bunch rot diseases. **Currants and Gooseberries** were set back in many locations by the hard freeze in early April. Harvest has begun but may be light in some areas. Be sure to cool fields with overhead irrigation during high heat periods or fruit drop may occur.

ENVIRONMENTAL DATA

The following growing-degree-day (GDD) and precipitation data was collected for a one-week period, June 10 through June 16, 2010. Soil temperature and phenological indicators were observed on or about June 16, 2010. Accumulated GDDs represent the heating units above a 50° F baseline temperature collected via our instruments from the beginning of the current calendar year. 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	2010 GROWING DEGREE DAYS		Soil Temp (°F at 4" depth)	Precipitation (1-Week Gain)
	1-Week Gain	*Total accumulation*		
Cape Cod	80	722	68˚F	*trace*
Southeast	83	730	74˚F	1.45"
East	84	786	72˚F	0.52"
Metro West	85	712	69˚F	0.55"
Central	74	705	56˚F	0.63"
Pioneer Valley	81	784	64˚F	1.09"
Berkshires	82	695	69˚F	0.95"
AVERAGE	81	733	67˚F	1.13"

(***Source**: UMass Extension 2010 Landscape Message #16, June18, 2009*) *-- = information not available*

STRAWBERRY

Strawberry Renovation

Sonia Schloemann and A. Richard Bonanno, UMass Extension

Matted row strawberry plantings benefit from a process called 'renovation' after harvest to stimulate new growth to support next year's crop and to interrupt the build-up of certain pests and diseases mid-way through the growing season. For best results, renovation should be started immediately after the harvest is completed to knock down two-spotted mites, sap beetles and/or root weevils and to promote early runner formation. Early runner-set translates to higher yield potential the following year. Build-up of leaf spots and other foliar pathogens can be cleaned up with this process, too. Renovation should be completed by late-July in normal years. The following steps describe renovation of commercial strawberry fields. Specific rates and timing of applications can be found in the New England Small Fruit Pest Management Guide. To order, contact Sonia Schloemann at sgs@umext.umass.edu or John Howell at howell@umext.umass.edu.

1. **Weed control**: Annual broadleaf weeds can be controlled with the 2,4-D amine formulation (Amine® 4 or Formula 40) applied immediately after final harvest. Be extremely careful to avoid drift when applying 2,4-D. Some strawberry damage is also possible if misapplied. Read and understand the label completely. If grasses are a problem, sethoxydim (Poast) will control annual and some perennial grasses. However, do not tank mix Poast and 2,4-D.

2. **Mow the old leaves off** just above the crowns 5-7 days after herbicide application. Be careful not to damage crown by mowing too low.

3. **Fertilize the planting**. The main goal is to deliver nitrogen at this time to help regrow the canopy. Nitrogen should be applied at 25-60 lbs/acre, depending on vigor and basic soil fertility. Split applications (one now and the rest in 4-6 weeks) are better than a single fertilizer application. This gives plants more time to take up the nutrients in the fertilizer. A leaf tissue analysis (recommended once the canopy has regrown) is the best way to fine-tune your fertilizer program. This will tell you what the plants are actually able to take out of the soil and what nutrients are in sufficient supply or not. See Leaf Tissue Test Sampling Instructions at the UMass Soil and Tissue Testing Lab website at http://www.umass.edu/soiltest/list_of_services.htm for more on this.

4. **Subsoil**: Where tractor and picker traffic has been heavy on wet soils, compaction may be severe. Subsoiling between rows will help break up compacted layers and provide better infiltration of water. Subsoiling may be done as a later step if field conditions are unsuitable.

5. **Narrow rows and cultivate between rows**: Reduce the width of rows to 12-18 inches at the base. More berries are produced along row edges than in row middles. Wider rows lead to lower fruit production (yield and quality) and increased disease pressure. Narrow rows also give better sunlight penetration, air circulation, spray coverage, and over-all fruit quality. Use a roto-tiller, multivator or cultivator to achieve the row-narrowing. Work in the straw between the rows at this time, too. If possible, try to throw 1-inch of soil on top of the rows at

this time to stimulate new root formation on established crowns and new runners.

6. **Weed control**: Pre-emergence weed control should begin immediately after the plants are mowed and the soil is tilled to narrow the crop row. The most common practice at this time is to apply half the annual rate of terbacil (Sinbar at 4 oz/acre). It is essential that the strawberry plants are mowed, even if 2,4-D was not applied, to avoid injury from Sinbar. If regrowth of the strawberry plants has started, significant damage may result. Some varieties are more sensitive to Sinbar than others. If unsure, make a test application to a small area before treating the entire planting. Sinbar should not be used on soils with less than 0.5% organic matter or on reportedly sensitive varieties such as Guardian, Darrow, Tribute, Tristar and possibly Honeoye. Injury is usually the result of too high a rate or overlapping of the spray pattern.

If Sinbar is not used, napropamide (Devrinol at 4 lb/acre) or DCPA (Dacthal at 8- 12 lb/acre) should be applied at this time. Dacthal is preferred over Devrinol if the planting is weak. If Sinbar is used, napropamide (Devrinol at 4 lb/acre) should be applied 4 to 6 weeks later. This later application of Devrinol will control most winter annual weeds that begin to germinate in late August or early September. Devrinol should be applied prior to rainfall or it must be irrigated into the soil. During the summer, Poast can be used to control emerged grasses. Cultivation is also common during the summer months. Cultivations should be shallow and timely (weeds should be small) to avoid root damage to the strawberry planting. The growth of strawberry daughter plants will also limit the amount of cultivation possible especially near the crop row.

