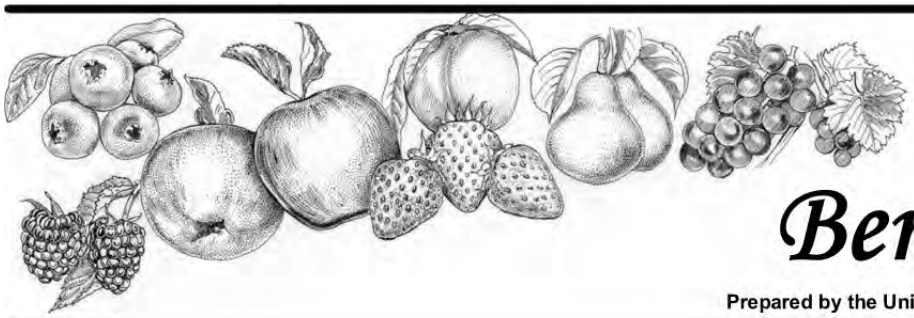

Berry Notes

Prepared by the University of Massachusetts Fruit Team

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IN THIS ISSUE:

Current Conditions:

Strawberries – row-covered fields and early varieties have begun harvesting. Other fields are progressing toward harvest, which should begin in many areas this weekend. Clipper damage is past in most areas, but tarnished plant bug is still active. Two-spotted spider mite may also begin to build up following high temps earlier this week. Also keep an eye out for strawberry sap beetle and slugs as fruit ripens. ***Raspberries*** – many summer bearing varieties are in bloom. Tarnished plant bug may be active in raspberries at this time. Avoid insecticide applications during bloom to protect pollinators; pre-bloom or immediate post-bloom applications can be made. Be ready for fungicide applications to control botrytis gray mold during bloom. Also, scout for symptoms of orange rust. ***Blueberries*** – are past bloom and progressing to 'berry touch'. Continue to scout for signs of cranberry fruit worm. First sprays for this pest are guided by declining trap catches, which happens around the time of berry-touch. Get ready to set out traps for blueberry maggot (more on this next time). Winter Moth continues to threaten blueberries in some areas. Caterpillars are too large for B.t. products to be effective. See the Winter Moth fact sheet for control options ***Ribes*** – fruitset appears to be excellent. Watch for Imported Currant Worm and Currant Borers at this time. Also watch for powdery mildew infections. Hot weather can cause significant fruit drop; overhead irrigation for evaporative cooling may be needed as fruit ripens. ***Grapes*** - are in pre-bloom but early varieties may reach bloom in some areas very soon. This is the most important stage for disease management in grapes. Grape berry moth are beginning to show up in traps. Also scout vineyards for grape cane girdler, flea beetle larvae and European red mite at this time.

ENVIRONMENTAL DATA

The following growing-degree-day (GDD) and precipitation data was collected for a one-week period, May 27, 2009 through June 2, 2009. Soil temperature and phenological indicators were observed on May 26, 2009. 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	2009 GROWING DEGREE DAYS		Soil Temp (°F at 4" depth)	Precipitation (1-Week Gain)
	1-Week Gain	*Total accumulation for 2009*		
Cape Cod	60	383	68˚F	0.40"
Southeast	50	411	65˚F	0.38"
East	44	453	54˚F	0.30"
Metro West (Waltham)	63	450	67˚F	0.50"
Metro West (Hopkinton)	44	484	75˚F	0.55"
Central	49	402	52˚F	0.65"
Pioneer Valley	45	444	60˚F	0.66"
Berkshires	53	443	64˚F	0.97”
AVERAGE	51	434	63˚F	0.55"

(***Source****: UMass Extension 2009 Landscape Message #14 June 5, 2009*) *-- = information not available*

STRAWBERRY

Strawberry Anthracnose: Cultural Control Options

Barbara J. Smith and Thad Cochran , USDA, Agricultural Research Service

Anthracnose generally refers to diseases of many fruit and vegetable crops worldwide caused by fungi belonging to species of *Colletotrichum*. Anthracnose diseases of strawberry are caused by three species, *C. fragariae*, *C. acutatum*, and *C. gloeosporioides.* All produce similar symptoms and may infect the fruit, crowns, flowers, petioles, runners, leaves, and roots of the strawberry plant. Anthracnose fruit rot, caused by *C. acutatum*, is an important disease that affects strawberry production worldwide, and anthracnose crown rot, caused by *C. fragariae* and *C. gloeosporioides,* is destructive in strawberry nurseries and fruit production fields particularly in the southeastern U.S. Increased losses due to anthracnose fruit and crown rots in the U.S. since the 1980s may be related to the shift from matted row culture to the annual plasticulture production system, as well as a change in cultivars. While fungicides are generally used to control anthracnose, cultural practices may be modified to reduce the incidence and severity of anthracnose in nurseries and production fields.

Anthracnose Pathogens

The greatest economic losses due to anthracnose on strawberry are from fruit rot caused by *C. acutatum.* This fungus also infects many other fruit and vegetable crops, including apples, tomatoes, peppers, peaches, blueberries, blackberries, and grapes. The presence of the pathogen has been reported on strawberries in almost all areas of the world where they are grown. Crown infections of strawberry plants by *C. acutatum* often result in stunted plants rather than plant death; however, infected plants usually do not thrive after transplantation and produce few berries at harvest.

Colletotrichum fragariae was assumed to be the causal agent of strawberry anthracnose in the U.S. until 1986 when the presence of *C. acutatum* on strawberry was reported in the U.S. In the late 1970s, *C. gloeosporioides* was identified as the causal agent on plants obtained from Arkansas and North Carolina nurseries that died from a crown rot identical to that caused by *C. fragariae.* It has a wide host and geographic range and causes anthracnose crown rot, petiole lesions, and leaf spots indistinguishable from those caused by *C. fragariae*.

