Volume 17, 2005

Berry Notes

Prepared by the University of Massachusetts Fruit Team

May 18, 2005, Vol. 17, No. 6

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

Berry Notes is edited by Sonia Schloemann with articles written by other contributors with attribution; sources are cited. Publication is funded in part by the UMass Extension Agriculture & Landscape Program, subscription fees and corporate underwriting . Questions can be directed to Sonia Schloemann at 413-545-4347, sgs@umext.umass.edu. Please cite this source if reprinting information that originates here.

IN THIS ISSUE:

Message from the Editor:

Crop Conditions: ***Strawberries*** – fruiting fields are progressing into bloom. Frost protection has been needed in most locations already. Be sure to keep an eye on weather forcasts for frost warnings in your area. Bloom fungicide applications are important during bloom to control fruit rots. See article below about Botrytis gray mold in strawberries. Scout fields for clipper and two spotted mite. Avoid insecticide applications during bloom. ***Raspberries*** – summer bearers are showing some fruit buds. This is still the pre-bloom period. Some foliage is showing raspberry fruitworm feeding injury. See article below on this pest. Remember to avoid insecticide applications during bloom. But, be ready for fungidice applications to control botrytis gray mold during bloom. More on this next time. Both summer bearers and fall bearers can be fertilized now. Mature planting should receive 40-80 lbs N/acre on summer bearers and 70–100 lbs N/acre in fall bearers in a split application. Use higher rates on sandier soils or if excessive rain falls. ***Blueberries*** - bloom is starting in early varieties. Cranberry fruitworm traps should be set out at this time. Hold insecticide applications until after bloom is complete. Soom sites may have suffered freeze damage to flowers. Be sure to have adequate pollinators for the bloom period. More on this below. Also, be ready for bloom fungicide applications to control fruit rots. See article below on this topic with updated recommendations. Fertilize now in a split application w/ 50-60 lbsN/acre in mature plantings. Make second application in 4-6 weeks. ***Ribes*** – Currants and gooseberries are setting fruit. Watch for Imported Currant Worm and Currant Borers at this time. Also watch for powdery mildew infections. Fertilize now in a split application w/ same rates as blueberry. **Grapes** – vines are in early shoot growth. Watch for grape flea beetle and grape plume moth. Pheromone ties for 1st flight of grape berry moth should be place in the field at this time. Start early season fungicide program at 1-5" shoot growth.

Gray Mold Gains Foothold in Strawberries at Bloom

Annemiek Schilder, Michigan State University

Gray mold, caused by the fungus *Botrytis cinerea*, is one of the most important fruit rot diseases affecting strawberries. Wet weather and moderate temperatures are conducive to development of this disease. Typical symptoms include a brown discoloration of the fruit and the presence of a gray fuzzy mold, which can rapidly develop and spread to neighboring healthy berries. Even if berries look perfectly healthy at harvest, they can start to show rot within several days in cold storage or the refrigerator.

Botrytis cinerea overwinters on old leaves and plant debris and can sporulate profusely on dead plant material. The spores easily become airborne and are usually plentiful in strawberry fields. In strawberries, primary infections take place almost exclusively through the flowers. This is why gray mold control efforts should be focused on the bloom period. If the bloom period is dry and/or good fungicide coverage is maintained, incidence of gray mold at harvest will be low. However, if infections occur at bloom, they remain dormant until the berries start to ripen. As gray mold develops on ripening berries, the emphasis has to be on preventing new infections of the surrounding berries, which become more susceptible as they ripen. Infected berries can easily infect other berries that touch them. Sometimes whole clusters are covered with the gray spore masses.

Where possible, remove sporulating berries from the field and destroy them to limit inoculum availability. During picking, avoid handling infected berries, since spores can be transferred on hands to healthy berries. Timely harvesting and rapid post-harvest cooling may also help to reduce losses to Botrytis gray mold.

There are several excellent fungicide choices out there for control of gray mold in strawberries. Elevate (fenhexamid) is a locally systemic fungicide with good to excellent activity against Botrytis. Captevate is a pre-mix of captan and fenhexamid and has a broader spectrum of activity than Elevate alone (It also protects against anthracnose and other fruit rots.). Switch (cyprodinil and fludioxonil) and Pristine (pyraclostrobin and boscalid) are also excellent products for gray mold control. Topsin M + Captan is also a good fungicide combination, but remember that Captan is strictly a protectant and can be washed off by rain or irrigation water. Thiram (thiram) is similarly effective but susceptible to wash-off.

Scala (pyrimethanil) is a new fungicide labeled for Botrytis gray mold control in strawberries. The active ingredient is related to one of the ingredients in Switch. Scala performed well against Botrytis bunch rot in grape trials in Michigan, but has not been tested on strawberries in the state. Cabrio (pyraclostrobin) and Quadris (azoxystrobin) are NOT suitable for gray mold control, but are effective against anthracnose and other fruit rot and leaf spot diseases. All fungicides mentioned above have a 0-day pre-harvest interval, except Topsin M and Scala (1 day) and Thiram (3 days). Remember to alternate fungicides with different modes of action for resistance management purposes. (***Source**: Michigan Fruit Crop Advisory Team Alert, Vol. 20, No. 6, May 17, 2005*)

Strawberries - Two-Spotted Spider Mites

Daniel Gilrein, Cornell Cooperative Extension

Check older or 'warmer' fields and along edges first. Often this pest is kept under natural biological control and sprays may be unnecessary. Examine under 60 middle and older leaves from around the field for mites. Control is suggested if 15 infested leaves are found – do not count leaves with fast-moving predatory mites. Options include Agri-Mek, Kelthane, Vendex, and the new Zeal, as well as pyrethroids Danitol and Brigade. Avoid treating during bee activity - Agri-Mek in particular is highly toxic to bees on contact, although residues dissipate quickly and it is essentially non-toxic after a few hours. Vendex is relatively non-toxic to bees and beneficial predator mites. Brigade and Danitol will also control spittlebugs, clippers and tarnished plant bugs but are very hard on predator mites. Zeal is somewhat slow-acting but has translaminar activity (like Avid), so coverage may not be quite as critical. One application/season is allowed with one day to harvest. Check for spittlebug masses, which are primarily an annoyance in U-pick fields and pose little threat otherwise. Sprays for tarnished plant bug will often control spittlebugs. For U-pick fields, count the foamy masses in five 2-foot sections of row. A suggested threshold is a total of over 10 masses. See the Cornell Guidelines for other labeled materials. (***Source**: Long Island Fruit & Vegetable Update, No. 9, MAY 13, 2005*)

Spraying Strawberries

Andrew Landers, Cornell University

There are many new developments in spray technology that will help reduce the costs involved in applying pesticides. The main costs associated with pesticide application are the cost of pesticides, which continue to rise in many cases. Any technology that reduces the amount of product necessary to control a weed, insect, or disease, or improve its effectiveness, is welcome. The other major costs to consider are those of labour and timeliness.