7. **Irrigate**: Water is needed for both activation of herbicides and for plant growth. Don,t let the plants go into stress. The planting should receive 1 to 1-1/2 inches of water per week from either rain or irrigation.

8. **Cultivate to sweep runners into the row** until plant stand is sufficient. Thereafter, or in any case after September, any runner plant not yet rooted is not likely to produce fruit next year and is essentially a weed and should be removed. Coulter wheels and/or cultivators will help remove these excess plants in the aisles.

9. **Adequate moisture and fertility during August and September** will increase fruit bud formation and improve fruit yield for the coming year. Continue irrigation through this time period and fertilize if necessary. An additional 20- 30 pounds of N per acre is suggested, depending on the vigor.

Overview of the Biology and Management of Root Weevils

Greg Loeb, Cornell University

I have three general goals or objectives I want to accomplish with this article. First, you should come away with a pretty good understanding of how to recognize root weevils that affect berry crops and their damage symptoms. Second, you should have a good sense of the life-cycle of root weevils that impact berry crops and their phenology (when different stages appear in your fields). And third, I hope you will have a general understanding of the different management alternatives.

Figure 1. Photo of adult strawberry root weevil. (Source:NYSAES, Cornell University).

Biology

Root weevils are beetles in the weevil family (snout beetles). Hence, the adults have elongated snouts and hard or leathery forewings. There are primarily three species of root weevils, all in the genus *Otiorhynchus*, which attack

Figure 2. Photo of larval strawberry root weevil. (Source:NYSAES, Cornell University).

strawberries in the Northeast (Fig 1). They all look fairly similar, being brown or black in color with small indentations along the leathery outer wings, called elytra, but differ in size. Strawberry root weevil is the smallest at about 0.2 inches in length. Rough strawberry root weevil is a bit larger (0.3 inches) and black vine weevil is the largest (0.4 inches). The larvae all look about the same (Fig 2). They are white or cream colored and legless. The larvae feed on roots while the adults feed above ground on leaves.

The elytra (forewings) of Otiorhynchus root weevils are fused and hence, adults cannot fly. This becomes important for understanding some of the management options discussed below. The adults of the three species pupate in the spring and emerge during late May through June depending on species. Initially the adults feed on leaves, creating characteristic notches along leaf edges. This damage is not of economic importance. This pre-ovipositional stage, where they do not lay eggs, lasts from two weeks (strawberry root weevil) to maybe a month (black vine weevil). If control actions are going to be taken against the adult stage, this is the time to do it, before they start laying eggs. The egg laying period can last much of the summer. Eggs are laid at the base of the plant, hatch, and larvae enter the soil. They initially start feeding on smaller roots but move to larger roots or the base of the crown as they mature. Larvae overwinter in the soil and resume feeding in the spring before pupating (see figure 3 for life-cycle).

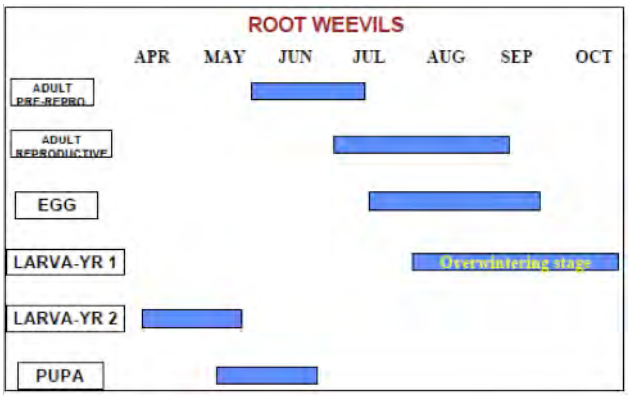

Figure 3. Diagram showing general life-cycle of Otiorhynchus root weevils.

Impact

Feeding damage to the roots causes economic injury resulting in reduced vigor and death, depending on the number of larvae feeding on the root system and the overall health of the plant. Older strawberry fields tend to have larger root weevil populations since it takes time for the fields to be colonized by the flightless adults and for populations to build. The exception would be when an infested field is immediately replanted without insecticide treatment. A heavily infested strawberry field shows weak vegetative growth and patches devoid of strawberry plants (gaps). Sandy sites tend to be more prone to weevil damage but this is probably because these sites also are more prone to drought stress, which is aggravated by the root feeding (Figure 4). There are not good data on how many larvae per plant results in economic damage and it probably depends on the overall health and water status of the planting.

Figure 4. Strawberry planting with serious root weevil damage.

Monitoring

There are several methods for monitoring for adult root weevils in strawberry plantings. The most direct method is to go after dark with a flashlight and inspect for adults on foliage (adults active at night, not day). Perhaps a more practical method is to inspect, on a regular basis from late May through June, for the characteristic notching in leaves caused by adult feeding. You can also put out pit fall traps (plastic cups sunk into the ground with the cup lip even with the ground and partially filled with water plus detergent). A roofing shingle or other structure should be propped up over the trap to shelter it from rain. To monitor for larvae, excavate several strawberry crowns plus 3-4 inches of roots and soil with a trowel. In the spring the larvae are fairly large and easy to see. In summer the larvae are still quite small, but visible.

