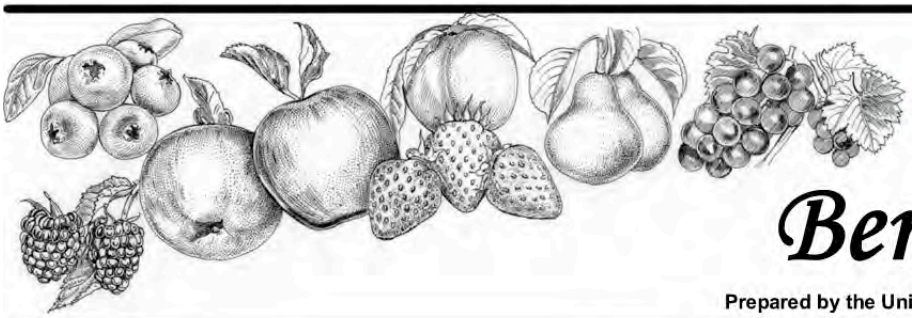

UMassAmherst EXTENSION

Berry Notes

Prepared by the University of Massachusetts Fruit Team

Oct. 2007 Vol. 19, No. 14

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

Massachusetts Berry Notes Underwriters:

NOURSE Growers of the Finest Small Fruit Plants

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IN THIS ISSUE:

REGISTER NOW FOR THE 2007 NEW ENGLAND VEGETABLE & FRUIT CONFERENCE AND TRADE SHOW

This biennial event will take place December 11, 12, and 13 at the Radisson Hotel in Manchester, NH. The program features 27 different half-day sessions on topics such as strawberries, blueberries, brambles, apples and grapes, as well as tomatoes, sweet corn, pumpkins, leafy greens, and many other vegetables. In addition, there will be sessions on organic production, renewable energy, soil health, weed control, and season extension. In between these sessions are 'Farmer to Farmer' discussions focused on topics like: crop planning, cucurbit disease management, greenhouse tomatoes, cultivation equipment, cut flowers, garlic, and organic Sweet corn. The trade show features over 100 exhibitors. Pre-registration to attend the conference and trade show is just $70 for the first member of the farm or business and $40 for each additional member (family or employee) when pre-registered with first member. The fee for students (high school or college) is $30 each when pre-registered by the instructor. Pre-registration must be received by November 30, 2007. There is an additional fee of $10 per person for late registration or walk-ins. (check or cash only if registering at the door). The complete conference program and registration form are on-line at www.newenglandvfc.org or call me for a printed copy of the conference brochure. If you need overnight lodging, be sure to make hotel reservations soon. The Conference takes place at the Radisson Hotel, (603) 625-1000, www.radisson.com/manchesternh. The rate for conference attendees is $97 per night plus 8% tax; mention "vegetable conference" to get this rate; the deadline is November 18, 2007. Just down the road is the Hilton Garden Inn, (603) 669-2222, www.hiltongardeninn.com. A limited number of rooms are reserved for conference attendees at $119 per night plus 8% tax. Again, mention "vegetable conference" to get this rate; the deadline is November 19, 2007.

Strawberry – Powdery Mildew

Jay W. Pscheidt, Oregon State University Extension

Cause: *Sphaerotheca macularis f.* sp. fragariae, a fungus that overwinters on infected plant tissue including living leaves. This fungus is favored by conditions that produce high humidity but dry leaves. Conidia are able to begin germination after 6 hours and complete it within 24 hours, irrespective of temperature. Lesion expansion is related to temperature but does not seem to be related to relative humidity. It is a highly specialized pathogen that forms a close association with the host. Conditions that favor the host also favor the pathogen. Much of the fungus remains on the outside of infected plant parts but sends in rootlike structures, haustoria, to obtain nutrients. The white growth seen is composed of both mycelium and fungal spores. 'Hood', 'Totem', and 'Benton' are moderately resistant or tolerant to mildew; 'Shuksan', 'Sumas', and 'Linn' are moderately susceptible; 'Olympus', 'Redcrest', 'Independence', 'Puget Summer', 'Firecracker', 'Whonnock' and 'Northwest' are very susceptible.

Note the curled leaves and gray patches on underside of leaves.

Powdery mildew symptoms has a grayish-white appearance on underside of leaves.

Symptoms: Edges of infected leaflets curl up, exposing undersides that often are reddened and coated with a grayish white powdery mildew fungus. Diseased leaves later turn purplish or red. In irrigated fields, the fungus also may attack fruit. Some day-neutral cultivars are susceptible to fruit infection in fall even though leaves may appear healthy.

Cultural control:

1 Destroying old leaves by renovating plants after harvest may help reduce inoculum.

2 Plant resistant cultivars.

Chemical control: The disease needs to be controlled on highly susceptible cultivars after summer renovation so plants remain vigorous until they cease growth and go dormant in late fall. Many of these products, such as soaps, oils and sulfurs, may influence mite problems in the field.