Timeliness is crucial if pesticides are to control disease or insects. Applying the spray mix too early may act in a prophylactic way if the product is designed to do that. Many sprays must be applied to the target at a specific growth stage of the weed, insect, or disease. Failure to apply products on time will lead to increased disease levels or insect activity.

Coverage is essential. Poor spray coverage is a major factor contributing to poor disease control. Better coverage leads to better control, and a thorough application of an effective material is required. Uneven coverage increases the amount of fungicide that must be applied in order to provide adequate control on poorly covered areas and the number of sprays required if it allows a disease to become established.

Whilst canopy size and shape will affect application volume, there are equally dangers in not applying enough spray and in applying too much spray. There is an optimum quantity required for a thorough coverage of the target. The old adage that you should spray until the leaves drip is misplaced; likewise lowering spray rates to below the minimum which offers control is also misguided advice.

A number of growers have reduced application volumes to extremely low levels and are observing poor control due to inadequate coverage. Interestingly, research around the world confirms similar results and indicates that there is an optimum volume to provide thorough coverage and control.

A number of pesticide manufacturers are adopting the ASAE/BCPC nozzle selection system and stating on the pesticide label the spray classification needed for their product. Reference nozzles, tested in a laboratory using a laser analyzer, are then classified according to the characteristics of the spray produced. Fine, medium, and coarse are the categories of agricultural sprays. The label recommendation makes nozzle selection far easier for the sprayer operator. A general guideline is:

- Fine classification for contact fungicides and insecticides
- Medium classification for herbicides
- Coarse classification for pre-emergent sprays

Growers may find these spray classifications in the latest nozzle catalogues and should cross-reference the selected nozzle type, based upon flow rate, with the spray classification. Growers have to consider good coverage and penetration into the canopy, so traditional fine sprays may not penetrate, so the traditional compromise takes place, a medium spray quality should be chosen. On no account should large droplets or coarse spray quality be used, as the droplets run-off the target.

Large droplets can also be created from worn or damaged nozzles, remember to change nozzle tips when their output is greater than 10% of the manufacturers recommended flow rate.

However, weather conditions, particularly wind and its effect upon drift, must be taken into consideration. If the label or supplier makes no recommendation concerning nozzles or spray quality, then a reasoned choice of spray quality must be made, based upon the target, the product, and the risk of drift

Spray drift of pesticides is an important and costly problem facing pesticide applicators. Drift can result in damage to susceptible off target crops, environmental contamination to watercourses and a lower than intended rate to the target crop, thus reducing the effectiveness of the pesticide. Pesticide drift also affects neighboring properties, often leading to concern and debate. There are two types of drift, airborne drift, often very noticeable and vapor drift. The amount of vapor drift will depend upon atmospheric conditions such as humidity, temperature and the product being applied and can occur days after an application is made. Drift is influenced by many inter-related factors including droplet size, nozzle type and size, sprayer design, weather conditions and last but not least the operator.

Directing the spray to the target is the key to successful penetration and deposition. Whilst many modern nozzles can control drift successfully, e.g. drift-guard and air induction nozzles, there is still much to be done on positioning those nozzles in relation to the crop target. Multi-nozzle assemblies surrounding the target often help.

Air assistance certainly helps but usually when there is a good canopy to intercept the spray plume and capture the droplets. In early season spraying, when little foliage exists, then air assistance can cause more drift. There is a need to consider adjusting the airflow to match the canopy development.

There is very little work published specifically for strawberry spraying. Nils Bjugstad, a colleague at the

University of Norway has conducted a five-year trial on improving spraying equipment. Bjugstad and Sonsteby (2004) observed the main issue is to obtain approximately the same spray and pesticide coverage and amount on the leaf surface on the outer and inner leaves as well as the upper and underside of the leaves (mainly spraying against grey mould in Norway).

Because the plant canopy increases considerably during the growing season, they concluded that they had to adapt the volume rate according to this change of mass. As shown in their papers, they recommend to use three nozzles in the start of the season; two from each side and one from the top, and for larger plants five nozzles per single row; one from the top and two from each of the sides, and in this way adjust the volume rate from 12.5, 19.0, 25 pints per 109 yards row length, (converted from the metric system)

015 nozzles seem to be too small and increase the risk of drift (drift will be measured next year) and lower the capacity (rows per hour). 02 and 03 nozzles seemed therefore to be more suited. They did not use cone nozzles in this study, only flat fan nozzles. Top angle 65 and 80 degrees should be used to maintain good penetration into the plant (but a good overlap has to be ensured). Best results were at 75 psi with the nozzles 4-8inches above the target.

They also tested Air induction (AI) and Drift guard (DG) nozzles, but they did not prove to be better, mostly they gave poorer results. They tried them out in combination with conventional nozzles, using AI and DG on the top. This will be interesting to study in the forthcoming drift experiments. They use mostly front mounted equipment in Norway to ensure a good overview and control, but operator exposure has to be taken into account, and therefore the nozzles making larger drops may be interesting in some occasions, but always combined with conventional nozzles to ensure a good coverage.

Conventional crop sprayers as well as air assisted boom sprayers are not in use in strawberries in Norway, because the inter-row is sprayed and penetration is poor, especially down to the inner leaves and to the lower sides. Normally they use front mounted equipment that cover three single or double rows. For good conditions this equipment may be built out for five rows.

Finally, labour, their skill, and attitude toward spraying will assist greatly in getting good spray coverage. Training of operators is a must if the product is to be work successfully.

References:

Bjugstad N. and Sonsteby A. (2004) Improved spraying equipment for strawberries. In: *Aspects of Applied Biology 71*, International advances in pesticide application. Pp.335-342.

(Source: New York Berry News, Vol. 4, No. 1, May 2005)

RASPBERRY

Raspberry Fruitworm

With the raspberry fruitworm, it is the worms or larvae that usually cause the most damage. However, the adult beetles are also capable of causing considerable injury to unopened buds and unfolding leaves and open flowers. The raspberry fruitworm prefers red and purple raspberries.

Figure 24. The adult raspberry fruitworm is often seen on tip foliage in early summer.

Symptoms

To the unsuspecting, the first evidence of a problem may be the presence of small yellowish-white worms adhering to harvested fruit. However, there are actually numerous signs earlier in the season that can lead to detection. Infestations in early season are to be suspected if longitudinal holes in the foliage give leaves a tattered appearance. Such foliage injury is caused by adults (Figure 24) feeding on unfolding leaves, often skeletonizing them. As blossom buds appear, they are attacked by the adult beetles feeding on the inside. Numerous beetles may destroy the entire cluster of buds.

Fruitworms attack raspberry receptacles (Figure 25) and, at times, the carpels of the berry. In tunneling through the receptacles, the larvae cause extensive damage, often loosening berries to the extent that they may fall off. In some plantings, more than half of the berries are infested with larvae. With such heavy infestations, some of the wormy berries arrive at the market or processing plant with noticeable presence of worms, leading to rejection of fruit.