Anthracnose Disease Symptoms

Fruit and flower: All three *Colletotrichum* spp. may cause anthracnose flower blights and fruit rots. Lesions on ripe fruit begin as whitish, water soaked lesions up to 3 mm in diameter, later turning a light tan to dark brown and eventually becoming sunken and black. Under high humidity, the lesions will be covered with pink to orange to light salmon-colored spore masses in 2 or 3 days. Infected fruit eventually dry down to form hard, black, shriveled mummies. On green fruit, anthracnose lesions are small (1/16 to 1/8 inch across) hard, sunken, dark brown or black, and infected seeds (achenes) on these fruit turn black and are slightly sunken. Infected green fruit mummify rather than ripen. Fruit can be infected at any stage of development, but green fruit are much more resistant to infection than fully ripe, pink or white fruit.

Fully open flowers are more susceptible to infection than closed buds. Infected flowers dry quickly, and dark lesions spread down the pedicel from the flower; or the pedicel may be infected first, then it is girdled and the bud dies. Sepal infections occur as the bud is emerging from the crown. Sepals dry and turn brown; the resulting tip burn resembles that caused by excessive fertilizer. When warm, humid conditions prevail during bloom, all parts of the flower truss may die and remain attached to the plant giving them a blighted appearance. Small black spots on young button-sized fruit may also develop from flower infections.

Petioles and Stolons: Each of the three *Colletotrichum* spp. causes petiole and stolon lesions which are dark brown or black and sunken and often girdle the petiole or stolon. Pink masses of spores are usually visible near the center of each lesion. When petioles or runners become girdled, individual leaves or entire daughter plants may wilt and die. Petiole infections occur at the base of the petiole, causing the leaf to bend sharply at the point of attachment and hang down.

Leaves: Black leaf spot, typically caused by *C. fragariae* and *C. gloeosporioides*, is characterized by grey or light black spots that usually are not necrotic and are peppered across the top surface of the strawberry leaflets. While the fungi do not sporulate in these leaf lesions, the presence of leaf spots may be a warning signal that abundant inoculum is present on other plant parts and anthracnose control measures should be implemented. Irregular leaf spot, caused by *C. acutatum*, has dark brown to black lesions forming on leaf margins and tips and extending along the margin and inward to the midrib. These lesions do not continue to develop in fully expanded leaves but infected leaves may persist on plants for several months. The fungus sporulates in these lesions and may serve as an inoculum source for flower blight and fruit rot.

Crowns: Anthracnose crown rot, caused by either *C. fragariae* or *C. gloeosporioides,* is first apparent by the wilting of the youngest leaves in the hottest part of the day. The young wilted leaves may appear to recover and become turgid in the evenings; however, most plants will wilt and die after a few days. Shortly after a plant wilts, a red discoloration appears within the crown tissue, after the plant has been dead for several days, the crown tissue turns dark brown to black. The fungus moves into the crown from petiole or stolon cankers, or an infection may start from spores washed by rain or irrigation into the center bud. *C. acutatum* also may cause crown death; however, typically a single side crown is infected rather than the entire crown, and infected plants are stunted but do not die. *C. acutatum* also causes root lesions.

Anthracnose Infection Process and Pathogen Dispersal

Infected transplants and soil from infected transplants are the primary source of inoculum in most fields, especially in annual production systems. This is especially true for *C. fragariae*, which has a limited host range and does not survive in soil over the summer. In perennial systems, the fungi may remain in infected plants and debris, providing inoculum for the following fruiting season. Spores are dispersed in the field by wind-driven rain, splashing water, insects, or by the movement of workers, equipment or animals. Disease development and spread is minimal under cool, dry conditions. Crown infections often occur in the nursery but do not appear until after transplanting into production fields where the fungus continues to develop. Infected plants may suddenly die during warm weather in the fall or early spring of the following year.

Anthracnose is a warm-weather disease with an optimum temperature for plant infection by *C. fragariae* between 80 and 90 °F. The disease is generally not a problem in cooler production areas unless warmer temperatures and rainfall prevail during fruit set and harvest. The optimum temperature for *C. acutatum* fruit infections is 68 °F. Both fungi need nearly 100% relative humidity for spore germination and infection to occur. Under rainy, warm conditions anthracnose spreads very quickly and may destroy the entire crop. The time from infection of the strawberry by *Colletotrichum* spp. to first sporulation is an important factor in the speed at which anthracnose may spread within a field and depends on the temperature and ranges from 2 to 3 days at 25 oC to 6 to

17 days at 5 oC. Spores produced by *C. acutatum* on symptomless foliage may be a significant source of inoculum for fruit infections and may also contribute to the availability of inoculum throughout the growing season. *Colletotrichum* spores may survive up to eight weeks on leaves and up to five weeks on fabric. The formation of spores on leaves increases when exposed to flower extracts compared to when exposed to leaf extracts or water suggesting that *C. acutatum* inoculum levels on strawberry foliage may increase during flowering.

Rain splash is the primary means by which *Colletotrichum* spp. spores are spread from plant to plant in the field. Most fruit infection occurs in a 10 inch (25 cm) radius of the source of the inoculum, which is often another infected fruit. *C. acutatum* spores may survive in soil and plant debris under dry conditions for up to 12 months, but die rapidly under moist conditions, i.e. when soil moisture is greater than 12%. When strawberries are planted in infested soil, they may become infected when soil containing spores is splashed onto crowns or stems by rain or irrigation water. In fields that have been fumigated, the disease usually originates on infected nursery stock or from strawberry plants in adjacent fields or from weeds that are known to be hosts of the pathogen. In addition, inoculum can come from contaminated soil on field equipment or be blown in from nearby weeds and other plants around production fields that were colonized by inoculum from a previous diseased strawberry crop. While many other fruit and vegetable crops are known to be hosts of *C. acutatum,* molecular analysis of *C. acutatum* revealed that the population on strawberry reproduces asexually and has limited diversity.