1 Abound at 6.2 to 15.4 fl oz/A. Do not apply more than 2 sequential applications or more than 4 applications per year. May be applied on the day of harvest. 4-hr reentry.
2 Bicarbonate-based products. Might supplement a normal program when powdery mildew is first observed. Do not mix with acidifying agents. Thorough coverage is essential. Easily washed off by rain, so reapplication is necessary.
   a Armicarb 100 (85% potassium bicarbonate) at 2.5 to 5 lb/100 gal water. 4-hr reentry.
   b Kaligreen (82% potassium bicarbonate) at 2.5 to 3 lb/A. 4-hr reentry.
   c MilStop (85% potassium bicarbonate) at 2.5 to 5 lb/A. 1-hr reentry.
   d Remedy (by Bonide) is registered for home use.
3 Cabrio EG at 12 to 14 oz/A. Do not use more than twice sequentially or more than five times per year. May be used at harvest. 12-hr reentry.
4 E-Rase RTU (Jojoba seed oil) is registered for home use. May solidify below 50oF. H O
5 JMS Stylet Oil at 3 quarts/100 gal water. Do not use during freezing temperatures, above 90°F, or when plants are under heat or moisture stress. Do not use when foliage is wet because good coverage is essential. 4-hr reentry.
6 Kumulus DF (80% sulfur) at 5 to 10 lb/A. 24-hr reentry.
7 M-Pede at 1 gal/50 gal water is registered on strawberry for soft-bodied insects and has shown good activity against powdery mildew on several other crops. 12-hr reentry.
8 Microthiol Disperss (80% sulfur) at 5 to 10 lb/A. Activity depends on temperature: it may not be as effective below 65°F and may burn plants if applied above 85°F. Do not use a spreader sticker. 24-hr reentry.
9 Pristine at 18.5 to 23 oz/A. Do not use more than 2 consecutive applications or more than 5 times/year. Can be used day of harvest. 12-hr reentry.

10 Procure at 4 to 8 oz/A. Do not apply within 1 day of harvest or more than 32 oz/A/year. See label for crop rotation restrictions. 12-hr reentry.
11 Rally 40 W at 1.25 to 5 oz/A. Applications may be made up to the day of harvest. Do not apply more than 30 oz/A/season. 24-hr reentry.
12 Safer Garden Fungicide (Ready To Use 0.4% sulfur) throughly sprayed over the entire plant. Do not use when the temperature is over 85°F or within a few weeks of an oil spray. Do not use on fruit that will be used for canning or within 1 day of harvest.

Biological control:
Sonata (Bacillus pumilis strain QST 2808) at 2 to 4 quarts/A is registered for suppression only. As such it is not recommended for use in the PNW. May be applied up to and including the day of harvest. 4-hr reentry.

References:
Nelson, M. D., Gubler, W. D. and Shaw, D. V. 1996. Relative resistance of 47 strawberry cultivars to powdery mildew in California greenhouse and field environments. Plant Disease 80:326-328.

Miller, T. C., Gubler, W.D., Geng, S. and Rizzo, D.M. 2003. Effects of temperature and water vapor pressor on conidial germination and lesion expansion of Sphaerotheca macularis f. sp. fragariae. Plant Disease 87:484-492.

(**Source**: The Oregon State University Extension Plant isease Control Guide on-line at HTTP://plantdisease.ippc.orst.edu/)

RASPBERRY

What's New in Fall Raspberries

Pam Fisher, Ontario Ministry of Ag., Food and Rural Affairs

The fall raspberry scene has progressed far beyond Heritage - which is a great berry, but too late for many Ontario growers.

Here are some other fall-bearing varieties of interest:

• **Anne (University of Maryland)** - This variety is yellow, sometimes greenish-yellow, with no pink or amber tinges. Produces large, conic, pale yellow fruit that ripen mid- to late season. It has very good flavor and texture. Tall upright canes sucker sparsely requiring higher planting density. It is resistant to Phytophthora root rot but susceptible to leaf hoppers and rust.

• **Autumn Bliss (England, 1984) -** Early, approximately 10 days earlier than Heritage. Large, flavourful fruit with large druplets. Most yield is harvested in the first two weeks of harvest. Somewhat soft. May be crumbly and dark.

• **Autumn Britten (England, 1995)** - A sibling of Autumn Bliss, Autumn Britten is the Ontario standard. It is more regular in shape and less crumbly than Autumn Bliss. Requires planting at closer spacings because it does not produce an abundance of canes.