Seasonal History and Habits

Adult beetles emerge from the soil during late April and early May, about the time the first leaves of raspberries are beginning to unfold. They begin to feed along the midrib of partially folded leaves and are found on the midrib of young

leaves. Beetles later seek protection between the blossom buds where they attack the soft tissues of the supporting pedicles. As buds begin to separate, the insects attack the blossom buds, making large entrance holes to feed on floral parts.

The females deposit their eggs most commonly on swollen, unopened blossom buds. However, at times eggs may be laid inside buds or on developing fruit. The grayish-white eggs (about 1 mm [1/25-inch] long) hatch after a few days, and the larvae commonly bore through the bud and enter the receptacle where they begin to tunnel. As the larvae increase in size, the tunnels are made larger, ultimately becoming grooves in the receptacle adjacent to the berry. When infested fruit is picked, the larvae may become displaced and remain attached to the cuplike interior and thus are transferred to the harvesting basket. Those that remain on the receptacle soon drop to the ground where they pupate and remain over winter.

Figure 25. Note portion of raspberry fruitworm on raspberry receptacle just as fruit is harvested; at times they adhere to the picked fruit, causing much concern.

Description

The fully grown worm is slender, 5.75 to 6 mm (1/4 inch) in length, 0.53 mm (1/50 inch) wide, nearly cylindrical, tapering towards either end. Each segment has two transverse rows of sparse, light-colored stiff hairs.

Control

It is helpful to maintain good weed control. Time chemical control applications to when fruiting buds first form and just before blossoms open. SpinTor, carbaryl, malathion and Pyrellin may be recommended.

(***Source***: *Brambles - Production Management and Marketing, Bulletin 782-99*)

BLUEBERRY

Blueberry Fruitworms: Deploy Monitoring Traps Now

Rufus Isaacs, Michigan State University

There are two species of fruitworms that can infest blueberries in Michigan: the cherry fruitworm and the cranberry fruitworm. The larvae can be found inside young blueberry fruit during and after bloom, but their presence is often not evident until the premature ripening of infested berries, or the webbing of berries together by cranberry fruitworm are noticed. However, an Integrated Pest Management approach using monitoring for moths, scouting and appropriate application of effective controls can prevent fruit contamination by these pests.

Cherry fruitworm moth in a trap

Regular weekly scouting in blueberry fields across west Michigan as part of our RAMP Project indicates that the flight of cherry fruitworm moths has just started. All our monitoring traps were empty one week ago, and yesterday male cherry fruitworm moths were trapped at a farm in Grand Junction. So, if not already deployed, monitoring traps for cherry fruitworm and cranberry fruitworm should be placed in fields this week. In recent years, some fields have experienced high pressure from cherry fruitworm, and it is worth monitoring for both moth species if this has been your experience. Cherry fruitworm emergence usually precedes cranberry fruitworm by up to a week.

To monitor for these pests, hang traps baited with a pheromone lure in the top third of the bush. Deploy one trap for each species per five acres of field with traps placed on bushes along wooded borders or areas where fruitworms were a problem last year. Traps should be checked weekly and the moths counted and removed. Writing the number trapped on the bottom of the trap is one way to keep track of the developing population.

Pheromone traps are very specific, but it is important to know what the species you are monitoring looks like. See the photos in this article for the correct species to identify.

Contaminant moths have been caught in cherry fruitworm traps at most of the farms we are scouting in Van Buren County, but these should not be confused with cherry fruitworm. These contaminants are Pseudexentra vaccinii, which are longer and lighter-colored than cherry fruitworm with a distinctive pattern.

Cranberry fruitworm moth

The monitoring traps catch male moths, but because females lay the eggs, controls should be delayed until egglaying starts. This is usually soon after petal fall begins, so in high-pressure fields an insecticide may be warranted during bloom, limiting grower's choices of what to apply. If pressure is lighter or if bush development is faster than the moths, growers may be able to wait until the immediate post-bloom timing to control fruitworms. (***Source**: Michigan Fruit Crop Advisory Team Alert, Vol. 20, No. 5, May 10, 2005*)

Options for Control of Fruit Rots in Blueberries

Annemiek Schilder, Michigan State University

Fungal fruit rots, especially anthracnose caused by *Colletotrichum acutatum*, continue to be of economic concern in blueberries. Losses can occur before as well as after harvest. The cultivars Jersey, Bluecrop, Rubel and Blueray are very susceptible to anthracnose fruit rot, whereas Elliott is generally resistant. Alternaria fruit rot is commonly found on Bluecrop fruit before harvest and affects most varieties after harvest. Botrytis fruit rot is not as common in Michigan, but may be a problem in years when cool, wet weather prevails during the flowering and fruit development period. Botrytis fruit rot mostly shows up as a post-harvest disease. These rots can be distinguished to some extent with the naked eye: anthracnose is characterized by wet, pink to orange spore masses; Alternaria fruit rot by a dark olive-green mold layer, and Botrytis by fluffy, tan to gray mold growth on the berry surface. A fact sheet for identification of blueberry fruit-rotting has been published by MSU Extension and can be viewed on-line as a pdf, ordered through the web site (using 2847 as the keyword), or purchased through your local Extension office. The MSUE Bulletin office home page is: http://web2.msue.msu.edu/bulletins/mainsearch.cfm

The anthracnose fungus overwinters in dead fruiting twigs, but has also been found to overwinter in live, dormant buds, which subsequently die. A twig blight, which is difficult to distinguish from Phomopsis twig blight, can also result from bud infection. Pink to orange spore masses may be visible on infected tissues in the spring. More recently, anthracnose lesions have also been found on young green canes in the base of the bush. With anthracnose there are two important periods when the fruit infection risk is high because of peak spore release: 1) from pink bud to about pea-size berry (due to overwintering inoculum), and 2) from first blue fruit until the end of harvest (due to sporulating berries that infect surrounding berries). Fungicide spray programs should focus on these periods. Since anthracnose infections increase greatly at the second and third harvests, it is advisable to spray between harvests as well as to protect the later-maturing fruit if this can be done without knocking the fruit off.

Effective cultural control measures are: timely harvesting, not harvesting the berries while wet, rapid cooling of harvested berries and timing irrigation to occur at night or in the early morning to limit the duration of fruit wetness. In addition, pruning bushes will remove dead and diseased twigs, which can serve as inoculum sources, and open up the canopy to reduce wetness duration and increase spray penetration.