Management: Host Plant Resistance

There has not been a lot of research on this issue but there appears to be some evidence that different strawberry cultivars vary in their susceptibility to adult feeding. Richard Cowles, Connecticut Agricultural Experiment Station, gave adult black vine weevils a choice between leaves of the cultivar Honeoye and 20+ other cultivars in pair wise choice tests. Five cultivars were less preferred: Delmarvel, Idea, Lester, Primetime, and Seneca. Latestar, Tristar, and

Marmolada were more preferred than Honeoye. The mechanisms for these preference differences are not well studied but the presence and amount of leaf hairs plays some role, as does nitrogen content. Although leaf feeding by adults is not economically important, variation in resistance could still be important for management since adult feeding is directly related to reproduction and larval densities. Cowles also tested for variation among these strawberry cultivars for resistance to larvae but did not find any significant differences. My suspicion is that some cultivars may at least be more tolerant to root feeding than others, although this has not been rigorously investigated.

Management: Cultural Practices

If sufficient land is available, rotating an infested field out of strawberry for a year or two is an effective cultural control method. New plantings should be placed 500 meters away from infested sites to minimize colonization by dispersing adult root weevils. If new plantings need to be located closer to infested sites, there is some evidence, based on research done in Ontario, Canada that a plastic barrier fence can be erected between the new and old planting to reduce rates of colonization of the new planting (see the article by Tolman et al. at [http://www.omafra.gov.on.ca/english/crops/hort/news/allontario/ao0306a2.htm]. A final idea for mitigating root weevil feeding damage on roots is to make sure the planting is well watered and maintained in good health. Of course, over watering can cause other problems related to root diseases.

Management: Biological Control

Although insect predators such as carabid beetles are known to feed on root weevil larvae, the best-developed method of biological control is the use of insect parasitic nematodes. Several studies have been conducted showing that the inundative release of large numbers (2.5 to 3 billion) of infective juvenile insect parasitic nematodes can reduce the density of root weevil larvae and damage. Two species in the genus *Heterorhabditis* have shown promise in our area: *H. bacteriophora* and *H. marelatus*. There are two times during the season that are good for releasing nematodes: spring as soil temperatures raise above 50 F and in the later summer or early fall. It's important for either release times that there is sufficient water via rain or irrigation to ensure the nematodes get moved into the root zone. There are a number of commercial sources for insect parasitic nematodes. See the web site on nematodes maintained by Ohio State University[http://www2.oardc.ohiostate.edu/nematodes/nematode_suppliers.htm]. Integrated Biocontrol Systems (Greendale, IN, [www.goodbug-shop.com]) is one supplier I am aware of that carries both of these *Heterorhabditis* species. IPM laboratories in Locke, NY (315-497-2063) also supplies *Heterorhabditis bacteriophora* as well as other nematode species.

Management: Chemical Control

In the past growers targeted the larval stage for chemical control using the insecticide carbofuran. This was an effective means of control but this insecticide turns out to be quite toxic to waterfowl and has subsequently been banned for most uses. Our current approach, therefore, is to target the adult stage using one of two insecticides: bifenthrin (Brigade WSB) or malathion (e.g. Malathion 57 EC). The idea is to kill the adults during the pre-oviposition period before the females have a chance to lay eggs. The best way to time the application is to scout for adult feeding damage in June. About ten days after the first sign of adult feeding would be appropriate, although the pre-ovipostion period varies depending on species from a couple weeks for strawberry root weevil to maybe a month for black vine weevil. Since the adults are nocturnal, an evening application may be more effective than a daytime application. You may need to make more than one application since adult weevils can emerge over an extended time period. (***Source**: New York Berry News, Vol. 8, No. 5, June 2009*)

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 (50-70ºF). 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 earlier-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 Advisory Team Alert, Vol. 23, No. 8, May 27, 2008*)

Orange rust symptoms on the underside of a black raspberry leaf.

Fireblight in Raspberries

Adapted from M. Heimann and S. Jeffers, University of Wisconsin

A serious disease of apple and pear trees in New England, fire blight also affects many other members of the Rosaceae, including brambles. Raspberries are the most susceptible of the bramble fruits to infection by the fireblight bacterium (*Erwinia amylovora*) but other bramble can also be infected.

Symptoms

The most obvious symptom results from infection of the cane tips, which become blackened and curl over as they die and dry out. This 'shepherd's crook' appearance is typical of fire blight symptoms on other host plants. As the disease progresses down infected canes, the leaf petioles and veins and surrounding tissue turn black. Discolored veins may be more apparent from the underside of leaves. Entire leaves may turn black, wither, and die. Typically, dicoloration and dieback are limited to tender young growth at shoot tips.

Raspberry cane tip bent in 'shepherd's crook' from fire blight. Photo from Wisconsin Cooperative Extension fact sheet A3499

The disease can affect fruit clusters as well. Infected fruit stems turn black and the young developing fruit becomes hard an dry.

Cause

Fire blight is cause by the bacterium *Erwinia amylovora*. Raspberry infections are caused by a different strain of the bacterium that what causes

apple/pear infections and so infections can not travel from one to the other. Infections are most likely spread from plant to plant by insects, wind and splashing rain. Wet conditions in the canopy from rain, high humidity, overhead irrigation combined with warm temperatures favor disease development.