• **Caroline (USDA Maryland, 1999)** - Excellent yield potential, berry size and fruit quality. Yields approx. 1 week earlier than Heritage but too late for most regions in Ontario. Susceptible to late leaf rust, but has moderate to good resistance to Phyophthora.

• **Polana (Poland, 1991)** - Approximately 2 weeks earlier than Heritage and slightly ahead of Autumn Britten. Early, fall bearing. High yields because buds produce 2 fruiting laterals each. Medium sized fruit of good quality. Susceptible to Phytophthora and verticillium.

Figure 1: Josephine raspberry fruit in high tunnels at Cornell University.

New for trials:

The following 5 varieties (except Josephine) are new and on trial at 3 observation plots in Ontario, planted in 2007.

• **Himbo Top** (Switzerland) produces good quality, large fruit on primocanes. The fruit is bright red with good flavor. Plants are vigorous and upright and medium in height that will benefit from trellising. Reported to be resistant to Phytophthora root rot.

• **Jaclyn** (University of Maryland) is an early season

variety with large firm berries ripening 2 weeks before Heritage. Plants are vigorous and erect but susceptible to yellow leaf rust. Fruit is dark red and adheres tightly until fully ripe.

- **Joan J** (United Kingdom) Good quality firm fruit with small drupelets and good flavor. The fruit will hold and ship well, as it is dry. Considered early.
- **Josephine** (University of Maryland) Fruit is large with average flavor ripening mid-season. Berries are firm and cohesive. Plants are upright and vigorous needing little containment trellising. It is resistant to leaf hopper and Phytophthora root rot.
- **Polka** (Poland) has medium large primocane fruit that ripen in the early season. Widely grown in Europe, it is reported to have good fruit quality and good yields.

Thanks to Courtney Weber, Associate Professor, Cornell University's New York State Agricultural Experiment Station for the descriptions for Anne, Himbo,. Polka, Jaclyn, Josephine, from "Raspberry Variety Review: Old Reliable And New Potential" in New York Berry Times Vol 6 # 7 July 2007. (***Source**: The Ontario Berry Grower, Volume # 6, November, 2007*)

BLUEBERRY

Preparing for Next Year's Blueberry Planting

*Richard Fu*nt, *Ohio State University*

Soil and site preparation before planting is one of the most important aspects of establishing highbush blueberries. Making the best choices during the preparation year and the year of planting sets the stage for the next 10 to 20 years of production. With investments in land, labor, plants, irrigation, and equipment, the establishment costs ran reach $6,000 per acre. In today's competitive global economy, considerable planning, thinking, and decision-making are essential for success.

Highbush blueberries require a site that has at least a 160-day growing season. They require 750 to 1000 hours of chilling during the fall and winter. Flower buds can tolerate -15^{o} F (-26.1^{o} C) in midwinter; woody tissue can sustain -20^{o} F (-28.9^{o} C). Certain highbush blueberry cultivars may sustain a 24^{o} to 28^{o} F (-4.4^{o} to -2.2^{o} C) during full bloom. They grow best in warm sunny summers. Hot summers decrease flavor and firmness.

Blueberries grow best in well-drained, acid, sandy loam soils with an organic mater content between .4 and 7%. Organic matter can be increased by adding compost or peat moss to the row before or at planting. A pH of 4.5 to 5.5, if the organic matter is high, is suggested. If the pH is high, it can be reduced easily in sandy soils with sulfur. Lowering the pH in clay soils can be difficult, particularly if they are saturated with calcium above 2,000 pounds per acre.

Avoid soils having a water table or poor internal drainage in the upper 14 to 18 inches of soil. Raised beds of 8 inches high and 48 inches wide are suggested for most Ohio soils. Raised beds should be prepared in the fall before spring planting. Supplemental irrigation (trickle or microirrigation) is nearly always essential for maximizing production especially on raised beds. A water supply containing unchlorinated water with low salt and a low pH (below 6.0) is most desirable. (***Source**: Blueberry Bulletin, Vol. XXII, No. 22*)

GRAPE

Sampling Focus: Noiret and Canopy Management for Hybrids

Timothy Martinson, Cornell University

Most growers and winemakers have at least a basic understanding of canopy management techniques (vertical shoot positioning, shoot thinning, leaf removal in the cluster zone, and summer hedging) used with *Vitis vinifera* cultivars to deploy the grapevine canopy to maximize sunlight interception while allowing the cluster zone partial or full exposure to sunlight. Enhancing fruit exposure improves fruit and wine quality, increasing fruity and floral characteristics, decreasing herbaceousness (green, unripe flavors), and improving color and tannin intensity. Moreover, avoiding shading in the shoot renewal zone increases bud fruitfulness.