There are several fungicide options for control of blueberry fruit rots. Early in the season, the best control options are Bravo, Captan, or Ziram (with or without Topsin M). Around bloom and later in the season, the strobilurin fungicides Abound (azoxystrobin), Cabrio (pyraclostrobin), and Pristine (pyraclostrobin and boscalid) are good choices. They are locally systemic, rainfast within several hours of application, and have a 0-day PHI. They have excellent activity against anthracnose and are also labeled for control of Alternaria fruit rot, although the latter has not been sufficiently investigated in Michigan. If Alternaria fruit rot is a concern, good options are Aliette (fosetyl-Al) and Switch (cyprodinil and fludioxonil). Switch is a systemic fungicide with activity against anthracnose, Alternaria fruit rot, and Botrytis fruit rot. Elevate (fenhexamid) primarily works against Botrytis, while Captevate is a premix of Elevate + Captan with activity against Botrytis as well as anthracnose (due to the Captan component). Lime sulfur as a dormant spray also reduces anthracnose infection at harvest, but should not be used as a stand-alone measure. (***Source**: Michigan Fruit Crop Advisory Team Alert, Vol. 20, No. 4, May 3, 2005*)

Pollination

Gary C. Pavlis, County Agricultural Agent, ,Rutgers University

Pollination is an important factor in production of the highbush blueberry. Lack of adequate pollination causes reduced yield, small berry size, and a delay in berry maturity. It is chiefly the honeybee which performs this task. While bumblebees are efficient and diligent pollinators (even under more adverse weather condition), their numbers are steadily decreasing. According to MSU Entomologist, Dr. Roger Hoopingarner, "Historically, feral (wild) honey bee colonies have provided more than half of the pollination in Michigan." Wild bee populations are declining. This is due to changes in our own blueberry production practices which remove bee forage and suitable habitat, and there is the problem with mites.

Varroa and trachael mites are killing wild and managed colonies in the U.S. The varroa mite has completely wiped out all of the wild colonies in Europe. It is certain that our dependence upon this population of bees will be reduced in the next few years in Michigan as well.

What does this mean for blueberry producers? What happens when we lose the free pollination service provided by wild bees? You probably already know - more honey bees.

Blueberries have a tremendous number of blossoms per acre. A single bush may have 2,000 to 3,000 blossoms. At a planting density of 870 bushes per acre, that's 1.75 to 2.6 million flowers! Large-block single-variety plantings make it essential that high numbers of pollinators be available at one time.

The number of colonies needed per acre is determined by weather during the bloom period, colony size, variety, and blossom density per acre.

Weather during blossom time affects the honeybee's foraging efficiency. Honeybee activity increases as the temperature increases from 50 to 95˚F. Sunshine also increases foraging, especially at lower temperatures.

Cold, wet, windy weather decreases foraging activity. Temperatures above 95˚F will also reduce foraging as the bees spend their time cooling the hive.

As a general rule, over-wintered colonies are stronger than package bees. A three-pound package may have 12,000 bees, while an over-wintered colony may contain two to three times as many. Honeybee colonies will be smaller in an early bloom year. In essence, the crop has developed faster than the development rate of the forager bees. Are honeybees the answer? Many of you have seen your bees fly out of the hive, past your 'Jersey' bushes, and over to your neighbor's 'Rubel' field. This preference for one variety over another is not fully understood. It may be related to the quantity of nectar, pollen, sugar concentration, or flower color. At this time, honeybees are the best bet. For the long term, we need to learn to cultivate the wild pollinators.

The recommended concentration of hives per acre to use are tabulated below: Remember that the number of hives needed per acre depends on the variety you have.

Unfortunately not all of the visitations to blueberry flowers by bees result in pollination. Pollen must be transferred from some parts of the bee's body, usually the head to the tip of the pistil (stigma) in order to achieve pollination. There are three ways in which honeybees "cheat" the grower by not earning their rental fee. 1) Acquire nectar by feeding through hole in blossom made by a carpenter bee. 2) The distance from the edge of a flower petal to pistil is very wide, as in Earliblue. The bee can stick its tongue down and get the nectar without touching the pistil. 3) The bee does not thrust through the open end but gets nectar through the bottom - very important in Bluecrop and Jersey. In some years such a high percentage of the bees may work through the bottom of the corolla that the crop can be significantly reduced. Bees develop this bad habit mostly on Jerseys and Bluecrop. The probable reason is that both of these varieties can produce small seedless berries without pollination (parthenocarpy). These parthenocarpy berries begin to develop shortly after the flowers open and once it starts the corolla becomes loose at the base after a few days, enabling the bee to secure its nectar through the loose juncture of the corolla and ovary. Since the honeybees usually select older flowers which have more nectar it enables the younger ones

VERY ATTRACTIVE TO BEES:	MODERATELY ATTRACTIVE:	POOR ATTRACTIVE:
1 Hive/2 Acres:	1 Hive/Acre:	2 Hives/Acre:
Rancocas	Weymouth	Stanley
June	Bluetta	Concord
Rubel	Blueray	Berkeley
GN-87	Pemberton	Coville
	Darrow	1316-A
	Bluecrop*	Elliott
	Duke	Jersey*
		Earliblue*

**Efficiency of pollination poor, add 1/2 hive more per acre.*

to start the parthenocarpic process which does not occur once the flower is pollinated. The solution may be to use higher concentrations of bee hives. The higher numbers of bees per bush forces them to accept younger flowers with the result that more berries are developed from bee pollination than by parthenocarpy. (***Source**: Blueberry Bulletin, Vol. 21 nos. 4&5, May 4 & 11, 2005*)

GRAPE

Early Season Grape Disease Management

Alice Wise, Cornell Cooperative Extension

A summary of Cornell Grape Pathologist Dr. Wayne Wilcox's comments on early season disease concerns along with local observations:

• **Phomopsis** – It is virtually impossible to totally control phomopsis in most vineyards. A little is normal, a lot can be disastrous. Inoculum comes primarily from dead wood, both canes and spurs, as well as infected wood retained at pruning. Where possible, pruning out of old infected spurs will go a long way in phomopsis control. Phomopsis has been a perennial problem on spur pruned Cabernet at the research vineyard. In Wilcox's trials, best control of shoot infections took place when materials were applied about every 2 weeks, from 1- to 3-inch shoots through the start of bloom. But 80-90% of control came from the first two sprays. Control of rachis and fruit infections was essential from when clusters appear (very soon) through bloom. Spore production for the season is virtually complete somewhere between bloom and pea sized berries. Captan and mancozeb provide the best control of shoot infections; research in '04 indicated no difference between those materials and the strobies in terms of fruit infections. Note that some Captan products have reduced reentry intervals, some down to 72 hours (from 96) and one reportedly at 24 hrs. Check with your supplier and examine labels for specifics. Ziram and ferbam pro vide good control but are more expensive. The strobilurins (Abound, Flint, Pristine) are less effective and should not be relied upon for control of phomopsis particularly when the weather is wet. Copper and sulfur offer little control. Phomopsis presents a major difficulty for organic production (esp. for susceptible varieties in wet springs) as there are currently no effective materials. For these growers, it reinforces the need for judicious pruning and removal of potential inoculum sources.