Discoloration of leaf tissue along veins showing spread of bacteria in the plant. Photo from Wisconsin Cooperative Extension fact sheet A3499

Disease Management

Cultural controls are very important in managing this disease. The following practices offer effective methods for limiting the spread of this disease in commercial raspberries:

1. Only plant with certified disease-free nursery material purchased from a reputable source
2. Use good sanitation practices in the field by removing and destroying all diseased and infested plant material as soon as it is found in the field and cleaning tools, especially pruning clippers, before using them in another field.
3. Manage insect pests to avoid transmission of diseases from one planting to another. Do this by regularly scouting the field to determine need rather than preventative spraying.
4. Do not overfertilize with nitrogen which stimulated excessive vegetative growth resulting in a dense and we interior canopy.
5. Plant and prune with an eye toward optimizing air circulation within the rows to help create good drying conditions as well as good spray penetration and coverage when sprays are applied.
6. Remove any wild brambles from surrounding areas which can be reservoirs of insect pests and pathogens than move into commercial plantings.

Cultivar Resistance

Fire blight infects red and black raspberries and blackberries. There are not truly resistant cultivars available, but some are more susceptible than others. Boyne, K81-6, and Encore are identified as more susceptible to this disease.

Chemical Control

No chemical controls are specifically registered for fire blight in raspberry. A delayed dormant copper application for other target diseases may help reduce inoculum, but may result in tissue damage in some copper-sensitive varieties. Following good cultural practices outlined above is recommended over relying on any spray applications.

BLUEBERRY

Monitoring & Management Strategies for Blueberry Maggot

Rufus Isaacs and John Wise, Michigan State University

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

Fig 8. Maggot on ripe blueberry; *Photo: R. Isaacs.*

Monitoring adult blueberry maggot flight is the foundation of an effective protection

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

After the pre-oviposition period is complete, female flies will begin actively searching for fruit to lay eggs in, and there is a trap available that mimics the visual stimulus of a fruit. A green sphere trap, baited with synthetic fruit volatile lure can be used to monitor fly activity in fields. Again, these traps should be placed in perimeter rows of the field unless there is evidence of a resident population far in the interior.

Fig 9. Blueberry maggot monitoring trap with V-orientation; *Photo: R. Isaacs*

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

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

GF-120 NF Fruit Fly Bait (spinosad) is registered for control of the blueberry maggot and is listed by the Organic Materials Review Institute (OMRI) for use in organic production. Because the primary route of entry into the insect is through ingestion, applying this product during the fruit fly preoviposition period is important for optimal performance. GF120 must be applied with specialized equipment, and is designed for low-volume application by air. Field efficacy data is encouraging, but it is sensitive to washoff. We have limited experience with this novel formulation in large-scale trials in Michigan.

The use of SURROUND WP for fruit fly control is based on creating a protective barrier between the plant and the pest that 1) reduces host recognition of the pest, and 2) prevents adult oviposition (i.e.; egg laying). Because it is not toxic to adult flies like conventional insecticides, complete coverage of the plant is critical. Multiple applications are typically needed to attain initial coverage; further sprays may be necessary to respond to wash-off from rain or excessive wind. Field trials indicate that when adequate coverage is maintained that excellent fruit protection can be achieved, although the white residue makes this not suitable for fruit destined for the fresh market. (***Source**: Michigan Blueberry Newsletter, June 8, 2010*)

Table 3. Products and their effectiveness against blueberry maggot.

Trade Name	Chemical Class	Optimal spray timing for BBM	Residual activity	Effectiveness rating**
Guthion, Imidan	organophosphate	w/in 7 days of 1st fly capture	14+ days	excellent
Malathion	organophosphate	w/in 7 days of 1st fly capture	5-7 days	good
Lannat, Sevin	carbamate	w/in 7 days of 1st fly capture	5-7 days	good
Asana, Danitol, Mustang Max	pyrethroid	w/in 7 days of 1st fly capture	7-10 days	good
Delegate, Entrust*, SpinTor GF120NF*	spinosyn	immediately after 1st fly capture	7-10 days	fair to good

Provado, Assail	neonicotinoid	w/in 7 days of 1st fly capture	10-14 days	good to excellent
Surround WP*	particle film protectant	multiple applications BEFORE fly emergence	as long as thorough coverage of canopy is maintained	good

** OMRI approved for organic production.*
*** Effectiveness rating of insecticides, 2010 Michigan Fruit Management Guide.*

Blueberry Aphid Management

Rufus Isaacs, Mocjogam State Univ.

The blueberry aphid (*Illinoia pepperi*) is the vector of blueberry shoestring virus that can cause bush decline and significant yield reductions. Because of the ability of these insects to serve as vectors of plant disease, aphids should be managed to minimize virus spread in infected fields.

Aphids hatch from overwintering eggs during early bloom and build their colonies through asexual reproduction. Aphid growth is most limited by nitrogen, so they tend to grow fastest on new young growth and especially on heavily fertilized bushes. Young shoots that sprout after spring rains also tend to be very susceptible.

Populations can grow quickly through May and June with warm weather promoting faster growth. Biological control agents such as ladybeetles, lacewings and tiny parasitic wasps can often prevent or delay population growth, and we have seen much faster growth of aphid colonies on bushes where natural enemies were excluded. Growers should be monitoring fields for aphids and controlling this pest in fields where shoestring symptoms have been detected.

Scouting for aphids Aphids are most often found on the undersides of young leaves at the base of plants. To scout for aphids, examine two young shoots near the crown on each of 10 bushes in a field and record the number of shoots where aphids are found. Multiply by five to get the percentage of infested shoots. Tracking this number through the growing season can help identify whether populations are increasing, remaining steady or declining. It is also a good idea to record the number of shoots with parasitized aphids to get a measurement of the level of biocontrol present in your field. Be sure to sample weekly from as wide an area in the field as possible to have a better chance of detecting whether aphids are present.

