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Berry Notes

Prepared by the University of Massachusetts Fruit Team

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IN THIS ISSUE:

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 especially with recent wet weather. See article below about disease management in strawberries. Scout fields for clipper and two-spotted mite. Tarnished plant bug have been found in various locations, so field scouting should include TPB, too. 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 in last week's issue for more information on this pest. Remember to avoid insecticide applications during bloom. But, be ready for fungicide applications to control botrytis gray mold during bloom, especially in light of the wet weather of late. See article in this issue about disease management in brambles. Fertilizer applications made prior to this rain may have leached past roots and a repeat application may be required. 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 underway especially in early varieties. Cranberry fruitworm traps should be set out at this time. Hold insecticide applications until after bloom is complete. Some sites may have suffered freeze damage to flowers. Be sure to have adequate pollinators for the bloom period. Giberellic acid applications may aid in overcoming poor pollination. See article in this issue on how to use GA. Scout fields for signs on mummyberry strikes and apply fungicide as needed. Also, be ready for bloom fungicide applications to control fruit rots. Apply fertilizer as soon as fields are passable in a split application w/ 50-60 lbsN/acre in mature plantings. Make second application in 4-6 weeks. **Grapes** buds have burst and leaves are unfolding in some varieties. Frost may have damaged some primary shoots. See more on this below. Growers will need to begin their spring fungicide program as soon as the weather permits. Fertilizer and herbicide applications made before the rain may need to be repeated where large amounts of rain may have washed or leached materials away. **Currants** and **Gooseberries** are at fruit-set. 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.

ENVIRONMENTAL DATA

The following growing-degree-day (GDD) and precipitation data was collected for a one-week period, May 4, 2006 through May 10, 2006. Soil temperature and phenological indicators were observed on May 10, 2006. Accumulated GDDs represent the heating units above a 50° F baseline temperature collected via our instruments since the beginning of the current growing season. This information is intended for use as a guide for monitoring the developmental stages of pests in your location and planning management strategies accordingly.

Region/Location	2006 GROWING DEGREE DAYS		Soil Temp (°F at 4" depth)	Precipitation (2-Week Gain)
	2-Week Gain	Total accumulation for 2006		
Cape Cod	43	114	52˚F	1.00"
Southeast	45	155	50˚F	1.50"
East	53	177	50˚F	1.50"
Central	43	128	45˚F	1.95"
Pioneer Valley	50	199	55˚F	0.06"
Berkshires	47	124	54˚F	0.05"
AVERAGE	46.8	149.5	50.3˚F	1.01"

n/a = information not available

(***Source**: UMass Extension 2006 Landscape Message #11, May 12, 2006*)

STRAWBERRY

What Fungicide do I Choose for Disease Control in Strawberries?

Annemiek Schilder, Michigan State University

There are more choices for disease control in strawberries than ever before. This can be a rather bewildering experience, as growers have to consider the disease control spectrum, efficacy ratings and cost per acre for each product. This article aims to help strawberry growers in the decision-making process by outlining unique aspects of several strawberry diseases, characteristics of the newer fungicides, and by suggesting several possible fungicide programs. A few notes on specific diseases:

1) Control of leaf diseases, such as common leaf spot, scorch, Phomopsis leaf blight and angular leaf spot may only be needed on susceptible cultivars. Some leaf diseases can spread to the berries (e.g., Phomopsis can also cause a fruit rot), or berry caps (angular leaf spot and scorch). If these have been a problem in the past, start fungicide sprays before bloom.

2) Leather rot (*Phytopthora cactorum*) is best controlled by growing strawberries in well-drained soil and by applying straw mulch between the rows to prevent the berries from touching the soil (where the fungus resides) and prevent soil from splashing up onto the berries. If there still is a problem, use Ridomil Gold or Aliette for control. Some phosphorous acid products such as Agri-Phos (similar to Aliette) may also work, but have not been evaluated on strawberries in Michigan. Spray during bloom and fruit development.

3) Angular leaf spot is a bacterial disease characterized by translucent leaf spots and blackening of the berry caps. It is favored by cool, wet weather and nights with temperatures close to freezing. The bacteria are spread by rain splash or by irrigation water. Copper (e.g., Kocide, Cuprofix, Bordeaux, etc.) is the only chemical that works against this disease. Some labels suggest adding lime as a safener to reduce the risk of crop injury. In susceptible varieties, start spray applications before bloom to prevent multiplication of the bacteria on the leaves before they jump to the berry caps.