These canopy management techniques are not widely used with hybrids, for a variety of reasons. One reason is that, while *V. vinifera* varieties have an erect growth habit, many

Student Ben Riccardi and Dr. Justine Vanden Heuvel

hybrids have a procumbent (or downward) growth habit, like Concords do, that makes shoots hard to position vertically. This increases costs and frequency of wire-moving and shoot-tipping operations needed to produce VSP-type canopies. Another, probably more important reason is that these labor-intensive practices are too expensive to use routinely in hybrid vineyards, where the goal is to produce a moderate-priced, salable wine (or $400 to $800/ton grapes to sell to the wineries making these wines).

Are there appropriate and economically-feasible ways of improving quality of hybrid fruit through canopy and crop management? **Dr. Justine Vanden Heuvel**, Cornell's new Assistant Professor of Viticulture thinks so. Together with enologist and wine chemist **Dr. Gavin Sacks**, Justine has started a new project this year with to characterize 'hybrid aromas' that make up the flavor components of hybrids, and understand how canopy management might influence these flavors and wine quality.

The project, entitled **Improving the Quality of Hybrid Grapes and Wine** (one of 12 projects funded by the *NY Wine and Grape Foundation's Total Quality Focus* or *TQF program*), aims to compare effects of cluster sunlight exposure on standard fruit quality measures and flavor components of red varieties Marechal Foch, Noiret, and Corot Noir. The latter two are new red cultivars from Cornell's grape breeding program that were released in 2006. Both are a notable departure from traditional red hybrids, in that they produce tannic, full bodied red wines. Foch is an older 'Kuhlman' hybrid, known to produce what is known as characteristic 'red hybrid' flavor, and is made into lighter-style, non-tannic red wines.

So the two questions Gavin and Justine are addressing are: 1.) What are the chemical aroma and flavor compounds that produce this flavor known as 'red hybrid'? and 2.) What can we do in the vineyard to improve and enhance favorable flavors to improve wine quality of these and other hybrids?

The "Noiret" Experiment. One venue where these questions is being addressed is at Jim Bedient's Noiret vineyard near Branchport, NY, on the West side of Keuka Lake. The Noiret planting is approximately 5 years old, and the vines are trained to a VSP system, with mid-wire canes and catch wires. There, Ben Riccardi, summer Shaulis Scholar and senior in Cornell's undergraduate viticulture program, established four different treatments in this five year-old vineyard under Dr. Vanden Heuvel's directions. The treatments were:

1. No shoot thinning, no leaf removal
2. Shoot thinning, no leaf removal
3. No shoot thinning, leaf removal
4. Shoot thinning and leaf removal

Ben measured canopy density at various times in the season and made adjustments to treatments as necessary. We harvested the fruit last Tuesday (see photos). Ben and several fellow Enology students at Cornell will make wine out of the four treatments for an independent study project, under the direction of Cornell Lecturer Kathleen Arnink.

Observations about Noiret. I was out harvesting with the crew last Tuesday. What I saw (in the 'normal' portions) was vigorous vines, trained to VSP, but with a trailing growth habit. Shoot vigor was such that many of the shoots that had been positioned grew back downward, reaching

Other parts were less dense and showed moderate fruit exposure

Parts of Noiret canopy were very dense with little cluster exposure.

halfway or more to the ground. In a few panels of the vineyard, shoots had slipped out of the catchwires, and had

grown straight down from the fruiting wire. Clusters in those panels appeared to be much more exposed than in some of the VSP panels. Noiret's large leaves, some almost the shape and size of 'Catawba' leaves, do tend to promote shading as well. Clusters were large (1/2 lb or more), and it was rare to see over 30 on a vine. Some of this was a 'treatment effect' (i.e. could be a result of shoot thinning), but it seemed that there were often 1 to 2 clusters on a shoot, rarely more than 2. This indicates to me that previous shading may have reduced bud fruitfulness.

Shoots have strong downward growth tendency

Bruce Reisch, the breeder who developed and released the variety, told me that this variety has large clusters, but is not prone to overcropping like some other large-clustered varieties such as Seyval blanc and Chambourcin.

My opinion: This is a variety that wants to droop, and thus seems more suitable to high training than to low-wire training systems such as VSP. I feel that shoot positioning might have lowered bud fruitfulness - it looked to me like many potential renewal canes were heavily shaded this year. This variety would seem to me to be a candidate for standard 'umbrella'- type or high cordon training. The latter system, with some additional shoot thinning and positioning, could be the best bet for maximizing fruit exposure. When the data is worked up, it will be interesting to see just how much the treatments reduced shading this year. Stay tuned!