Anthracnose Cultural Control Measures

1. Use clean transplants. Since disease-free transplants are the primary control of anthracnose crown rot and fruit rot, always purchase disease-free transplants from a reputable nursery. To lessen their risk of purchasing anthracnose infected plants, strawberry growers in the southeastern U.S. were advised to obtain their transplants from nurseries in the northern U.S., Canada, or California that were believed to be outside the range of *C. fragariae*. However, *C. acutatum* does occur in these areas so purchasing plants from nurseries in these areas does not guarantee that they will be free of anthracnose. Anthracnose-free transplants can be produced in regions where the disease is present by locating nurseries away from areas where strawberries are grown commercially and limiting the movement of personnel and equipment from production fields into nursery fields.

2. Inspect Fields Regularly. During the growing season, watch for anthracnose symptoms. If infected plants are found promptly remove and destroy (bury or burn) them and all plants within about a 10 foot radius. Pay close attention to developing fruit during times of high moisture levels particularly following rains or sprinkler irrigations. If fruit rot appears in a small area of the field or before the plant canopy is well developed, foliar fungicides may be necessary to prevent further spread of the disease and reduce crown infections.

3. Reduce Inoculum Spread. Anthracnose spreads within a field by splashing water and is especially severe in fields mulched with plastic. Straw, as well as, and living mulches (such as wheat, rye, or rye grass) in row middles will reduce splash and disease spread within a field. Sublethal doses of grass specific herbicides such as Poast® may be used to prevent excessive growth of rye grass. Anthracnose is less severe when water is supplied to plants using drip irrigation rather than overhead irrigation.

4. Remove Inoculum from Field (Sanitation). The best control of anthracnose is to keep the pathogen out of the strawberry fields. New fields planted with healthy transplants can be established and kept disease-free if they are located some distance away from diseased fields. To reduce the buildup of anthracnose fruit rot in the field, harvest fruit frequently and remove all rotten fruit from the field. To reduce the spread of inoculum, do not work in the field during wet conditions. Infected areas of a field should be harvested last in the day or workers should wash up and change to clean clothes when they must enter uninfected areas of the field after they have harvested areas where fruit rot is present. Clean field equipment before using it to ensure that contaminated soil and plant parts are not transported into a field or from an infested part of the field to a non-infested section.

If transplants are suspected to be contaminated with the fungus, thoroughly wash all soil from them before planting to remove most of the inoculum. Plants that have been in long-term cold storage (28°F) may be treated with hot water before transplanting by dipping trays of the transplants into a hot water bath for 7 minutes before planting to kill the fungus. Thoroughly wash these plants before treatment to remove all dirt; then place them in a circulating water bath held at a constant temperature of 120°F. Immediately after the hot water treatment, immerse the transplants into cold water and plant them as soon as possible. This hot water treatment is not recommended for fresh-dug transplants that have only been stored at 33°F.

5. Soil Solarization: Solarization has been shown to be effective for the control of soil-borne pathogens and weeds in areas where high soil temperatures can be obtained. Solarization is carried out after the beds are formed and can be effective if weather conditions are ideal, i.e., 30-45 days of hot weather that promotes soil temperatures of at least 122°F down to about 14 inches.

6. Use Nitrate Fertilizer. The use of calcium nitrate rather than an ammonium form of nitrogen will reduce the severity of both anthracnose crown rot and fruit rot in

production fields. In a greenhouse study strawberries grown in soils with high levels of nitrogen, especially from ammonium sources, were more susceptible to anthracnose than plants grown in soils with lower nitrogen levels or those with higher levels of nitrogen supplied as calcium nitrate.

7. Manage Weeds in and around the Field. Crop rotation with a non-host crop will reduce levels of the pathogen in the soil. Good weed management in and around the field will destroy weeds that may harbor the pathogen. It is important to remove the weeds from the fields after they are destroyed because the pathogen can still produce spores even though the weeds are dead. Surrounding production or nursery fields with a tall, non-host crop, such as sorghum, will reduce spore movement into the field from adjacent contaminated fields.

8. Plant Anthracnose Resistant Cultivars. Breeding for genetic resistance to anthracnose and the development of resistant cultivars is a primary means of reducing economic losses due to this disease. This is environmentally sound because it results in reduced use of fungicides. In Florida, planting resistant cultivars such as Carmine and Sweet Charlie has consistently controlled anthracnose; however, when moderately susceptible cultivars (e.g., Strawberry Festival) or highly susceptible cultivars (e.g., Camarosa and Treasure) are grown, regular applications of fungicides are usually needed to suppress anthracnose.

9. Use Fungicides. In areas where anthracnose pressure is very high, such as in the southeastern U.S, cultural practices may not provide adequate disease control, and protective fungicide treatments applied from bloom through harvest may be necessary to achieve an acceptable level of disease control. Fungicide dips can be used on transplants before planting in production fields, and foliar fungicides are available for use on plants when the disease is present and conditions are ideal for foliar and fruit disease development. Strobilurin fungicides such as Abound® or Cabrio® may be tank mixed with a protectant fungicide. Captevate®, Pristine®, and Switch® are useful during bloom because each fungicide contains two active ingredients; one for anthracnose control and another for botrytis control.

Organically Acceptable Methods: Most of the cultural controls discussed in this paper, including organic mulches, soil solarization, washing soil from crowns before planting, hot water treatment and crop rotation, are acceptable for use in an organically grown crop. Since inoculum tends to readily build up in multi-year plantings, the use of annual planting will reduce the severity of anthracnose.

Conclusions

Our knowledge of the anthracnose pathogens and the epidemiology of anthracnose diseases has increased and thereby has improved our ability to control these diseases. Changes in cultural practices have resulted in reduced levels of disease. At the same time, development of more effective fungicides and their registration for use on strawberries have greatly reduced losses due to both anthracnose crown rot and fruit rot. Anthracnose resistant cultivars have further reduced economic losses due to these diseases. Even so, growers may sustain severe losses when environmental factors are highly favorable for anthracnose development.

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(***Source**: NY Berry News, Vol. 8, No. 5. May 2009, Reprinted with Permission from: Proceedings of the Annual Conference of the North American Strawberry Growers Association, New Orleans, LA, January 2009*).