• **Black rot** – Economic losses usually occurs from berry to berry spread thus keeping out the early fruit infections is the key. Fortunately, most local vineyards are fairly low in inoculum. Berries are highly susceptible from the start of bloom until 3 weeks or so later and gradually become highly resistant after 4-6 weeks. Note that the incubation period for black rot can be very long – as long as 6 weeks after infection. The best materials currently are Nova and Elite both of which provide good post-infection control. Mancozeb is good, Rubigan and Captan are only fair. The strobies (Abound, Flint, Pristine) all provide very good forward control – the advantage over mancozeb is that the strobies are more rainfast, and rainy seasons are when control is needed the most. Copper offers some control but will not hold up if the weather is wet. Interesting fact: in monitoring studies conducted over several years, mummies (old dried up infected berries from previous season) within the canopy produced 10-20 times the number of spores vs. mummies on the ground. This was likely related to 1) the mummies in the canopy produced spores for a much longer period and 2) the mummies on the ground stopped producing spores after bloom likely due to degradation of the berries by soil microorganisms, worms and so on. Thus the recommended practice of being sure to prune out old mummies is based in science. In terms of organic production, black rot is an even greater threat since this is a disease that can - and will - wipe out entire crops if allowed to get rolling in a bad year. The good news is that it takes time to get established in the vineyard so this won't happen from one year to the next. Again, sanitation and removal of inoculum sources is absolutely critical in these situations. Once established, black rot will be a major player in the disease spectrum of the vineyard. (***Source**: Long Island Fruit & Vegetable Update, No. 9, MAY 13, 2005*)

Early Season Grape Insects

Bruce Bordelon, Purdue University

Flea beetles and climbing cutworms are occasional problems in vineyards. Neither of these insect pests are a problem in every vineyard every year however they can cause significant damage under the proper set of conditions. Scouting is the key to pest management, and especially for these pests, so that you can decide if there is adequate damage to warrant making a pesticide application. Scout vineyards for these insects or their damage and control if more than 5% of the buds have been damaged. Damage from flea beetles appear as holes eaten

into the sides of buds. The insects are small (1/8 inch long) and shiny green, blue or black in appearance. They crawl quickly along the canes and tend to drop to the ground if disturbed. Incidence often occurs in outer rows adjacent to fencerows or woods, making spot spraying an option. Climbing Cutworms over winter in plant trash on vineyard floors. They climb grape trunks on warm spring nights and feed on swelling buds and early new growth. After this brief period they are seldom a problem. Good weed control helps prevent the occurrence of cutworms and flea beetles. Sevin will provide excellent control of these insect pests. See ID-169, 2005 Midwest Commercial Small Fruit & Grape Spray Guide, (www.hort.purdue.edu/hort/ext/sfg) and the Midwest Small Fruit Pest Management Handbook (www.ag.ohio-state.edu/~sfgnet/) for complete discussions of grape IPM. (***Source**: Facts for Fancy Fruit, Vol. 05, No.-02, May 6, 2005*)

Spring Weed Management in Grapes

Mark Chien, PennState Cooperative Extension

Weed control can start now. We are taking a little different view of weeds in contemporary viticulture, realizing that some biodiversity in the grape monoculture is a good thing. But out of control weeds can hamper performance and quality, especially in young vineyards. Tall weeds in the canopy contribute shade and exacerbate disease. Weeds compete with vines, especially young ones, for water and nutrients. Andy Senesac and Alice Wise of Cornell Cooperative Extension on Long Island give excellent information on weed control. It all begins with knowing your enemy. Have a good weed ID book so you know what it is you are trying to control. They recommend *Weeds of the Northeast* (you know you are a real farmer when you own a book about weeds) as the best resource for identifying weeds. There are many ways to control weeds, both chemical and mechanical, and a blended method may be the most effective. The timing of all control methods, but especially mechanical, is critical to success – don't be late or you will pay the price in quality of control and the effectiveness of your herbicide or hoeing application. Grape growers realize that herbicides are not good for the environment and try to limit their use of these chemicals. If they are used in a responsible and minimal way, growers can control weeds with minimal environmental impact. Pre-emergent herbicides prevents weed seeds from germinating and are applied at this time of year. Pre-emergent products such as Prowl, Devrinol and Surflan will control grasses and some broadleaves, are labeled for use in non-bearing vineyards. For bearing vineyard, pre-emergent choices that are effective mainly on grasses includes Devrinol, Surflan and Karmex. For broadleaf weeds the choices are Princep, Goal and Karmex. Goal must be applied before budswell. Please check the NY/PA Pest Management Guidelines for details. For more information on post-emergence herbicides, I strongly recommend that you read Alice's grape section in the LI Fruit and Vegetable Update, a weekly growing season newsletter that is full of great information for grape growers, regardless of species/cultivar – a recent two part article covered pre and post emergence herbicides. One way to design an effective weed control program is to try various methods on small parts of the vineyard. Another is to look around and see who is managing their weeds well and ask them what they do. (***Source**: Grape and Barrel Newsletter, Vol. 1, No. 3, April 19, 2005)*

General Information

Spring Round-up of Small Fruit Arthropod Pests

Greg English-Loeb, Department of Entomology, NYSAES Cornell University, Geneva, NY

Management of arthropod pests begins in earnest as the temperatures increase and the growing season gets under way. Before reviewing the list of **potential** arthropod pests for each of the major berry crops, I want to summarize some changes in chemical control options included in the 2005 version of the Pest Management Guidelines for Berry Crops. Over the next few years, use of Azinphos-methyl (Guthion 50WP) will be restricted or lost. New labels have been developed to reflect these changes and product with the old labels could only be sold up until November 2003. Growers can continue to use older labeled product if registered in New York State until its used up, but be aware that only five Azinphos-methyl labels are currently registered. Check the following web site: http://pmep.cce.cornell.edu/pims/current/. Azinphos-methyl products currently registered in NY include: Guthion Solupak 50WSB (EPA# 3125-301, discontinued and expires 9/30/06), Guthion Solupak 50WSB (EPA# 264-733), Azinphos-M 50 WSB (10163-78, discontinued and expires

9/30/05) and Azinphosmethyl 50W (51036-164). Strawberries are no longer labeled. Caneberries will probably only be supported through 2005 and only for one pest (raspberry crown borer). Guthion can still be used on blueberries (for maggot, fruitworms, plum curculio, lecanium scale) through the 2005 field season at least, but EPA is reviewing use on blueberries and it is possible there will be an extension. U-pick operations should be aware that the general public is not allowed to enter a Guthion-treated blueberry field within 30 days of application. Thanks to Dan Gilrein, CEE from Suffolk County for updated information on aziphos-methyl as well as other pesticide related news.