Samples from the two extreme treatments (Shoot thinning/Leaf Removal and no thinning/removal) have been part of our Harvest Maturity Report (see p5-7). The day before harvest, the leaf removal/shoot thinning berry sample had 0.5º higher brix and 0.2 g/l lower titratable acidity than the non-thinned, no leaf removal treatment. (***Source**: Veraison to Harvest, October 5, 2007*)

Sustainable Viticulture Workbooks Now in Print

Alice Wise, Cornell Cooperative Extension Suffolk County

Through a statewide committee of both Cornell Cooperative Extension personnel and NY grape growers, CCE has published a 125-page self-assessment workbook on sustainable agriculture for grape growers. The workbook, New York Guide To Sustainable Viticulture Practices, is now available in both print and online versions. New York Guide To Sustainable Viticulture Practices offers grape growers in New York and other regions of the northeastern United States guidance in the evaluation and adoption of best management practices to minimize environmental impacts, reduce economic risks and protect worker health and safety. These practices include: soil management to reduce erosion, runoff and leaching; use of integrated pest management (IPM) practices for insect, disease and weed management; nutrient management, with a particular focus on nitrogen use; pesticide management and spray technology; and cultural practices used in viticulture. The workbook asks growers 134 questions related to these practices. The Long Island Grape Program will have a limited number of copies available to industry members at a reduced price. Contact Libby or Alice at 631727-3595. The guide can also be purchased on-line for $30 through the NYSAES bookstore at: www.nysaes.cornell.edu/store/catalog/. Alternatively, the online version is available at www.vinebalance.com.

General

New Insecticides and Fungicides for Berries

Kathy Demchak, Penn State University

New Insecticides

Several new insecticides became available for use on berry crops in PA recently. Here is a summary of additions.

Actara (thiamethoxam) is a group 4A (neonicotinoid) insecticide that had been labeled for control of aphids and whiteflies on strawberries, blueberries, gooseberries and currants for a couple of years. A supplemental label that adds uses against Japanese beetles, aphids, cranberry weevils, leafhoppers, and weevil adults on blueberries; and Japanese beetles (adults), aphids, leafhoppers, stinkbugs, tarnished plant bugs, whiteflies, and weevil adults on caneberries (brambles) has been approved. Previously, there

were very few materials labeled for Japanese beetle control on these crops, especially on brambles. Actara has a 3-day PHI, which is at least shorter than the 7-day PHI for Sevin, and a 12-hr REI.

Platinum, a soil-applied insecticide drench, with the same active ingredient as Actara (thiamethoxam) has a supplemental label for control of white grubs in blueberries, including grubs of Japanese beetles, and for treatment of strawberry root weevil larvae and other grubs on strawberries. It can be quite effective for this use, but must be applied while the larvae are small. For strawberry root weevils, this means that the material should be applied during mid-late summer. Platinum has a 75-day PHI on bushberries, and a 50-day PHI on strawberries. There is a 12-hr REI.

Admire and **Admire Pro**, soil-applied formulations of imidacloprid, are labeled for control of aphids and whiteflies on strawberries; and white grubs on strawberries post-harvest in perennial systems. Admire and Admire Pro are also labeled for both adults and grubs of Japanese beetles feeding on bushberries, as well as other grubs, and for control of aphids, leafhoppers, whiteflies, and red-necked cane borer on caneberries (brambles), a pest for which a control measure was sorely needed. The PHIs are 14 days for strawberries, and 7 days for bushberries and caneberries. Both are group 4A insecticides, so they cannot be rotated with Actara or Platinum for resistance management.

Mustang Max (zeta-permethrin) is a group 3 (pyrethrins and synthetic pyrethroids) insecticide labeled for use on the berry crop group (bushberries and caneberries), which includes blueberries, brambles, gooseberries, and currants, but not strawberries. It is restricted-use due to toxicity to fish and other aquatic organisms. Mustang Max has a 1-day PHI and 12-hr REI. It can be used for control of leafrollers, orange tortix, and root weevils (adults). These aren't typically much of a problem in PA, so this product will likely have limited use.

Be careful with use of any of the above insecticides to avoid affecting foraging bees, as all are very toxic when they come in contact with bees. Remember that even though your crop may not be in bloom, weeds in or near the field may be, and insecticides on the weeds are just as toxic to the bees as insecticides on your crop. Take precautions such as pulling, mowing, or applying a burndown herbicide to the weeds before making an insecticide application to your field. Consult the labels for additional precautions and changes. The label is the law concerning how the material in your possession can be used.

New Fungicides

There are two new fungicides to discuss, Orbit and Tilt. **Orbit** and **Tilt** both have the same active ingredient, propiconazole. Both products are labeled for use on strawberries and on the berry crop group, which includes the caneberries (brambles) and bushberries (blueberries, elderberries, gooseberries, etc.).