Strawberry IPM Update from Maine

David Handley, Univ. of Maine

Situation: Early strawberry varieties in southern Maine are now in full bloom or slightly beyond, while later varieties are just coming into bloom. Many areas had a frost this week and damage reports have varied from light to moderate, depending on the stage of bloom and the growers' ability to get the irrigation turned on in time. The approach of bloom means that it is time to manage gray mold. This fruit rot is best controlled by applications of an appropriate fungicide at 10% bloom and full bloom, with follow-up applications if the flowers are exposed to prolonged periods of wet weather. Insect pests are also starting to be of concern this week, as we have seen fields over threshold for clipper, tarnished plant bug and two-spotted spider mites.

Strawberry bud weevil or "clipper" is becoming more active in strawberry fields this week. We continue to find signs of adult feeding activity (holes in flower petals) and three fields (Cape Elizabeth, Dresden, Monmouth) were over the control threshold of 1.2 clipped buds per two foot sample. Clipping activity is likely to increase on later-flowering varieties with warmer weather and more flower buds becoming available. Remember that damage is usually first noticed at the edges of the field, and that border sprays may be effective in larger fields. If the field has a history of clipper problems it is likely to exceed threshold every year.

Tarnished plant bugs are also becoming more active. We continue to see adult bugs in the fields and some small nymphs. Only two fields have been over the threshold for nymphs to date, but overwintering adults may still be laying eggs, and we should be seeing higher nymph populations as the weather starts to improve. The nymphs are small, active, yellow-green insects. It is important to scout for the nymphs regularly, as they can show up quickly in warm weather. Be on the alert and scout your fields often.

Two-spotted spider mites: The extended cool wet weather appears to be keeping two-spotted spider mites in check for most fields this week. Only one field in Cape Elizabeth was over the threshold of 25% of leaves infested. However, spider mites can reproduce rapidly under warm, dry weather, so it is important to scout for them regularly. Miticide options for strawberries include Acramite, Savey®, Zeal®, Vende®x, Oberon®, Brigade®, Danitol®, Thionex® and JMS Stylet oil® (oils will cause plant injury if used in combination with captan or within 14 days of an application of sulfur).

Root weevils: We have observed some plantings of strawberries infested with the grubs of black vine weevil and strawberry root weevil this spring. Infested plants appear week and stunted, usually in somewhat circular patches in a field. Digging under the plants will reveal small (1/4 -1/2") crescent-shaped legless grubs. It is too late this spring to control the grubs with an insecticide drench. Once the adults become active, bifenthrin (Brigade®) will provide some control if used at the highest labeled rates. The best timing for this spray is at night during the peak feeding activity of adults, before

they start laying eggs, or about 1 week before harvest ends.

Platinum® (thiamethoxam) insecticide may be applied as a soil drench when the next generation of grubs is active in the fall.

Slugs are likely to be a problem in some fields this season. Moist conditions encourage the presence of these mollusks. Slugs usually feed at night, leaving large holes and tunnels in ripening fruit. Baits such as Deadline® and Sluggo® offer some control of slugs, but should be used prior to fruit ripening. Pay close attention to label instructions and precautions. Baits should also be applied to the fields in mid-September if slugs have been a problem, to reduce egg-laying.

Diseases

Bloom is the critical time to protect the fruit against **gray mold**, especially when conditions have been damp. Two to three sprays of fungicide during bloom will usually provide good protection against this disease. Most locations in southern Maine are now in full bloom and are applying their second fungicide application. Remember to alternate fungicides with different modes of action for resistance management purposes.

Leather rot (*Phytopthora cactorum*) may also be a problem because of the all the water in the fields. Foliar sprays of Aliette®, Agri-Phos® or Phostrol® during bloom and fruit development may provide control. These fungicides will not provide control of gray mold.

Red stele root rot: The cold damp soil conditions have helped maintain conditions for red stele root rot infection. Weak plants in low areas of the field may be infected. To diagnose red stele, pull up a few plants that look weak and scrape the roots to see if the center of the root is rusty red in color, instead of the normal white. The red color would indicate an infection. Symptoms are most evident in cool wet springs, and can be mistaken for winter injury. Ridomil Gold®, Alliette® or Phostrol® are fungicides that can be applied in the spring for control of red stele. Many varieties have some level of resistance to the disease, but the most effective management strategy is to plant only into well-drained soils, and or plant on raised beds.

Powdery Mildew: Periods of humid weather can often stimulate symptoms of powdery mildew on strawberry plants. The most obvious indication of this fungus is the upward curling of the leaves. Purple or reddish blotches, and/or white, powdery growth may be observed on the undersides of the leaves. Mildew infections weaken plants and can reduce yield the following year. Some varieties are more susceptible than others, for example Annapolis is quite susceptible, while Mira and Mesabe are thought to be resistant. Abound®, Captan, Pristine®, Cabrio®, Topsin-M® and Stylet oil are presently registered to control powdery mildew. (***Source**: Maine Strawberry IPM News, No. 2, 5/29/09*)

RASPBERRY

Monitor for Orange Rust in Brambles

Annemiek Schilder, Michigan State University

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

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*)

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.

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

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.

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.

Disease Management

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

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

Cranberry Fruit Worm Management in Blueberry

Rufus Isaacs and John Wise, Michigan State Univ.

Cranberry fruitworm is one of the key insect pests of blueberry in Michigan, infesting the crop during and after bloom. Moths usually start flying during bloom, and this year is no exception. The first male moths have been trapped over the past week in Van Buren and Allegan counties, coinciding with peak Jersey flowering.

Once moths are flying and petals start falling off young fruit, growers should protect these blueberry fields to prevent crop infestation by the larvae that bore into berries and web them together. The aim of managing this pest is to minimize the number of larvae that bore into the fruit, but timing sprays for fruitworms can be challenging in some years. MSU entomologists have developed a simple degree day model to help growers know when to start protecting berries from fruitworm infestation. Using degree days to make sure you don't miss the start of fruitworm flight is expected to improve the effectiveness of your insect management program. Implementing degree-day based management for cranberry fruitworm requires the following:

- Monitoring traps to detect moth flight and biofix.
- A method to track insect development.