The DEC has approved tolerances for additional crops for the neo-nocotinoid insecticide imidacloprid (mainly effective against sucking insects like whiteflies, aphids, and spittle bugs but also some beetle species) including strawberries, currants, and gooseberries. Note that there have been label changes in just the past 6 months (after the guidelines went to press). Initially Provado 1.6F included strawberry on the label for use against whiteflies and aphids. On the new label for Provado 1.6F strawberry is not included, although currants and gooseberries are. However, strawberry is now listed on the systemic formulation of imidacloprid, Admire for the control of aphids and whiteflies. This needs to be applied through the drip line or as a plant or hole treatment at planting (14 days PHI for Admire, max of 24 fluid ounces/Acre per season, don't use both application methods on the same crop in the same season). Note that the federal label for both Provado 1.6F (aphids, leafhoppers, Japanese beetle adults, thrips and blueberry maggot) and Admire (Japanese beetle adults, white grub larvae) now lists blueberry and this use has been approved by DEC. Restrictions for Provado 1.6F on blueberries include a PHI of 3 days, max interval between applications of 7 days, max total amount per season of 40 fluid ounces/A, and max application volume of water of 20.0 GPA for ground application, and avoid application during prebloom and bloom to protect pollinators). Restrictions for Admire on blueberries include a 7-day PHI and max amount per season of 32 fluid ounces/A). Note also that the DEC has decided, due to concerns regarding ground water contamination, to classify Provado and Admire as restricted use compounds as of 1/1/05, including product you have in storage from last year. Thus, the use of this product is limited to persons who are certified applicators.

Finally, the miticide Zeal (etoxazole) has been labeled for use against two-spotted spider mite on strawberry. Zeal is an insect growth regulator, which negatively influences the growth process (molting between immature stages of the mite). It also sterilizes adult mites, although it will not kill them. Because of its mode of action, Zeal probably is best used early in an infestation, much like Savey.

Blueberries

A number of species of **scale insects** feed on the twigs of blueberry and can greatly reduce plant vigor. Look for the hardcovered female scale on small branches early in the spring. A dormant oil spray (2-2.5%) applied at bud swell, but before the first leaf stands out, can be effective in reducing scale populations.

Cranberry Fruitworm and **Cherry Fruitworm** are the main blueberry arthropod pests in the spring and early summer. These moths overwinter as fully-grown larvae. They pupate in the spring and begin flying in late May and early June (around the time of flowering). Egg laying begins at around petal fall with eggs being placed at the base of newly set fruit. A sex pheromone is available to monitor the flight activity of adult **cranberry fruitworm** (Great Lakes IPM, www.greatlakesipm.com, 989-268-5693). Two applications of an insecticide such as Confirm or Guthion, starting at petal fall and 10 days later, are required for sites with heavy pressure. Research in New Jersey indicates that in areas of moderate pressure, one application 5 to 7 days after petal fall provides as good control as two applications.

Other pests to keep an eye out for are **plum curculio** (notice crescentshaped scar created from egg-laying on young fruit), **leafrollers** (larvae make shelters by silking together terminal leaves), and **blueberry tip borer** (larvae bore into stem causing shoot tips to die back). Of course, later in the summer you need to be alert for **blueberry maggot flies**, **blueberry stem borer**, and **Japanese beetle** (more on these in next newsletter).

Raspberries

There are a number of potential pests of raspberries to be concerned with early prebloom to postbloom. Be on the alert for feeding damage from the adult **raspberry fruitworm** (a beetle, light brown in color) on foliage and fruit buds. The larvae of this beetle pest feed inside flower buds and young fruit. Adult feeding damage on foliage creates a skeletonized appearance somewhat similar to the feeding damage caused by larvae of **raspberry sawfly** (pale green caterpillar-like body with many long hairs). Both the fruitworm and the sawfly appear during the prebloom period. Carbaryl [Sevin] is labeled for both of these pests and the timing is similar as is Spintor [spinosad].

Tarnished plant bug (TPB) is another potential problem for raspberry growers during the period from bloom to harvest. Both the adults and their nymphs can cause deformed fruit, although the deformities are not as obvious in raspberries as in strawberries where TPB is also an important pest (see below). We do not have a good estimate of the economic threshold for TPB in raspberries but a rough guide would be 10 to 20% of canes infested with adults or nymphs. Carbaryl is labeled for control of TPB on raspberry. Its not the most effective material on plant bugs but pretty much all we have with plant bugs specifically on the label. Malathion can be effective against TPB, but I have yet to find a product registered in NY with plant bug on the

label for caneberries. Note that weedy fields aggravate TPB problems.

Raspberry cane borer and related beetle species make their appearance during this period. The adults emerge in the spring, mate and start laying eggs. Larvae bore into canes during the season and for some species, the next season. They cause injury and death to canes and potentially entire crowns. The best time to kill adults is during the late prebloom period (for summer-bearing raspberries), although note that there is nothing specifically labeled for it now that methoxychlor [Marlate] is no longer available. As an alternative to insecticides, during the season remove wilted shoot tips below the girdled stem (two rows of punctures around an inch apart) where the egg of the raspberry cane borer has been placed. Also, during the dormant season remove and destroy canes with swellings.

Another pest that can cause serious injury to canes and the crown is the **Raspberry crown borer**. The larvae of this moth feed at the base of the cane and into the crown over a two-year period. The first signs of a problem often appear during fruit maturation. The withering of and dying of canes, often with half matured fruit, can be a symptom of feeding damage at the base. Canes with these symptoms, and the associated crowns, should be removed during the growing season and destroyed. The adult moth actually does not appear until later in the summer (early August). It is a very attractive moth, which superficially resembles a yellow jacket. Guthion is labeled for use against raspberry crown borer larvae through the 2005 season. Apply to lower parts of canes and soil only in spring to summer (you are only allowed 2 applications per season, at least 10 days apart). As noted above, the general public is not allowed into the planting within 30 days of application.

During the spring and into the summer you may find two species of aphids that attack raspberries, **large raspberry aphid** and **small raspberry aphid**. Feeding damage by aphids causes leaf curling and reduced growth of shoots. The more important injury comes from viruses transmitted by the aphids (raspberry mosaic virus by the big aphid and raspberry leaf curl virus by the small aphid). This can be a particular problem for nursery plants. Both Malathion 57 EC and Di-Syston (disulfoton) are labeled for aphids, but Di-Syston is restricted for use for nursery stock.

Finally, I should mention **two-spotted spider mite (TSSM)** as a potential pest. These tiny spider-like arthropods can become very numerous on foliage, causing white stippling on leaves. They seem to be most problematic in dry sites and/or in mild growing areas such as the Hudson Valley and Long Island. As of a couple of years ago there is a miticide registered in New York for control of TSSM (Savey DF). Predatory mites can also provide control of TSSM. These beneficial mites are frequently naturally present in raspberry fields, especially where few broad-spectrum insecticides are used, but can also be purchased from a supply house. For both Savey and predatory mites, it's important to start control actions early before you see lots of severe injury to foliage (bronzing).