Propiconazole is in fungicide activity group 3, which includes the triazole fungicides such as Indar, Nova, and Procure, so none of these fungicides can be rotated with each other for resistance management purposes. For strawberries, Tilt and Orbit are labeled for control of anthracnose and powdery mildew. They are also labeled for a type of leaf spot and a rust that aren't usually a problem on strawberries in PA. In the berry crop group, Tilt and Orbit are especially useful for use in control of mummy berry on blueberries. Both can be used for leaf spots caused by *Septoria* spp. (usually only a problem on certain cultivars of blackberries), and for blueberry rust which is only occasionally a problem in PA. The re-entry interval is 12 hrs for Tilt and 24 hours for Orbit. With both Tilt and Orbit, the PHI is 0 days for strawberries and 30 days for caneberries and bushberries. Consult the labels for additional precautions and changes.

The label is the law concerning how the material in your possession can be used. (***Source**: The Vegetable & Small Fruit Gazette Vol. 11, No. 9 & 10, September & October 2007*)

Japanese Beetle Management for Organic Fruit Farms

Mary Barbercheck and Elsa Sánchez, Penn State University

Japanese beetles were out in force this year. Several growers noted this and we also had larger than typical populations at the research farm. In fact, they were found feeding on strawberries in our dayneutral plots. That's the first time we've seen that! If you're thinking about next year, below are some options for Japanese beetle management.

Both adult Japanese beetle adults and the soil-dwelling larvae (white grubs) can be destructive plant pests. Knowing the life cycle of Japanese beetle can help with understanding how to manage this pest. The mobile adult beetles feed on the foliage and fruits of several hundred species of fruit trees, ornamental trees, shrubs, vines, and field and vegetable crops. The larvae (grubs) develop in the soil, feeding on the roots of various plants and grasses and in high numbers can damage turf and pastures. Because adults and larvae live and feed in two different environments, management of each stage is quite different. A good IPM program incorporates a diversity of control

tactics – cultural, physical, biological, and when necessary, appropriate chemical controls – for vulnerable life stages of a pest.

The adults are present and feed and reproduce in early to mid-summer. During the feeding period, females intermittently leave plants, burrow about 3 inches into the ground – usually into sod or pasture – and lay a few eggs. This cycle is repeated until the female lays 40 to 60 eggs. By mid- to late summer, the eggs hatch, and the young grubs begin to feed in the soil. Each grub is about an inch long when fully grown and lies in a curled C-shaped position. In autumn, the grubs burrow 4 to 8 inches into the soil and remain inactive all winter. This insect spends about 10 months of the year in the ground in the larval stage. In early spring, the grubs move towards the soil surface and feed on grass roots until late spring, when they develop into pupae. Development of adults from the pupal stage takes about 2 weeks, after which time adults emerge from the ground. This life cycle takes a year.

Japanese beetle flight is greatest on clear days with temperatures between 84° and 95° F and winds less than 12 miles per hour. Arrival of new beetles into a field can challenge any control program. When these weather conditions exist, check plants frequently for new arrivals. A few beetles on plants or moderate damage will attract more beetles because they produce aggregation pheromones that will attract others to feed and mate. Also, volatile odors from damaged plants may attract more beetles and keep numbers high. Keeping numbers and damage low can result in fewer new arrivals.

Management of Adults

Cultural options:
Hand Picking: If you have only a few plants to protect, pick off the first adults that arrive and destroy these scouts that attract additional pests. Adults are less active in the early morning or late evening. They can be destroyed by dropping into a container of soapy water.

Plant selection: Plant non-attractive plants or remove attractive plants from borders of vulnerable crop area. Japanese beetles are highly attracted to plants in the apple (*Malus* spp., *Prunus* spp., *Rubus* spp.) family. They are also attracted to wild grape, Virginia creeper, linden and sassafras. Removing attractive non-crop species from the areas around your fields may help with management of adults. The adults do not like to feed on ageratum, arborvitae, ash, baby's breath, garden balsam, begonia, bleeding heart, boxwood, buttercups, caladium, carnations, Chinese lantern, cockscomb, columbine, coral bells, coralberry, coreopsis, cornflower, daisies, dogwood (flowering), dusty-miller, euonymus, false cypresses, firs, forget-me-not, forsythia, foxglove, hemlock, hollies, hydrangeas, junipers, kale (ornamental), lilacs, lilies, magnolias, maple (red or silver only), mulberry, nasturtium, oaks (red and white only), pines, poppies, snapdragon, snowberry, speedwell, sweet pea, sweet-William, tulip tree, violets and pansy, or yews (taxus). Having a well-dispersed mixture that favors non-preferred species can reduce the level of beetle-caused damage.

Ripe and damaged fruit removal: Adult Japanese beetles are attracted to ripe fruit; therefore, harvesting on a tight schedule as well as harvesting all ripe fruit helps manage this pest. Diseased and poorly nourished trees and plants are especially susceptible to attack by beetles. Therefore, keep your plants healthy. Also, prematurely ripening or diseased fruit is very attractive to beetles. Remove this fruit from the plants and the ground. The odor of such fruit will attract beetles, which are then in a position to attack sound fruit.