Varietal susceptibility to shoestring virus Some varieties are resistant to shoestring virus. Resistant varieties include Bluecrop and Atlantic. Varieties with moderate resistance include Draper, Aurora, Liberty, Legacy and Brigitta. Aphid control should be considered in fields of susceptible varieties, especially if there are symptoms of shoestring virus present. Aphid control is most important in fields containing varieties that are susceptible to the shoestring virus, such as Jersey, Blueray, Burlington, Earliblue, Elliott, Jersey, Rancocas, Rubel, Spartan and Weymouth. If fields of these varieties contain symptoms of shoestring, aphid control should be a priority during the season and infected bushes showing symptoms should be tagged and removed in the late fall once aphids are not able to be spread through the field during removal.

Aphicides for control of blueberry aphid There are some aphid control materials available to blueberry growers that have excellent activity. These should be applied after bloom in June as aphid populations start to increase with application by ground sprayers to ensure coverage of the lower parts of the bush. Good coverage is essential for effective aphid control, and this will be more challenging in weedy fields. Controlling the aphids now will limit spread of the virus, thereby reducing the loss of yield or need for removing infected plants.

The most effective insecticides for aphid control are the systemic neonicotinoid insecticides Assail 30SG (2.5-5.3 oz/ac), Provado (4 oz) and Actara (3-4 oz).

Foliar application of one of these products will move in treated leaves, helping ensure that aphids receive a lethal dose. They also provide long-lasting control; because these insecticides are very effective and blueberry aphids do not readily form winged individuals, getting excellent control early in the season typically provides season-long control.

Selection of an insecticide for aphid control may be made considering the other pests present, to get multiple insects controlled with one spray. For example, Assail and Provado are also labeled for blueberry maggot (check the rates), and Assail is also very effective against fruitworms.

Soil-applied neonicotinoids Admire and Platinum can also be used to provide aphid control. These must be banded under the bush and watered in to allow them to get into the plant tissues. With the time needed for uptake into the foliage, these applications should be made soon after bloom to allow time for uptake before aphid populations get too large.

Broad spectrum insecticides applied after bloom for control of other pests such as fruitworms can also provide some control of aphids. Lannate and the various pyrethoids registered for blueberry are active on aphids if applied to target the lower shoots. However, these can also be disruptive to natural enemies, so fields should continue to be monitored for aphids to ensure that the populations do not increase again later in the season. **Harvest-time considerations** In mechanically-harvested fields, patterns of virus infection are often along the rows, indicating spread by harvesters. Aphid control prior to harvest is particularly important in fields with a history of shoestring virus infection to prevent this method of spread. Washing harvesters before moving to the next field is a simple strategy to further reduce the spread of BBSSV within and between blueberry farms.

New blueberry aphid and virus publication from MSU MSU has produced a new bulletin titled "Blueberry Aphid and Shoestring Virus" (Extension bulletin E3050). This is available for purchase through the **MSU Bulletin office**, or it can be downloaded for **FREE** as a printable version from this webpage: **www.blueberries.msu.edu/pdf/E_3050.pdf** (***Source**: Michigan Fruit Crop Advisory Team Alert, June 15, 2010*)

GRAPE

Canopy Management

Donn Johnson, University of Arkansas

This is the critical time period for canopy and crop load management practices to be done!

Shoot positioning of vines on high-wire trellis system should be underway in all areas of the region by now. This should begin when shoots are long enough to remain in place once they are positioned. For most varieties this occurs when they are around 20-24 inches in length. Shoot positioning is accomplished by "combing" the shoots, that is, separating them and positioning them perpendicular to the cordon and in a downward orientation. Delaying this operation can make it more costly to accomplish as the tendrils of adjacent shoots will begin to wrap around each other, making separating the shoots without breaking them more difficult.

Crop load adjustment should be done within two weeks past fruit set to get the most benefit from cluster thinning. Small-clustered cultivars such as Vignoles or Norton are generally not cluster-thinned unless they are young and still undergoing canopy development. With moderate- to large-clustered cultivars it is recommended to follow the 2-1-None Rule: At fruit set, if the shoots are greater than 20 inches in length, **retain 2** clusters. If shoots are between 8 and 20 inches in length **retain 1** cluster. If they are less than 8 inches in length, retain **none**.

Leaf removal should begin shortly after fruit set and be done by the time the berries are pea-sized. It is accomplished by removing 6-8 leaves from the basal area of the shoot around the fruit clusters and should be done on the east (N-S rows) or north (E-W rows) sides of rows. Leave foliage of the south (E-W rows) or west (N-S rows) sides to protect the fruit from overexposure and sunburn. Leaf removal creates a favorable environment for developing high-quality fruit by allowing more sunlight and air movement into the fruiting zone. At the same time it creates an unfavorable environment for diseases by decreasing humidity within the canopy and promoting more rapid drying of fruit after wetting events such as rains and dews. It can decrease disease pressure from powdery mildew which is favored by shaded, humid conditions and from bunch rot diseases. It also facilitates better spray penetration and coverage of the fruiting zone and canopy interior. (***Source**: Missouri/Arkansas Vineyard and Pest Mgt News, June 13, 2009*)

The Lowdown on Lingonberries

Cathy Heidenreich, Cornell University

Several inquiries have come in about lingonberries and their potential as a new NY small fruit crop. What follows is an overview of lingonberries and their commercial production.