Additional arthropod pests that might show up later in the season (bloom to harvest) include **Root weevil, Japanese beetle**, **picnic beetle**, and **potato leafhopper**.

Strawberries

During the prebloom period the **strawberry bud weevil (clipper)** is the main arthropod pest to watch out for. In recent years, we have learned that many strawberry cultivars, such as Jewel and Seneca, can tolerate a fair amount of bud loss from this pest, although at sufficient densities, it can still be a problem. As a rough rule of thumb, treat for clipper when you observe more than one clipped primary or secondary flower bud or more than 2 tertiary buds per truss, on more than one truss per foot of row. Note that once flowers are open they are no longer at risk from clipper. Clipper often is a more severe problem along borders of plantings, near woods. Lorsban [chlorpyrifos] and Brigade [bifenthrin] are labeled for clipper in New York.

Also during the prebloom period, and extending through harvest, and sometimes after renovation, the **two-spotted spider mite** can be a problem in some plantings. Look for whitish or yellowish stippling on leaves. Current threshold is 5 mites per leaf or about 25% of leaflets have at least 1 mite. This is likely a conservative threshold for a healthy planting. There are several compounds labeled for mites on strawberries in New York: Kelthane [dicofol], Vendex [hexakis], Agri-mek [abamectin], Savey [hexthiazox], Zeal (etoxazole). Acramite (non bearing crops), Danitol [fenpropathrin] and Brigade. Kelthane, Danitol, and Brigade are hard on predatory mites. Agri-mek label calls for 2 applications, 2 weeks apart. For all these materials, coverage is very important, especially on the underside of leaves.

Tarnished plant bug (TPB) is the key insect pest of strawberries during bloom to near harvest. Both adult bugs and the nymphs cause injury (deformed fruit) but nymphs are probably of the greatest concern for June-bearing cultivars. The economic threshold is half a nymph per flower cluster (you sample by tapping cluster over a white plate and counting nymphs that fall off). It is worth sampling for this pest on a regular basis since it varies in population size from place to place and from one year to the next. *Spraying a pesticide when nymph counts are below threshold costs you money and may kill beneficial arthropods unnecessarily*. Good weed management can help reduce problems with TPB.

Cyclamen mite is a potentially serious pest that seemed to show up in more fields than usual three years ago but was not very prevalent recently. The mites get active in the spring with populations peaking after bloom. The mites like

to feed on young leaf tissue (just as the leaves are unfolding). The mites themselves are difficult to see without a good hand lens. Cyclamen-damaged leaves tend to be stunted and crinkled. Prior to bloom or after renovation are good times to treat for this pest. Kelthane and Thiodan [endosulfan] are labeled for use against cyclamen mites. Use lots of water for thorough coverage.

Two more insect pests deserve mention at this time. The first is **Strawberry sap beetle (SSB)**. This small, brownish beetle seems to be increasing as a pest in New York strawberries. Both the adult beetles and the larvae feed on ripe and overripe fruit. We still are exploring the best ways to control SSB. Two pyrethroids are labeled in New York for its control: Danitol and Brigade. Note that Brigade does not have a preharvest interval while for Danitol it is 2 days. However, Brigade is more expensive. For both materials, good coverage is likely to be important for its control. Note that SSB probably does not move into strawberry fields in significant numbers until fruit begins to ripen.

Spittlebug starts appearing on leaves, stems, and flowering racemes about this time (bloom) and extending into harvest. They overwinter as eggs in the soil and hatch out as temperatures rise in the spring. The nymphs crawl up the plant and begin feeding on the xylem tissue (the water conducting vessels of the plant). There are not a lot of nutrients in xylem and therefore nymphs need to process a lot of sap, extracting the few nutrients out for their use and excreting the remaining water. This water is frothed into white spittle, which helps protect the nymphs from desiccation and natural enemies. You can often find several nymphs within a spittle mass. Feeding by spittlebugs, if extensive, can stunt plants and reduce berry size. Perhaps more importantly, the spittle masses are a nuisance to pickers. Threshold for spittlebug masses is 1 mass per foot row. Thiodan, Brigade, Danitol, and Provado are labeled for use against spittlebugs. Weedy fields tend to have more problems with spittlebugs.

Root weevil (there are several species) is the last strawberry pest I want to discuss in this issue. The larvae feed on roots and crowns and when abundant can cause serious damage to plantings. Beds with heavy infestations show distinct patches or spots that appear stunted and have reduced yields. Drought stress aggravates the injury from larval feeding. Chemical control (Brigade) is targeted at the adults that emerge in mid to late June. Look for characteristic adult feeding damage on leaves (notching from the edge) to help determine timing. The adults feed for a few days before starting to lay eggs. Some growers have also had success controlling root weevil larvae using parasitic nematodes. These can be applied either in the spring (late April and early May) and/or in the fall. Use sufficient water to get good penetration. Rotation out of strawberries is the best remedy for root weevils. They are wingless and do not move a great distance. However, new plantings should be placed 50 meters or more from an infested planting.

Currants and Gooseberries

Over the past few years we have been seeing a fair amount of leaf cupping caused by the **Currant Aphid**, especially on red currant plants. In addition to leaf cupping, rounded galls form on the topside of the leaves in response to the presence of aphids in pockets on the underside. An economic threshold for currant aphid has not been worked out. Malathion is labeled for currant aphid on currants, applied as leaf buds are opening. Recently Provado has been labeled for currants and should be quite effective against aphids.

Imported Currant Worm (ICW), when present, can cause considerable injury to foliage. The adult, which becomes active in the spring, is wasp-like in appearance (indeed its in the wasp group, but part of a primitive line called sawflies that are herbivorous as larvae). Eggs are laid along the midrib or on the undersides of the leaves. Larvae of the first brood appear in spring, shortly after leaves are out. They initially feed in colonies but as they become larger, feed singly. A second brood of larvae is produced in early summer and in some years a partial third brood is produced later in the summer. Malathion is labeled for use against ICW.

Another currant and gooseberry pest to be on the look out for in the spring is the **currant borer**. A relative of the raspberry crown borer, the adult moth has clear wings, blue-black body with yellow markings resembling a wasp. The adult emerges in the spring, mates and begins laying brownish eggs on the bark of canes. After hatching, larvae burrow into canes and begin feeding within the pith. No insecticides are labeled for currant borer although removal of weak canes in the spring and fall will help keep populations down.

Other pests that might be observed attacking currants and gooseberries in the spring to early summer include the **currant stem girdler** (lays an egg in shoot tips and then girdles stem below) and **gooseberry fruitworm** (larvae feed inside young fruit, sometimes weaving portions of stems together with silk). (Source: New York Berry News, Vol. 4, No. 1, May 13, 2005)

Guthion Status:

Daniel Gilrein, Cornell Cooperative Extension

As you may recall, many uses of Guthion (azinphos-methyl) have been cancelled and some are being phased out. Labels have been revised to delete the cancelled crops, and product with old labels could be sold only until Nov. 20, 2003. New labels also add additional restrictions on spray drift, U-pick situations, buffer zones, re-entry intervals, etc. and eliminate some uses for certain crops (e.g. can only be used for cabbage root maggot on Brussels sprouts and raspberry crown borer on **caneberries**).