Physical options:
Row covers: Row covers may be appropriate for some high value, susceptible crops where larval populations do not exist or have been controlled.

Traps: Traps for adult Japanese beetles are commercially available. Under favorable conditions, a trap will capture only about 75% of the beetles that approach it. Traps operate primarily with a combination of a pheromone, or sex attractant and a floral lure to attract male and female adult beetles to the trap. Adult beetles can fly long distances, so those caught in traps may have come from up to a mile away. Traps are not recommended for general use unless special conditions can be met. Traps have been demonstrated to be effective in reducing damage and populations only when landscapes are isolated from other Japanese beetle breeding areas or when mass trapping (everyone in the area) is used. In most areas, traps tend to attract more beetles into the area than would normally be present. If you use traps, be sure **not** to put traps near your fruit crops or susceptible plants. Put them at the borders of your property, away from plants the beetles may damage.

Biological Control:
Japanese beetles are an invasive pest from Asia that entered the US without the parasites that keep it under control in its native lands. Two parasites of the Japanese beetle have been brought to the US from Asia. Researchers have established these insects in areas inhabited by the Japanese beetle, and the parasites are now functioning as important biological control agents of the beetle. These parasites are not yet commercially available; however, you can contact your local Extension educator to see if they are established in your area. If they are, planting the appropriate food plants will attract these parasites and increase the rates of parasitism, and help control the Japanese beetle on your property.

Parasites: Tiphia vernalis, a parasite of the Japanese beetle grub, and *Istocheta aldrichi*, a parasite of the adult, have been shown to be important in regulating the population dynamics of the beetle in the NE US. The fly, *Istocheta aldrichi,* is an internal parasite of the adult Japanese beetle.

The female flies are capable of depositing up to 100 eggs during a period of about 2 weeks. The eggs are usually laid on the thorax of the female beetles. Upon hatching, the maggot bores directly into the beetle's body cavity, killing the beetle. Because it does not take this fly long to kill the beetle, *I. aldrichi* can suppress Japanese beetle populations before beetles can reproduce. Another food source for *I. aldrichi* is aphid nectar deposited on Japanese knotweed (*Polygonum cuspidatum*), a persistent perennial weed native to Japan.

Chemical control:
Pyganic targets adults and is listed as a restricted product by OMRI (Organic Materials Review Institute) and can be used if other methods provide inadequate control.

Kaolin clay particle film (e.g., Surround) acts as a repellent by creating an unsuitable surface for adult feeding, and the white color may disrupt the insect's host-finding ability. Particles of kaolin act as an irritant to the insect. After landing on a treated surface, particles of kaolin attach to the insect's body and trigger an excessive grooming response that distracts the pest from feeding. Apply Surround a soon as beetles begin to emerge. Kaolin clay, especially when applied later in the season, may not be a good option for managing Japanese beetles on fruit for direct markets. The whitish coating left on fruit may discourage buyers.

Informing consumers about kaolin clay may be necessary to promote sales. Washing the fruit, particularly small fruit, prior to marketing can promote postharvest disease development and decrease shelf-life.

As always, contact your certifier to verify that using any product will not compromise your certification.

Management of Soil-Dwelling Larvae

Cultural options:
Removal of sod cover between rows: A survey in Michigan revealed farms using cultivation between rows had Japanese beetle larvae populations 72% lower compared to farms with sodded row middles. A study conducted in Michigan verified these results; cultivation of row middles in the spring and fall reduced Japanese beetle populations over 50%. Incorporation of cover crops and green manures into a rotation can help maintain soil quality, increase soil fertility, suppress weeds, prevent soil erosion and conserve soil moisture. Some growers are placing shredded bark mulch peat moss, straw, or similar material or landscape fabric between rows; although, this can be costly on a large scale.

Biological controls:

Nematodes: Insecticidal nematodes are microscopic insect-parasitic roundworms that actively seek out grubs in the soil. Upon infecting a grub, the nematode progresses through its own life cycle, reproducing and ultimately killing the grub. When the resources inside the nematode-killed grub are used up, the nematodes leave the cadaver to seek new host insects. The two nematodes that are most effective against Japanese beetle grubs are *Steinernema glaseri* and *Heterorhabditis bacteriophora*. The latter is commercially available. More information on using insect-parasitic nematodes can be found at http://www.ento.psu.edu/extension/factsheets/nematode.htm

When using nematodes (and any biological control), remember they are alive and should be ordered when needed and used in a timely fashion. They should also be protected from high temperatures and direct sunlight until used.