Lingonberry, a member of the blueberry and cranberry plant family (Ericaceae), is a low-growing, perennial semi-evergreen woody shrub with relatively small berries. This native to arctic and subarctic regions of the world is widely distributed across cold climates of Northern hemisphere including the Canadian Pacific Northwest, Northeastern Canada, the Northern US (Alaska, Washington, Oregon), Greenland, northern Europe, Germany, and Scandinavia. It is also found in mountainous regions of central and southern Europe and Asia. Lingonberry's natural habitat includes densely wooded areas, heath, grass moorland, raised bogs, rocky exposed cliffs, and mountain peaks.

Vaccinium vitis-idaea or lingonberry is known by several other common names including partridgeberry, foxberry, northern mountain cranberry, cowberry, wolfberry, dry ground cranberry, rock cranberry, and ling berry among others. In parts of Scandinavia it's also known as "tyttebaer".

There are two types of lingonberry: the wild or American lingonberry, and its cultivated cousin the European lingonberry. The American or wild lingonberry (*Vaccinium vitis-idaea var. minus*) generally produces one 1 crop per year in summer. These plants tend to be short (7 inches or less) and have single blooms. The European or cultivated lingonberry (*V. vitis-idaea*) produces 2 crops per year, summer (August) and fall (late October – mid-November). These plants range from 2 to 16 inches in height with branches 3 -4 inches long. Leaves are bright green, oval and alternate. Lower leaf surfaces are matt below and covered with small black dots. New growth is covered with fine hairs. Plants may spread 3 feet in width, forming dense mats.

Lingonberry flowers on the previous year's growth. Flowers are similar in shape to those of blueberry and may be white or pink in color. Lingonberries (1/4 to 1/2" in diameter) are bright to dark red in color. They are considered highly flavored but not as tart as cranberries.

Their high benzoic acid content gives them a long shelf life; 8 – 12 weeks in the refrigerator, and several years in the freezer. Unpicked ripe fruit may persist on plants into spring, birds permitting.

Commercial production

Harvest of wild populations - Approx. 10% of the wild crop is harvested annually. Newfoundland wild populations are harvested commercially as wild partridgeberries (212,750 lb/year). Harvest of wild fruit can no longer keep up with demand.

Europe - Commercial production of lingonberries is well-established in Sweden, Finland, Germany, Austria, and Switzerland. Additional acreage is now being planted in Latvia, Lithuania, parts of former Soviet Union, Bulgaria, and Poland. Yield in Europe is approximately 80 million pounds per year.

North America – Commercial planting of this small fruit crop essentially got its start in Wisconsin during the 1990s through the efforts of Dr. Elden Stang of University of Wisconsin. Its production is expanding into the colder areas of Canada and the US.

Site selection and preparation

Lingonberries prefer light, well drained soils such as sand or silt loams with 2 to 6% organic matter and a pH range between 4.3 and 5.5. As with blueberries, high soil calcium content may have a toxic effect on plants. Avoid soils with high salt content, especially sodium and chloride.

If soil pH needs adjustment, begin lowering it the fall prior to planting by applying elemental sulfur. If planting on heavier soils or soils lacking in organic matter, also incorporate peat, leaf mold, sawdust, or finely shredded pine bark before planting at a rate of approximately 10 tons (4 inches) per acre. Organic matter should be incorporated into the top 3 to 4 inches of soil.

Table 1. Recommended fertilization rates for lingonberries

Plant age (years)	Actual N (lb/A)	Nitrogen Source	Comments
1 to 6	20 – 40	Urea, Ammonium nitrate	Use only chloride free fertilizers. If pH is high, use ammonium sulfate.
6+	40 lb	Urea, Ammonium nitrate	Nitrogen rates above 60 lb/A actual N can cause excessive vegetative growth and reduce flowering and yield

Select a site in full sun with good air and soil drainage. Tile installation or soil ripping may be needed to improve drainage prior to planting on wetter soils. Plantings may also be made on raised beds to improve drainage. Raised beds should be 4 to 8 inches high and 2 to 3 ft wide.

Lingonberries are noted for surviving winter cold, summer heat, and windy exposures. Winter snow cover, however, is preferable. Plants in Wisconsin have survived winter temperatures as low as 2 oF. In areas where winter temperatures drop below 10 oF and snow cover is marginal, protect plants with straw much, floating row cover or overhead irrigation. Spring frost protection using floating row cover or over head irrigation may also be needed.

Test irrigation water also for pH, chloride, sodium, and calcium. Trickle irrigation is recommended. Bury drip lines in raised beds before planting.

Plant Selection

For best berry size and yield, interplant desirable varieties with pollenizer cultivars such as 'Red Pearl' or 'Sussi'. These pollinator cultivars, although somewhat lower yielding, should make up 10% of each planting to obtain good fruit size and yield. Pollination is done by honey and bumblebees.

Varieties

'**Koralle**' (1969) First released in Holland as an ornamental ground cover, then later cultivated for its fruit. Now a popular Dutch cultivar making up almost all of European production. Upright, strongly branched, vigorous. Uprights 12 inches. Produces light red to dark red somewhat tart, highly flavored fruit at a young age. Fruit may remain on the vines for several weeks without deteriorating.