Monitoring traps

We recommend the sturdy large plastic delta trap to monitor fruitworms, because these withstand rain and irrigation intact, plus they can be used for multiple years.

Place one to two traps per field near historical fruitworm hot spots or near woods next to fields. Place the trap baited with a lure containing the fruitworm sex pheromone in the top third of the bush. Moths are predicted to start flying at 375 degree days (base 50) after March 1. Because of this timing, traps should be in place by the start of Bluecrop bloom, and checked twice each week until moths are trapped. Regular checking allows you to detect the *first sustained* catch of moths (biofix), the peak of moth activity, and how long moths are active. First sustained catch is when one or more moths are trapped in consecutive trap visits. The biofix (point at which degree days should start being counted) is the date immediately before this, i.e. the date at which zero moths were trapped, right before the start of the flight.

Degree day model

Our research has shown that egglaying by cranberry fruitworm starts between 80 and 100 GDD days after biofix. The MSU Enviroweather program now includes a cranberry fruitworm model page, accessible online at **www.enviroweather.msu.edu**. Degree days are tallied automatically for the numerous weather stations across Michigan, and this system also predicts degree days totals for the week ahead. This can allow growers and consultants to look at when the target degree day accumulation is expected to be reached, helping to plan sprays ahead of time.

If you have not used degree days in your pest management program before, there are some useful resources online to explain them. One is at: **www.ipm.ucdavis.edu/WEATHER/ddconcepts.html**. Your local MSU Extension educator will also be able to help with how to monitor degree days on your farm, or how to access information from the nearest weather station.

A short note on cherry fruitworm

There is no degree day model for this pest in blueberries, but we have been trapping this insect in the past few weeks. In fields that have experienced infestation in past years and where moths have been trapped this spring already, protection of the young fruit should be considered as petal fall starts to expose the fruit to egglaying.

Preventing frutworm infestation

Fields requiring protection against cranberry fruitworm should be treated using an insecticide applied to achieve excellent coverage of the berries. This will improve the chance that larvae are controlled. In high pressure fields, the first application is usually during bloom, so growers should use the bee-safe insecticide Intrepid (at 12 oz/ac) or a *B.t.* based product such as Dipel or Javelin starting at 50-100 GDD after biofix. Follow label directions regarding bee safety. A follow-up spray may be needed, with the timing of this depending on the residual control provided by the first spray, the amount of new fruit-set since the first application, whether bees are still in the field, and the amount of rain.

Once bees are removed from the fields, broad spectrum insecticides become an option that growers can consider for protecting their berries from fruitworm infestation. Guthion, Imidan, Lannate, Asana, Mustang Max, Danitol, and Sevin are effective broad-spectrum insecticide options available to blueberry growers. With all these products, maintaining good coverage of the fruit clusters is still important, to get residue to the parts of the berry where fruitworms are found, such as in the calyx cup where eggs are laid. The larvae of the two fruitworm species chew into the berries in this location, with cranberry fruitworm larvae preferring to enter berries at the stem end. Because these insects move over such a small distance, it is important to use sufficient water and to consider spray additives (spreader-stickers) that will help spread the material across the berry surface.

EPA's phase-out of Guthion will remove this insecticide from blueberry production by the end of 2012. Given the current reliance on this chemical for fruitworm control, it would be wise for growers to test alternative programs on a few fields this season, so that an effective fruitworm control program is in place when Guthion is completely restricted. There are many options for chemical control of fruitworms, including some recently-registered products such as Assail and Delegate that have performed well in our recent trials at research stations and at commercial farms.

Research trials in Michigan have demonstrated that Intrepid or Confirm applied after bloom to fields with low or moderate fruitworm pressure can also achieve control of these pests. These insecticides have the benefit of minimal negative impact on natural enemies such as parasitic wasps, ladybeetles and lacewings, plus long residual activity because of resistance to wash-off and ultraviolet breakdown. In trials conducted at commercial blueberry farms over the past few years, a program that used Confirm or Intrepid during bloom followed by Asana post-bloom was similar in performance to a Confirm, then Delegate, then Assail program, and these were similar to performance of a Confirm then Guthion program. For organic growers, formulations of B.t. such as Dipel, Javelin, etc. and the spinosyn insecticide Entrust provide good control, but they must be reapplied every four to five days, and they are not resistant to wash-off. (***Source**: Michigan Fruit Crop Advisory Team Alert, May 26, 2009*)

Aphids and Blueberry Scorch Virus

Cesar Rodriguez-Saona, Dean Polk, Rutgers University

Aphids: About 55% of samples were positive for aphid infestation this past week, with 9% over the 10% of infested shoots level. This is an increase since last week, but many sites are showing good predator activity. Predators can significantly depress an aphid population, particularly if harsh insecticides are avoided.

Biology and Life Cycle. Aphids are soft bodied, slow moving insects. The adults are on average about 2 mm long, light to dark green. They have piercing-sucking mouthparts, and two siphunculi (cornicles) that protrude to the rear from the 6th abdominal segment. Nymphs resemble the adults, but are smaller and wingless.

There are four principal species of aphids that attack blueberries. These include: the blueberry aphid, *Illinoia pepperi* (present in Michigan), *I. azaleae* (present in New Jersey), the (western) blueberry aphid, *Ericaphis fimbriata*, and the green peach aphid, *Myzus persicae*. Aphids overwinter as eggs, which are deposited on stems and small shoots. Eggs hatch in the spring. At this time of the year, immatures feed on tender new growth, usually on the undersides of leaves at the top or bottom of blueberry bushes. During most of the season, females produce more females (newly emerged nymphs) by live birth, which in turn produce more live females (Figure 1). Males and egg-laying females are produced in the fall. There are several generations per growing season.