Bacteria: Milky spore is a bacterium that is applied to the soil to kill larvae. It is costly; although, at least one grower mentioned finding it in commercial quantities, therefore, making it more economical. When grubs eat spores in the soil, spores germinate in the grub's gut, and enter the blood, where they multiply. The buildup of spores in the blood causes the grub to take on a characteristic milky appearance. Milky spore disease builds up in soil slowly (over 2-4 years) as grubs ingest the spores, become infected, and die, each releasing 1-2 billion spores back into the soil. Milky spore disease can suppress the development of large beetle populations. It works best when applied in community-wide treatment programs. Check with your Extension educator regarding the availability of milky spore material.

Bacillus thuringiensis (Bt) var. *BuiBui is* a naturally occurring soil bacterium typically used as a microbial insecticide. The Bt strain registered for the Japanese beetle is for use on the grub stage only. Bt is a stomach poison and must be ingested to be effective. Apply it to the soil as you would insecticides. Effectiveness is similar to that of insecticides. Check with your Extension educator regarding the availability of *Bt* var. *BuiBui*.

Parasites: Tiphia vernalis is a small, parasitic wasp of Japanese beetle grubs resembling a large, black, winged ant. Its current distribution is believed to be throughout the NE US and south to North Carolina. After a brief period of feeding and mating during the spring, the female wasp digs into the soil, paralyzes a grub by stinging, and then deposits an egg on the grub. When the egg hatches, the emerging wasp larva consumes the grub. Other food sources for adult wasps of this species include the honeydew of aphids associated with the leaves of maple, cherry, and elm trees and peonies. In North Carolina, the nectar of tulip poplars has been found to be an important food source for the adult wasps. (***Source**: Penn State Vegetable and Small Fruit Gazette, Vol. 11, No. 9, September 2007*.)

Upcoming Meetings:

Nov 8-11, 2007 - **Farm Education Symposium**. Shelburne Farms, Shelburne, VT. For more information visit www.farmbasededucation.org or call Brooke Redmond at (617) 306-0090.

November 13, 2007 - **Greenhouse Tomato Conference** Sturbridge Host Hotel, Sturbridge, MA Topics include choosing varieties, nutrient management, managing plant vigor, biological control, hands-on grafting session, disease identification and management, tomato plant disorders and grower panel on growing and marketing ideas. 3 pesticide credits.
Sponsored by University of Massachusetts Extension, University of Connecticut Cooperative Extension System, University of Rhode Island Extension and Northeast SARE
Contact: Tina Smith, UMass Extension 413-545-5306 or tsmith@umext.umass.edu.

Dec. 11-13, 2007 - **New England Vegetable and Fruit Conference**. Manchester NH. See page 1 for more detailed information or go to http://www.nevbc.org/

December 14, 2007 **- Growing and Marketing Greener: Greenhouse Growers and Retailers**. Sturbridge Host Hotel, Sturbridge, MA**.** Topics include organic certification requirements for greenhouse ornamentals, principles of organic growing media and fertilizers for greenhouse production, biocontrol and pesticides for organic greenhouse growers, using biofungicides for diseases in greenhouses, choosing and using biodegradable pots, recycling plastics - film and containers, using biofuels, energy conservation, seasonal thermal storage, solar options and a panel on organic products for retailers. 3 pesticide credits
Sponsored by University of Massachusetts Extension, University of Connecticut Cooperative Extension System and Northeast SARE.
Contact: Tina Smith, UMass Extension 413-545-5306 or tsmith@umext.umass.edu.

Jan 15 – 17, 2008. **NJ Annual Vegetable Meeting** at the Taj Mahal in Atlantic City. For more information contract Mel Henninger at henninger@aesop.rutgers.edu .

Jan. 29-31, 2008. (A berry triple header!)
Mid-Atlantic Fruit and Vegetable Convention, Hershey Lodge and Convention Center, Hershey, PA. For more information Contact William Troxell, 717-694-3596.
Annual meeting of the North American Strawberry Growers Association will be held in conjunction with the Mid Atlantic Fruit and Vegetable Convention (above), and the National American Bramble Growers meeting (below). For more information: see news brief below or contact Kevin Schooley at kconsult@allstream.net or visit www.nasga.org.
NABGA Annual Bramble Conference will be in Hershey, Pennsylvania in association with the Mid-Atlantic Fruit and Vegetable Convention and the North American Strawberry Growers Association. For more information contact: Debby Wechsler, 1138 Rock Rest Rd. Pittsboro, NC 27312**, nabga@mindspring.com .**

Feb 7-9, 2008. **Pennsylvania Association for Sustainable Agriculture (PASA) 17th Annual Farming for the Future Conference**. Penn Stater Conference Center, State College, PA. For more information visit www.pasafarming.org .

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