4) Botrytis gray mold, the predominant fruit rot in most areas where strawberries are grown, primarily enters the berries through the blossoms, which means that chemical control should be focused on the bloom period. The Botrytis fungus can produce numerous spores on dead leaves and other plant matter and spreads easily by wind. Make sure to protect the king blooms especially, since these provide the largest berries. The other period for control is pre-harvest, since Botrytis can spread rapidly from infected berries to ripe and overripe berries. Pre-harvest sprays reduce post-harvest rots and increase shelf life of the berries.

5) Most other fruit rots, including anthracnose, tend to infect the berries somewhat later in the season, i.e., during the green fruit or ripening stage. Anthracnose fruit rot is favored by warm, humid conditions and can spread rapidly during rains or frequent irrigation. In cool seasons, it tends to appear closer to harvest or may not show up at all. Anthracnose fruit rot can be identified by black sunken lesions with wet, orange (and sometimes gray) spore masses in them. The anthracnose fungus is able to multiply on the

leaves without visible symptoms, which may explain its sometimes widespread and sudden appearance in fields.

New fungicide characteristics (prices are estimates for comparative purposes only and may vary depending on the supplier and quantity purchased). Please follow label directions carefully before use.

Pristine (pyraclostrobin and boscalid) contains a strobilurin and an analid active ingredient. This fungicide is a very broad-spectrum material and has excellent activity against leaf spots, powdery mildew, and fruit rots, including Botrytis gray mold. It is surface-systemic (i.e., it is somewhat mobile within the wax layer on the plant surface) and has limited back action. The fungicide gets rainfast quickly. The label rate is 18-23.5 oz/acre (approximate cost: $32-$42/acre). The number of applications is restricted for fungicide resistance management. PHI=0 days.

Cabrio (pyraclostrobin) is a strobilurin-type fungicide with excellent broad-spectrum activity against leaf spots, powdery mildew and fruit rots. However, it does not provide much control of Botrytis gray mold. It is surface-systemic and has limited back action. The fungicide gets rainfast quickly. The label rate is 12-14 oz/acre (approximate cost: $16-$18/acre). The number of applications is restricted for fungicide resistance management. PHI=0 days.

Abound (azoxystrobin) is also a strobilurin-type fungicide with good to excellent broad-spectrum activity against leaf spots, powdery mildew and fruit rots. It does not have much activity against Botrytis gray mold. It is surface-systemic and has limited back action. The fungicide gets rainfast quickly. The label rate is 6.2-15.4 fl oz/acre (approximate cost: $12-$30/acre; $24 at the 12-oz rate). The number of applications is restricted for fungicide resistance management. PHI=0 days.

Elevate (fenhexamid) is a fungicide with a new chemistry that has excellent activity against Botrytis gray mold. While fenhexamid has some systemic activity, it should be used as a preventative fungicide. The fungicide gets rainfast quickly. Can be used to alternate with fungicides in other chemical classes. The label rate is 1.5 lb/acre (approximate cost: $41/acre). PHI=0 days.

Captevate (fenhexamid and captan) is a pre-mix of Elevate and Captan. It has excellent activity against Botrytis as well as moderate to good activity against anthracnose and other leaf spot and fruit rot diseases. This formulation appears to perform a bit better than a tank mix of Elevate and Captan. The label rate is 3.5-5.25 lb/acre (approximate cost: $42-$63/acre) . At the high rate, the dose is equivalent to 1.5 lb Elevate and 5 lb Captan. The PHI=0 days.

Switch (cyprodinil and fludioxonil) is a mixture of a systemic and protectant active ingredient (both are new chemistries). Switch has excellent activity against Botrytis gray mold and moderate to good activity against anthracnose and scorch. The label rate is 11-14 oz/acre (approximate cost: $39-$50/acre). PHI=0 days.

Older fungicides such as Topsin M, Captan, Thiram, Sulfur, etc. remain effective disease control tools. The approximate prices per acre: Topsin M $16/acre; Captan $13/acre; Thiram $8/acre; Sulfur $1-2/acre; and copper formulations: $3 to $4/acre. (***Source**: Michigan Crop Advisory Team Alert, Vol. 21, No. 5, May 9, 2006*)

How To Monitor For Clipper Weevil In Strawberries

Pam Fisher, Ontario Ministry of Agriculture and Food

How to Monitor for Clipper Weevil

In a field 5 acres in size or less:

1) Check 5 locations near the edge of the field, near sheltered areas, woods or bush.
2) Mark a 2 ft square.
3) Check all the buds on all the plants in that section.