Cancelled crops include alfalfa, beans (succulent & snap), birdsfoot trefoil, broccoli, cabbage, cauliflower, citrus, celery, clover, cucumbers, eggplant, filberts, **grapes**, melons, onions (green and dry bulb), pecans, peppers, plums, quince, spinach, **strawberries** and tomatoes. Growers can continue to use older labeled product if registered in the state until used up. [Use the EPA registration number on the bag to verify status of the product that you are planning to use]

Crops to be phased out by August 31, 2005 include cotton, **cranberries**, nectarines, peaches, potatoes, southern pine seed orchards and **caneberries** (raspberries, blackberries, etc.).

Originally uses after 12/31/05 were not to be allowed, but EPA received several requests for extension and registrations will remain pending their review. Some registrations (almonds, apples, **blueberries**, sweet and tart cherries, pears, pistachios and walnuts) may continue depending on outcome of EPA review of submitted data. (***Source**: Long Island Fruit & Vegetable Update, No. 9, MAY 13, 2005*)

Phosphorous Acid Fungicides

Annemiek Schilder, Michigan State University

Recently, a number of new fungicides that have phosphorous acid as the active ingredient have come on the market. Other names that you might hear for this group are "phosphonates" or "phosphates." Examples are ProPhyt, Phostrol and Agri-Fos. Aliette (fosetyl-Al), an older fungicide, is the prototype for this group of fungicides. However, the long-standing patent on Aliette had prevented similar fungicides from being developed up to recently. In Australia, where the patent did not apply, growers have been using these types of fungicides for over a decade.

This term "phosphorous acid" should not be confused with phosphoric acid or phosphorus (P), a fertilizer component. In fertilizers, P is normally found in the form of phosphoric acid (H_3PO_4), which readily disassociates to release hydrogen phosphate (HPO_4^{2-}) and dihydrogen phosphate ($H_2PO_4^-$). Both of these ions may be taken up by the plant and are mobile once inside the plant. Phosphorous acid is H_3PO_3. A single letter difference in the name of a chemical compound can make a make major difference in its properties. Phosphorous acid releases the phosphonate ion (HPO_3^{2-}; also called phosphite) upon disassociation. Phosphonate is easily taken up and translocated inside the plant. Phosphorous acid does **not** get converted into phosphate, which is the primary source of P for plants.

Because phosphorous acid and its derivatives do not get metabolized in plants, they are fairly stable and probably contribute little or nothing to P nutritional needs of the plants. Some researchers have investigated the ability of phosphorous acid to act as a nutrient source for plant growth and found that P-deficiency symptoms developed with phosphorous acid as the sole source of P. This means that although phosphorous acid can control diseases it is not a substitute for P fertilization. The inverse is also true: phosphate is an excellent source of P for plant growth, but is unable to control diseases other than improving the general health of the crop. So applying high amounts of P fertilizer will not work as a disease control measure.

Researchers have found that phosphorous acid fungicides are especially effective against Oomycete pathogens, such as *Phytophthora, Pythium* and downy mildews in a number of crops. Phosphorous acid has both a direct and an indirect effect on these pathogens. It inhibits a particular process (oxidative phosphorylation). In addition, some evidence suggests that phosphorous acid has an indirect effect by stimulating the plant's natural defense response against pathogen attack. This probably explains the much broader spectrum of activity observed in fungicide efficacy trials in small fruit crops in Michigan. We've found, for instance, that ProPhyt had efficacy against downy mildew, Phomopsis and black rot (but not much against powdery mildew) in grapes. We also have evidence of activity of these compounds against anthracnose in blueberries.

The phosponate ion is highly systemic and fairly stable in plants. The systemic activity allows them to be applied as foliar fungicides for prevention of Phytophthora and Pythium root rots. They also display curative activity. In

general, applications every 14 days seem to be effective in grapes, but follow label directions. These fungicides are sold as solutions of potassium and/or sodium salts of phosphorous acid. To compare them, one should look at the "phosphorous acid equivalent," which should be listed on the label. Prices range from about $25 to $35 per gallon, and the application rate ranges from 2 to 5 pt/acre (~$6.25 to $22 per acre, depending on the product and rate). Under high disease pressure, higher rates may need to be used and spray intervals tightened. Since these fungicides are actually in salt form, care must be taken not to exceed a certain concentration as crop injury may result. In addition, if the concentration is too high, the pH may become so low that in tank mixes with copper products (particularly copper hydroxide, such as Kocide), too much copper will become available and result in crop injury. (***Source**: Michigan Fruit Crop Advisory Team Alert, Vol. 20, No. 5, May 10, 2005*)

Upcoming Meetings

UMass Fruit Team Twilight Meetings

June 14, 2005, UMass Cold Spring Orchard, Belchertown, MA *Special Starting Time of 3:00*
Jon Clements 413-478-7219, clements@umext.umass.edu, www.umass.edu/fruitadvisor/meetinginfo/meetings.html

June 15, 2005, High Hopes Orchard, Keene, NH *co-sponsored with UNH Extension*
Jon Clements 413-478-7219, clements@umext.umass.edu, www.umass.edu/fruitadvisor/meetinginfo/meetings.html
George Hamilton 603-641-6060, George.hamilton@unh.edu

June 16, 2005, Sweet Berry Farm, Middletown, RI *co-sponsored with URI Extension*
Jon Clements 413-478-7219, clements@umext.umass.edu, www.umass.edu/fruitadvisor/meetinginfo/meetings.html

Program for all meetings:
5:30 PM Farm tour.
6:30 PM Speaking program will include updates of current cultural practices and integrated pest management approaches.

Pesticide-license recertification credit (2 hours) will be offered.
Please be there on time to receive pesticide credits.
A $10/person ($20 maximum/orchard) registration fee will be charged (at the door) for the April 12 and 14 meetings. Light refreshments will be served.

Essex County Fruit Growers.
Our next meeting will be on Thursday May 19th at the Cider Hill Farm in Amesbury. The meeting starts at 6:30 p.m. **Directions**: take 495 to exit 54 onto Route 150 and follow 150 north through Amesbury center. After passing through the center watch for Fern Avenue crossing Route 150. Turn right on Fern Avenue and you will see Cider Hill Farm just down the road.

Massachusetts Cultivated Blueberry Growers' Summer Meeting, June 18, 2005,
Contact: Elizabeth Patt (508) 429-6795

Massachusetts Berry Notes is a publication of the University of Massachusetts Extension Fruit Program which provides research based information on integrated management of soils, crops, pests and marketing on Massachusetts Farms. No product endorsements of products mentioned in this newsletter over like products are intended or implied.