Damage. Aphids suck sap from tender growth and new shoots, especially from developing terminal foliage. Under heavy populations, a sooty mold can develop on the honey dew secreted by the aphids. This is usually of minor importance in blueberries, since growers seldom allow aphid populations to build up to high densities. Of more importance is the fact that many aphids function as disease vectors. In blueberries aphids can transmit blueberry scorch virus (BlScV) and its several strains.

Monitoring and Control. Since disease transmission is a main concern in commercial blueberry farms, only very low aphid populations is tolerated, especially if BlScV is a known problem. Aphids may be present while bushes are in bloom, but populations don't start to build up until after bloom. Monitoring should begin as soon as bees are removed and continue through at least the first picking. Sampling should be biased in new terminal growth, and data recorded as the percent of terminals infested with aphid colonies. Where disease transmission is an issue, a colony should be defined as a minimum of 1-2 aphids, either nymphs or adults. Treatment is justified if greater than 10% of terminals are infested with live aphids. The neonicotinoids Assail, Actara, and Imidacloprid (e.g. Provado) provide good aphid control. Lady beetles, lacewings, syrphid flies, and other biological controls are often abundant in blueberry farms at this time of the year and may help maintain aphid populations at low levels. (***Source**: Blueberry Bulletin, Vol. XXV, No. 9*)

GRAPE

June Disease Management – Prebloom/Bloom/Postbloom
Gear Up for the Main Event

Jim Travis & Bryan Hed, Penn State University

Viewing SkyBit weather reports for the month of May reveals that all parts of the state have experienced unusually high rainfall events, frequent windy days and extremes in temperature. In all locations, except Erie County, early May was wet for an extended period of time just as grape buds were breaking and new shoots developing. Significant wetting events in all parts of the state in mid-May and late May combined to make May a difficult disease management month. Generally, temperatures have been cool with a few warm spikes. Frost damaged new growth in several PA locations in May.

By theses reports and accounts from growers this has been a challenging spring to provide grape vines and emerging clusters protection from disease infection. Growers have had to adjust management plans to heavy and frequent rain events, high winds, with cold and even freezing temperatures. In addition, on top of challenging spring weather, grape growers have had to consider the dilemma of fungicide resistance with resulting questions,

which material is still effective, what rates are best, how many applications are needed and how often to spray?

So, how have you done? Your vineyard has the answer and may help you prevent spread to the fruit. Pick your most susceptible cultivars or areas of the vineyard with a history of disease. Walk into your vineyard and take a look. If you don't see any disease keep looking, you've not looked in the right place.

Phomopsis is commonly best seen at this time of year next to old wood. The base of the green shoots will reveal dark elongated lesions and the nearby leaves will have very small, pinpoint black specks often with yellow hallows. If you see these symptoms you know that your protectant fungicide program was insufficient. If you are to prevent Phomopsis fruit infection from this point on you will need to improve your program.

Black Rot is also often first seen near old wood or a missed cluster stem from last season. The lesions are most often round and the diameter of a pencil eraser with tiny black specks in the very center. Again, if you see these symptoms you are warned that so far this season your fungicide program has been insufficient and black rot fruit infections are likely unless you make significant improvements.

Downy Mildew has begun to show up in vineyards on the oldest leaves (base of shoot) with white spore masses visible on the underside of the leaf. If present, check your fungicides for efficacy and review application records.

Powdery Mildew – although infections may have occurred earlier in the season, you won't be able to see it yet. Keep up the spray program and you'll see the result in clean fruit or powdery mildew infected fruit at about fruit set.

Botrytis –first infections will occur during bloom, so nothing is visible yet, BUT wet spring weather favors the abundance of Botrytis spores during bloom. Beware!

What to do next? Early June begins the most critical period to control grape diseases. The leaves and fruit are highly susceptible at this time and weather conditions during this period will at some point be ideal for infection. It is good if you have kept the leaves and fruit free of disease up to now. It will reduce the risk for leaf and fruit infections during the prebloom/bloom/postbloom period. However, there is plenty of disease inoculum even in a 'clean' vineyard to cause crop loss and extensive leaf infection.

Planning your spray schedule for prebloom/bloom/postbloom.
Don't forget to apply effective fungicides for each of the problem diseases in your vineyard. Risk levels will vary between cultivars and carry-over pressure from last season. Check the latest production guide for recommendations for the best fungicides for your vineyard.

It is generally wise to increase spray water volumes and reduce travel speed to improve spray coverage as the canopy fills in and highly susceptible grape clusters require uniform coverage.

Always spray before it rains. At the end of a spray interval don't delay or extend the next spray until after it rains. Most fungicides are more effective if applied before the rain as protectants. As long as the spray residue dries, systemic fungicides are safe inside the leaf or fruit and surface fungicides (example Penncozeb or captan) can withstand up to an inch of rain and still maintain effectiveness. If rains are more than an inch, shorten the next spray interval.

Wind is a problem. Coverage is the key to good disease control with fungicides. Most sprayers, even large sprayers can not 'fight' the wind. Adjust spray application times to minimize the affect of wind. Disease outbreaks can be traced to poor coverage of fungicides on windy days.

Fungicide resistance is the biggest unknown in development of effective disease management programs. You should know that the grape disease fungi in your vineyard have adapted to your 'best' fungicide programs of the past. Apply the same fungicides, in the same way and the disease causing fungi are ready for you. But, if you change up materials, rotate fungicides with different modes of action, improve coverage and timing, you will maintain effective disease management in your vineyard. It seems 'risky' to change what has worked so well in the past but the real risk is to keep on using the same fungicides. The best fungicide programs, used season after season, will fail.

Final Comments. This spring season has been a challenge but good disease management is possible. Think through and implement your disease management strategy without taking chances and you can anticipate a clean crop at harvest. (***Source**: PA Wine Grape Information, June 1, 2009*)

GENERAL INFORMATION

Fungicides for Disease Control in the Home Landscape

Jay Pscheidt, Oregon State University

Many fungicides are registered for use on plants, but only a few are readily available to gardeners. They are not restricted in use or categorized as highly toxic. Often they are difficult for the average gardener to obtain in small

quantities. Several companies cater to the backyard grower by packaging in small quantities and selling through local variety stores or garden centers. Some labels, however, do not specify for "home owners only" and therefore are not recommended in Washington. In the Host and Disease Descriptions sec-tion of this book, materials available in homeowner formulations and packaging are identified with the symbol .