How to Evaluate Damage

There are two ways to evaluate damage:

1) Count the number of buds which have been clipped. If the average is 13 or more clipped buds per 2 foot square, then control is recommended.
2) Look at the whole flower cluster, rather than individual buds. Decide if the cluster is highly damaged by clipper or not. A cluster is highly damaged if:
   - the primary bud has been clipped
   - two or more secondary buds have been clipped
   - three or more tertiary buds have been clipped

Use a threshold of 3 or more highly damaged clusters per 2 foot square.

Other Monitoring Tips

Other monitoring tips:

1 Holes in petals or base of the bloom indicate clipper weevil adults have been feeding on pollen. Expect to see injury shortly.

Figure 1. Monitoring for strawberry clipper weevil in strawberry plants.

2 Clipper weevil adults are most active when temperatures, especially nighttime temperatures, exceed 16°C.
3 Clipped buds, which appear brown or dry, have been clipped for a few days or more. Clipped buds, which are green or fresh looking, indicate more recent injury.
4 Clipped buds often fall to the ground, leaving a stem with a black stubby end. Don't forget to include these in your count.
5 Clippers do not clip buds in bloom. Monitor twice a week until tertiary buds open.

(***Source**: Ontario Berry Bulletin for May 11, 2006*)

RASPBERRY

Bramble Disease Management – an ounce of prevention is worth a pound of cure!

Cathy Heidenreich, Cornell University

What does it take to consistently produce high quality bramble fruit? Some would say sheer luck; others might cite things like favorable weather, excellent soil, the "proper" cultivars, a good fertilizer program, ample irrigation, excellent pest management, etc. And, in fact, all of these things in concert determine final fruit quality.

That said, let's consider in particular disease management and the direct and indirect impact it has on fruit quality. Gray mold is a perennial problem in bramble fruit production, and is the number one cause of loss of fruit quality and yield. Cane diseases and root rots (spur and cane blights, Phytophthora root rot, Verticillium wilt) weaken brambles over time to such a degree yields are reduced or in some instances, lost. They may also make brambles more susceptible to winter injury and subsequent death. Other bramble pathogens such as powdery mildews, rusts and anthracnose may infect multiple plant parts including leaves, canes, flower buds, and fruit. Virus diseases such as Raspberry Mosaic Virus Complex or Crumbly Berry may reduce plant vigor and productivity and/or fruit quality.

What's the secret, then, to good bramble disease management? It's quite simple: Bramble disease management needs to be proactive to be successful!

While the concept itself is simple to understand, the implementation of it involves serious forethought and energy. Successful bramble disease management requires a short-term commitment to get it started in your operation, and a longterm commitment to sustain it as part of your every day operation. Let's take a look at the steps involved in setting up a proactive bramble disease management program. We will start at ground zero with a new planting and then work through disease control strategies for established plantings. We will finish up with a bramble disease management checklist by way of review. Ready? Set? Go!

Before You Grow

Whether you are a first time grower or have been in the business for an extended period, there are some basic things to consider in terms of disease management before you put in a new planting There are 4 key items that you need to identify before you begin: your plant host, potential diseases, environmental conditions favoring their build up, and potential control strategies.

Know your hosts

There is, for the most part, some degree of host susceptibility/resistance to each of the bramble diseases previously discussed. That means the cultivar you select may determine in part what disease problems you face. Do your homework and determine to which diseases your host is most susceptible. Does the dollar return on sales substantiate the investment needed for disease control on a particularly susceptible variety? If not, consider selecting an alternate variety of comparable quality with greater host resistance. Does the planting site or some portion of it favor

development of a particular disease? If so, be sure to put your most resistant varieties in that area and locate more susceptible varieties on more favorable sites. A word of warning, in the case of root rot diseases, even the most resistant cultivars may fail under favorable environmental conditions and high disease pressure…

Identify potential diseases

Now that you have researched your hosts and know their relative susceptibilities to various diseases, you need to explore what diseases may pose a threat in your area. What bramble diseases are most common in your geographic region? Your locality? Are there other operations in the vicinity? What disease issues do they have?