'**Red Pearl'** (1981) Dutch cultivar. Fast-growing, wide, bushy, upright plant. Uprights to 13 inches. Dark red, round fruit larger (1/3 inch diameter) and more mildly flavored than 'Koralle'. Most tolerant of less than ideal soil conditions. Two flower periods.

'**Suissi**' (1985) Swedish cultivar producing abundant large globular dark red fruit. Spreading but short uprights 6 – 7 inches. Heavy yields of medium to large berries.

'**Erntedank**', '**Erntekrone**', '**Erntesegen**' – three German cultivars found by Albert Zimmer on a German heathland, vigorous growers, mild-flavored fruit.

'**Scarlet**' – Norwegian cultivar, produces some fruit. Best used as pollinator for 'Koralle'.

'**Ida**' (1997) Vigorous, upright Swedish cultivar with large red berries (to 1 3/4 oz).

'**Linnea**' (1997) A smaller berried Swedish variety than 'Ida'. Vigorous, upright, heavy cropper.

'**Regal**' (1994) first of 2 introductions from University of Wisconsin-Madison from seed collected in Finland. Uprights 7-8 inches. Berries 1/3 inch in diameter, 1 1/3 oz. Two bloom periods.

'**Sanna**' (1988) Swedish cultivar with uprights to 12 inches. Heavy cropper, excellent berry quality. Recorded yields 1 1/4 lb/bush or 6 tons/acre.

'**Splendor**' (1994). University of Wisconsin-Madison. From the same seed source as 'Regale'. Vigorous, modest spread, uprights 6 – 8 inches. Matures in 2nd year, often producing a crop. Brillant red fruit 1/3 inch diameter, 1 1/2 oz.

Propagation

Lingonberries reproduce by seed or underground rhizomes. Commercial methods include tissue culture or stem cuttings. Cuttings are taken in late summer from the current year's growth and rooted in a 1:1 mix of moistened peat and sand. Raised polyethylene covers or

overhead mist is needed to maintain high humidity. Cuttings may also be propagated much like cranberries. Runners sliced off during bed narrowing are gathered and incorporated into soil using agricultural discs. Overhead irrigation is needed for this method to allow for good root development and establishment.

Plant Establishment

Planting - Planting is generally done in spring or fall with one year rooted cuttings or plugs. Suggested spacing is 4 to 5 ft between rows and 12 to 18 inches between plants in-row. Recommended plant density is 8,700 plants per acre.

Plants will fill in rows much liked matted row strawberry plantings.

Mulching - Mulch plants after planting with a 4 to 6 inch layer of peat or other organic matter to encourage root growth and promote higher harvest yields. Reapply mulch every 3 to 6 years as needed.

Irrigation – Irrigate through the first summer to help plants establish and reduce sunburn at a rate of 1/2 to 3/4

of an inch of water per week. Do not allow soil to dry out between waterings. Avoid overwatering on heavier soils which increases risk of Pythium or Phytophthora root rot development.

Fertilizer - Nitrogen should be applied in the ammonium form as urea or ammonium sulfate (Table 1).

Pruning – No pruning is needed until plants reach 5 years of age or older. Then mow alternate rows every 3 to 6 years to increase shoot density and stimulate 1 year old growth.

Pest Management

Weeds - Relatively few pest or weed management products have been labeled for lingonberries as they are still a relatively new minor crop. This makes it imperative to establish new plantings in "clean" soils – those where preplant perennial and annual weed management has been thoroughly done prior to plant establishment.

Good weed management is critical during plantings years 1 through 3. Management methods include in-row hand weeding, and mechanical cultivation. Cultivation needs to be shallow and done with extreme care to avoid damaging roots. Plant grass sod between rows to help minimize weeds. Mow to keep grasses from seeding.

Harvest

Smaller summer crops are generally not harvested in favor of heavier fall crops. Berries are said to be best picked after a sharp frost. Harvesting may be done much like lowbush blueberry or cranberry using hand-held scoops. Machine harvest is also possible using mechanical harvesters similar to those used for dry harvesting cranberries. Plants reach full production 4 to 5 years after planting. Yield is approximately 10 lb fruit per square yard of row. Average yield per acre is 4-5 tons. Newer varieties have the potential to produce up to 10 tons/acre.

Marketing

Portions of the harvested lingonberry acreage are direct marketed as fresh fruit to consumers. That said, lingonberries, like their cranberry cousins, are mainly marketed for their use in valued-added products such as sauces and juices. Other value-added lingonberry products include wines, liqueurs, syrups, jams, jellies, trifle, cheesecake, cocktail, soufflé, sherbet, ice cream, candies, and pickles. They are also used as an ornamental ground cover in landscape gardens. Lingonberries are rich in antioxidants, containing high levels of benzoic acid, vitamins A and C, and magnesium. Lingonberry extracts have several medicinal uses such as a component for cough syrups. They are also used for treatment of blood disorders and urinary tract infections.

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(All photos courtesy Dr. Marvin Pritts, Cornell University. Drawing courtesy USDA, NRCS Plants Database; original illustration found in: Britton, N.L., and A. Brown. 1913. *An illustrated flora of the northern United States, Canada and the British Possessions*. Vol. 2: 697.*)*

Survey Reports Latest Honey Bee Losses

Kim Kaplan ARS News Service, Agricultural Research Service, USDA

Losses of managed honey bee colonies nationwide totaled 33.8 percent from all causes from October 2009 to April 2010, according to a survey conducted by the Apiary Inspectors of America (AIA) and the Agricultural Research Service (ARS). Beekeepers identified starvation, poor weather, and weak colonies going into winter as the top reasons for mortality in their operations.