Some of the fungicides, such as the sulfur and copper products, can be used for growing organic produce. Others, such as captan, triforine, and chlorothalonil, are synthetically produced and not used for organic gardening.

Fungicide names can be very confusing at first. Plant pathologists usually refer to them by their general or common name such as chlorothalonil. Manufacturers and retailers use trade names. For example, chlorothalonil is packaged as Daconil 2787, Fungonil, or Multi-Purpose Fungicide for the home market, and as Bravo or Exotherm Termil for commercial markets. The differences are in the formulation (such as a liquid or powder), in how much active ingredient there is per unit of weight (10%, 50%, etc.) and in how it is used (as a spray or drench, for example). Some products, such as a generic flower or fruit spray, may contain more than one type of chemical, usually an insecticide and a fungicide together. The ingredient list on the label will tell you what is in the product.

The label is the law. No matter what anyone else says, always follow label directions. To do otherwise is against the law. However, there are some specific exceptions. If the label says to use a certain amount of product, you cannot use more of it. You can use less, but only if it is still effective at the lower rate. Never use a product on a plant that is not listed on the label. You can use a product to control a disease that is not listed on the label as long as it is effective and the plant is on the label.

Some fungicides work better (stay on the plant longer or spread over the leaf surface) if a spreader sticker (such as Sta-Stuk-M) is mixed with the solution. It is usually a good idea to add these materials to powders or dusts to be sprayed on plants. Liquid fungicide formulations usually already include such compounds.

Understanding the disease cycle, proper timing, coverage and selection of the right fungicide are needed to get good control using fungicides. Many fungicides work by protecting healthy plant tissues. Captan, copper products, chlorothalonil, and sulfurs must be present before fungi begin the infection process. Although myclobutanil and triforine are locally systemic, they must be applied soon after (or before) infection for maximum benefit. None of these fungicides can revive heavily diseased plants.

The following chemicals are listed first by their common name, then by trade names used for the homeowner market. The chemical and its uses are then described.

Captan (Hi-Yield Captan Fungicide) - One of the best all-around, general-purpose fungicides for controlling a huge variety of plant diseases, but it is not very good against powdery mildews and rusts. Captan is labeled for ornamentals, lawns, vegetables, and fruit but only in mixes with other pesticides. It works well to control leaf spots, blights, and fruit and vegetable rots. It is compatible with many other fungicides but cannot be mixed with oils, lime, or strongly alkaline (soapy-feeling) materials.

Chlorothalonil (Ortho Daconil 2787, Bonide Fungonil, Maxide Multi-Purpose Fungicide) - This is another good, general-purpose fungicide for many fungal diseases. It is best as a foliar treatment as it breaks down rapidly in soil. It is one of the longer lasting fungicides available so you do not have to spray as often, as with other products. Some people are allergic to it and may develop skin rashes. It is labeled for vegetables, fruits, and many ornamentals including shade trees.

Copper based compounds (bordeaux mixture, Bonide Copper Fungicide, Lilly Miller Kop-R-Spray, Lilly Miller Microcop) - There are many copper products, but fixed copper sulfate is the one most gardeners will find. Bordeaux mixture, made by adding copper sulfate and calcium hydroxide to water, was the first fungicide. It still is used extensively in France to control downy mildew on grapes. It is a highly effective fungicide that stays on the plant surface even after several rains. Usually it is used as a dormant spray since it may burn young tissues. The copper most commonly obtained is labeled for use on many fruits, nuts, ornamentals, and a few vegetables. It controls many fungal and bacterial cankers, galls, blights, and leaf spots. Experts recommend copper for many plants and diseases not listed on labels because the federal agencies have decided that no tolerance levels need to be established due to copper's low toxicity and insolubility in water.

DMI-type fungicides such as Myclobutanil (Spectracide Immunox), Propiconazole (ferti-lome Systemic Fungicide), and Tebuconazole (Bayer Advanced Disease Control)—These fungicides have been around in commercial agriculture for some time and are now available in home packaging. They are very effective against powdery mildews, rusts and many leaf spots. Best used when green foliage is on the plant since they move into plant tissues. Be careful not to overuse these materials as fungi can develop resistance resulting in poor disease control.

Horticultural Oils (Neem Oils such as Concern Garden Defense or Green Light Rose Defense, Sunspray Ultra-Fine Year-Round Pesticidal Oil, Jojoba Oils such as E-Rase) - Some of these are petroleum derived oils while others are from plants. These are effective when powdery mildew has gotten away on you. A good eradicant of the fungus if you get excellent coverage of the plant surfaces. Do not use when plants are

wet from rain, irrigation or dew. Some oils such as neem oil have a lot of paraffin and may freeze up at low (less than 40°F) temperatures. Just use warm water to get it back in solution. Overall, the neem oils have not done as well for disease management as other horticultural oils in western Oregon.

Lime sulfur or calcium polysulfide (Bonide Lime Sulfur, Lilly Miller Polysul, Lilly Miller Dormant Spray for Disease) - Lime and sulfur boiled together create calcium polysulfide, a foul-smelling but effective fungicide. It is primarily used as a dormant spray because it can burn young foliage. However, it can be safely used on some crops when diluted with a larger amount of water. It is labeled for several ornamentals and fruits and controls powdery mildew, scab, brown rot, peach leaf curl, rusts, and mites.

PCNB (Hi-Yield PCNB Granular Fungicide) - If you live in a snowy area and have snow mold problems on your lawn then this fungicide might be right for you.

Soaps (Safer's Insect Killing Soap) - These are effective on powdery mildew if you use them often and get excellent coverage of the plant surfaces. Also has activity on soft bodied insects.