Determine Environmental Conditions Favoring Disease Development

Take a good look at your planting site. Then look again. And again…Is there an air or water drainage issue that cannot be redressed? Is it located next to hedge rows or abandoned fields with high populations of wild brambles? Is it in a frost pocket that may result in cane injury? Perhaps it's an exposed site with a lot of strong winds. Or a site next to a hedgerow which is shaded a good part of the day. What were the crops previously grown on that site? Crop history in solanaceous plants such as potatoes, tomatoes, peppers etc. may have facilitated population buildup of Verticillium, which may persist in soil over periods of 10 years or longer. Even solanaceous weeds, such as nightshade serve as hosts for Verticillium. One or more of these factors may favor disease development in your new planting.

What time of year are diseases most likely to occur? How often do they occur during the season? What conditions favor their build up? Are they weather related? Related to host growth stage? At what point do you need to take action? Are there established action thresholds?

Explore short-term and long-term control options

What are your options to help prevent an outbreak? They are three-fold: cultural, biological, and chemical.

Cultural methods - Exclude, Inhibit or Limit, and Eradicate! Starting with disease free plants is important for all diseases, but particularly important for orange rust and viruses. Always check to see if disease resistant cultivars are available and use them if feasible.

Select sites, soils and planting designs carefully to maximize air and water drainage. Maintain plant health by properly managing soil nutrition and irrigation, and minimizing plant wounding. Use physical barriers such as distance, mulches, row covers etc. Remove and destroy debris from pruning and harvesting operations immediately. Harvest ripe fruit promptly.

And finally, remove infected plants as soon as they are identified; this is especially important in the case of orange rust or viruses.

Biological methods – Perhaps you have heard the saying "Little bugs have little bugs to bite 'em, lesser bugs have lesser bugs, and ad infinitum!" More and more biological control organisms are now being produced on a commercial basis and may be available for use in disease suppression or prevention. For example, there is now a benign strain of the crown gall bacterium (K84) that maybe applied to bramble cuttings to help prevent infection by more virulent strains. Other pathogen predators, parasites or competitors may have been identified and made available commercially to help in the fight against bramble diseases.

Chemical methods - What disease control products, if any, are available to you as a commercial grower, as an organic grower? Check out these websites for more information:

Products labeled for use in NY State:
http://www.pmep.cce.cornell.edu
OMRI approved products (organic)
http://www.omri.org/OMRI_datatable.htm

When You Suspect a Disease

Like death and taxes, disease problems are inevitable. The steps above can often help delay or minimize the occurrence of diseases, but will not completely eliminate them. So, what to do if you suspect a disease? Now's the time to get out your hand lens and do a little detective work!

Sleuth out the Suspects

There are three prerequisites to disease detection- a keen eye, frequent observation, and good notes!

It's good to get out in the field early in the season and keep good notes about your plants' health.

Use notes on healthy growth and development as a "baseline EKG" to evaluate how plants are doing during the course of the current season or between seasons. This makes it easier to spot occurrences of an unusual nature: one section of field that is behind in growth compared to another, brown flecking on leaves, wilting, spots on canes, yellowing of green tissue, dead canes, swellings, stunted plants, etc.

Be sure to bring along the tools of the trade and do some CSI investigating of your own. These tools might include a field pack with the following: hand-lens, sample bags, trowel, pocket knife, pruner, permanent marker, note book, pencils or pens, and a map of each field to be scouted, pocket ID guides.

Record disease information on the maps during scouting; use maps to calculate areas for control measures, if needed.

Look for anything out of the ordinary. Record the specific plant part affected, and how it differs from a healthy plant (symptoms). Note the presence or absence of a pathogen (signs). Are there patterns of distribution on the plant, in the row, in the field? Does the appearance of damage

(symptoms) correlate with a specific event: weather, crop production procedure, chemical application, other…)?

Table 1. Bramble Development and Associated Diseases

Summer-Fruiting Raspberries/Blackberries	Primocane-Fruiting Raspberries
• *Bud break*	• *From petal fall through the beginning of harvest*
o Anthracnose	
o Spur blight (red raspberries)	o Gray mold
o Cane blight	Special Pests
• *Early bloom*	• Raspberry leaf spot
o Gray mold	• Orange Rust
o Powdery mildew	• Verticillium wilt
• *Full bloom*	• Phytophthora root rot
o Gray mold	• Crumbly berry
o Powdery mildew	• Mosaic virus complex

Confirm Your Diagnosis
Have good diagnostic resources and/or references at your disposal on the farm or online to help in making your initial diagnosis. A list of suggested bramble resources is provided for you in the bibliography following this article.