This is an increase from overall losses of 29 percent reported from a similar survey covering the winter of 2008-2009, and similar to the 35.8 percent losses for the winter of 2007-2008.

The continued high rate of losses are worrying, especially considering losses occurring over the summer months were not being captured, notes Jeffrey Pettis, research leader of ARS' Bee Research Laboratory in Beltsville, Md. ARS is the U.S. Department of Agriculture's principal intramural scientific research agency. The survey was conducted by Pettis and past AIA presidents Dennis vanEngelsdorp and Jerry Hayes. The three researchers said that continued losses of this magnitude are not economically sustainable for commercial beekeepers. *Right*: A honey bee on broccoli, one of the many crops that benefit from honey bee pollination. *(Photo courtesy of Russ Ottens, University of Georgia).*

The 28 percent of beekeeping operations that reported some of their colonies perished without dead bees present—a sign of Colony Collapse Disorder (CCD)--lost 44 percent of their colonies. This compares to 26 percent of beekeepers reporting such dead colonies in the 2008-2009 winter and 32 percent in the 2007-2008 winter. Beekeepers that did not report their colonies having CCD lost 25 percent of their colonies.

As this was an interview-based survey, it was not possible to differentiate between verifiable cases of CCD and colonies lost as the result of other causes that share the "absence of dead bees" as a symptom. The cause of CCD is still unknown.

The survey checked on about 22.4 percent of the country's estimated 2.46 million colonies. The survey reports only winter losses and does not capture colony losses that occur throughout the summer when queens or entire colonies fail and need to be replaced. Those summer losses can be significant.

*A complete analysis of the survey data will be published later this year. The abstract can be found at http://ento.psu.edu/pollinators/news/losses-2009-10.. More information about CCD can be found at www.ars.usda.gov/ccd. (**Source**: New York Berry News, Vol. 9., No. 6, June 2010)*

UPCOMING MEETINGS:

June 23, 2010. *Vegetable Fruit & Farm Stand Twilight Meeting***.** Hemingway Farms, Charlestown NH. 5:45-8:15pm. For info, contact Seth Wilner at 603-863-9200.

June 22-26, 2011. *10th International Rubus and Ribes Symposium, Zlatibor, Serbia***.** For more information contact: Prof. Dr. Mihailo Nikolic, Faculty of Agriculture, University of Belgr, Belgrade, Serbia. Phone: (381)63 801 99 23. Or contact Brankica Tanovic, Pesticide & Environment Research Inst., Belgrade, Serbia. Phone: (381) 11-31-61-773.

June 24, 2010. *Fruit & Vegetable Twilight Meeting.* McKenzie's Farm, Milton NH. 5:30-8:00pm. For info, contact Geoffrey Njue at geoffrey.njue @unh.edu or 603-749-4445.

July 9, 2010. *Bird Netting for Blueberries.* Butternut Farm, Rumney NH. Meeting will feature demonstration of setting up a blueberry bird netting system, and discussion of the advantages, disadvantages, and overall impacts of netting. Donna Doel from NRCS will discuss NRCS cost share options for bird netting for small fruits. For info, contact Heather Bryant at heather.bryant@unh.edu or 603-787-6944.

July 15, 2010 *Mass Fruit Growers Association Summer Meeting,* UMass Cold Spring Orchard Research and Education Center, 391 Sabin St., Belchertown MA.

July 21,2010. *Organic Strawberry, Blueberry and Raspberry Production*. Adam's Berry Farm, Burlington VT. 5 pm. For info, email vernon.grubinger@uvm.edu or call 802-257-7967

July 29, 2010. *2010 Cornell Fruit Field Day,* Geneva, NY. Save the date! Program details and registration information forthcoming.

August 11, 2010. *UMass Extension Vegetable , Field and Energy Crops Field Day.* UMass Agronomy Farm, 89-91 River Rd., South Deerfield MA. 12:30-8:00. Concurrent tours starting at 12:30, 2:30 and 6:00. Over 30 Presentations on Current Research! Five different tours will be offered: 1. Cropping Systems and Livestock, 2. New Crops and Cropping Systems, 3. Zone Tillage & Soil Amendments for Vegetables and Grain, 4. Energy and Rotation Crops , 5. Vegetable Medley For more information go to www.umassvegetable.org or contact Ruth Hazzard (rhazzard@umext.umass.edu) or Masoud Hashemi (masoud@psis.umass.edu).

August 17 & 18 2010. *NASGA Summer Tour in Montreal.* For complete information on this excellent tour and about joining the North American Strawberry Growers Association, go to http://www.nasga.org/.

August 19-21, 2010. *North American Fruit Explorers.* Best Western Motel/Conference Center, Lafayette, IN. To view the program and registration form, check: http://web.extension.illinois.edu/edwardsvillecenter/foodcrophort3031.html. For additional details or questions: contact Ed Fackler at cefackler@gmail.com or 812-366-3181.

Sept 14, 2010. *High Tunnel Construction with Ed Person, Ledgewood Farm Greenhouse Frames*. Edgewater Farm, Plainfield NH. 5 pm. For info, call 802-257-7967 or email vernon.grubinger@uvm.edu.

Sept 22, 2010. *GAPs on a Wholesale/Retail Vegetable Farm*. Paul Mazza's Fruits and Vegetables, Essex VT. 5 pm. For info, call 802-257-7967 or email vernon.grubinger@uvm.edu.

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