Sodium or Potassium Bicarbonates (Bi-Carb Old-Fashioned Fungicide, Bonide Remedy) - Yes, sodium bicarbonate is just plain old baking soda. The potassium bicarbonates were developed to prevent salt build up from the sodium form. No, not as good as many of the other products already listed but better than doing nothing. Research data is usually based on adding in oils, which are effective by themselves. Absolutely will not control black spot of rose.

Streptomycin (ferti-lome Fire Blight Spray) - An antibiotic produced from a common soil inhabiting, filamentous bacterium. There is a home label from ferti-lome for use on apples, pears and pyracantha to manage fire blight. Needs to go on at bloom when the weather is expected to be warm and wet. Although it is labeled for rose crown gall you most likely will be better off getting a new rose than following instructions on the label.

A few of the many fungicides available in the home market.

Sulfur (Safer Garden Fungicide, Bonide Sulfur Plant Fungicide and many other names with the word sulfur in them) - Elemental sulfur alone is active against powdery mildews, some rusts, leaf blights, and fruit rots. It also is active against mites. It is labeled for fruits, beans, and many ornamentals. Shorter application intervals are needed with sulfur when compared to other products. Sulfur is active as a vapor only within a certain temperature range. If the temperature is over 85 to 90°F at the time of application, some foliage may burn. At low temperatures, no fungicidal activity will occur. Some plants, like 'Concord' grapes or apricots, are sensitive to sulfur and will burn at any temperature. May also cause shorter stems on rose plants and can be caustic to your skin if you are frequently handling plants.

Thiophanate methyl (ferti-lome Halt Systemic Fungicide) - A close relative to benomyl (Benlate) and sometimes can be found at garden centers or nurseries. Use of benomyl on ornamentals was pulled in the early 1990s. This is the next best thing and can be used on ornamentals as well as lawns and some fruit trees. If you had fungi resistant to Benlate then they will be resistant to this product also. Tank mix with another fungicide for better management of diseases.

Triforine (Ortho Orthenex, Ortho Rose Pride Funginex) - Another locally systemic fungicide to control powdery mildew, rusts, and some leaf spots or blights. It is labeled for use on several ornamental plants and has been used for years to control all of the important rose diseases. Some gardeners may find that it does not work as well as it has in the past due to the build up of fungi resistant to the chemical.

Compared to nematicides and insecticides, these fungicides have low toxicity. One would have to eat, drink, or breathe very large quantities to have any immediate or short-term effect on one's health. Some fungicides, however, have been shown to cause tumors in laboratory animals. When using any pesticide, toxic or not, take several precautions. These are always outlined clearly on each label. Wear protective clothing (gloves, long-sleeve shirt, and long-leg trousers) while mixing or applying the product, keep it out of reach of children and animals, apply it when weather is calm, and clean all equipment, clothes, and yourself after application.

One last point. Many diseases can be controlled using several non-chemical control techniques. A combination of techniques, both cultural and chemical, usually works quite well for control of most diseases.

(Source: Oregon State Univ. Plant Disease Control series at http://plant-disease.ippc.orst.edu)

UPCOMING MEETINGS:

June 16, 2009: *UMass Fruit Team Twilight Meeting,* Clarkdale Fruit Farm, (www.clarkdalefruitfarms.com), 303 Upper Rd. Deerfield MA.

5:30 PM Farm tour including update on phenology and current pest status.
6:30 PM Speaking program will include updates of current cultural and integrated pest management practices.
Pesticide-license recertification credit (2 hours) will be offered at all meetings. You must be there on time to receive pesticide credits.

June 18, 2009: *UMass Fruit Team Twilight Meeting*, location to be announced. See www.umass.edu/fruitadvisor for updated information.

June 18, 2009: *UMass Floriculture Team Twilight Meeting,* J.P. Bartlett Co. Greenhouse, Rt 20, Sudbury MA. Focus on Garden Mums. 2 pesticide recertification credits. Visit www.umass.edu/umext/floriculture/upcoming_events/index.html for more information.

June 23, 2009: *UMass Vegetable Team Twilight Meeting, Pleasant Valley Farm,* 255 Merrrimack St. Methuen, MA. Focus on Phytophthora capsici mgt, drip irrigation systems, GAP certification, greens. 2 pesticide recertification credits. For more information contact Ruth Hazzard at rhazzard@umext.umass.edu.

June 25, 2009: *Maine Vegetable and Small Fruit Growers Assoc. Twilight Meeting*, Flaherty's Family Farm, 116 Payne Road in Scarborough, just off of Highway 95 at exit 39. Meeting starts at 6 p.m. Contact David Handley for more information, dhandley@umext.maine.edu.

June 27, 2009: *UMass Aquaculture Program summer workshop.* 302 Ag. Engineering Building, UMass, Amherst, MA. For more information contact Craig Hollingsworth at 413-545-1055, chollingsworth@umext.umass.edu or visit www.umass.edu/aquaculture.

July 15, 2009: *Massachusetts Fruit Growers' Association Summer Meeting*, **Tougas Family Farm**, 234 Ball St., Northboro, MA. All are invited but you must pre-register. The registration fee includes the program, lunch, and 2 pesticide recertification credits. Check the UMass Fruit Advisor website (www.umass.edu/fruitadvisor) for details at the date gets closer.

July 16, 2009: *Vegetable Research Field Day.* UMass Crops Research & Education Center, S. Deerfield. For more information contact Ruth Hazzard at rhazzard@umext.umass.edu or visit www.umassvegetable.org.

August 7-9, 2009: *NOFA Summer Conference,* University of Massachusetts, Amherst, MA. Excellent program! For more information visit www.norasummerconference.org.

August 11-12, 2009: *North American Strawberry Growers Association Summer Tour*, Tour highlights include innovative growers, fabulous farm markets and new growing systems, including stacking systems and the Filtrexx growing system. For more information, please visit www.nasga.org , or call Kevin Schooley at 613.258.4587

December 15-17, 2009; *New England Vegetable & Fruit Conference*, Radisson Hotel, Manchester, NH. For more information visit www.newenglandvfc.org.

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