Remember, not all disease is caused by a living organism such as a fungus, bacterium, virus, etc. Abiotic diseases often occur and may have symptoms similar to those caused by pathogens. Here is a short review of probable causes of abiotic disease:

- *Nutrient extremes*
  - deficiencies, toxicities
- *Temperature extremes*
  - winter/frost injury, ultraviolet radiation/heat
- *Moisture extremes*
  - drought, flooding, relative humidity
- *Phytotoxicity*
  - adverse reactions to chemicals
- *Environmental damage*
  - wind, hail, lightning strikes
  - air pollution, acid rain, wildlife
  - mechanical injuries and wounds

Consult your local cooperative extension office or regional specialist if you are unable to identify the disease with resources at hand. Or alternatively, send a sample to a diagnostic lab for further testing or confirmation.

Apply Control Strategies
Carefully follow all label instructions when applying control products. (Note: Both the crop and pest must appear on the NY label!) Always apply products or biologicals at the label recommended rates. Use sufficient volume and pressure to get thorough coverage of plant material. Maintain and calibrate application equipment on a regular basis. Store any remaining product according to manufacturer instructions.

A word to the wise on fungicide resistance development; because brambles are a relatively small market share for fungicide companies, fewer numbers of products are available for use on these crops as compared to other major fruit crops, such as apples or stone fruit. To maximize the efficacy and minimize fungicide resistance development for the limited products available, it is wise to alternate chemistries. See product label instructions for more specific information on managing fungicide resistance.

Once Disease Control Strategies are in Place
Continue to monitor disease-related information after control measures are in use. Was the control measure effective?

Has the occurrence or frequency of the disease been reduce to acceptable levels? Is there a need for future concern? Keep records to help determine the effectiveness of your control strategies, and provide information for next year's disease scouting forays. Adjust strategies as needed until acceptable levels of control are achieved.

In Summary
The process described above may seem rather time consuming and involved at first, but will pay big dividends in return for your investment. Once you have implemented it fully, it takes only a small amount of time each week to keep it running smoothly. And by the way, many of the general pest management principals listed above may also be used for insects, weeds, and wildlife! How's that for killing several birds with one stone (no pun intended…well, maybe!) Remember that checklist I promised earlier? Here it is!

Disease Control Strategies- Preplant
- Preplant cover crops for suppression of weeds and soil-borne diseases.
- Resistant cultivars.
- Certified, disease-free planting stock.
- Do not establish new plantings next to wild brambles.

- Select sites with good soil and air drainage.
- Orient crop rows with prevailing breezes.
- Space plants properly.

Disease Control Strategies- Established Plantings

- Maintain overall plant health.
- Thin to proper cane density.
- Maintain narrow rows.
- Avoid high rates of nitrogen; succulent growth encourages disease development.
- Prune out old fruiting canes.
- Remove dead and dying canes after harvest.
- Remove and destroy prunings, infected canes, fruit, and debris promptly.
- Consider dormant applications of lime sulfur.
- Scout weekly.

Bramble Disease Management Resources

PUBLICATIONS:

From Cornell CCE Press:
Cornell Pest Management Guidelines for Berry Crops (2006) by Pritts, Heidenreich, Carroll, English-Loeb, and Wilcox.
From NRAES Press:
Bramble Production Guide (NRAES-35) (1991) edited by Marvin Pritts and David Handley. NOTE: Second edition is getting ready to go to print.
From APS Press:
Compendium of Raspberry and Blackberry Diseases and Insects *(1991) by M. Ellis, R. Williams and B. Williamson.*
From Cornell University Press:
Weeds of the Northeast *(1997) by Richard Uva, Joseph Neal and Joseph DiTomaso.*

USEFUL WEBSITES:

Cornell Pest Management Guidelines for Berry Crops
www.fruit.cornell.edu/Berries/pestman/index.html

Cornell Fruit Website
www.fruit.cornell.edu

Nursery Guide
www.hort.cornell.edu/nursery

Berry Diagnostic Tool
www.hort.cornell.edu/diagnostic

The Tree Fruit and Berry Pathology Website
www.nysaes.cornell.edu/pp/extension/tfabp/

New York State IPM Program
www.nysipm.cornell.edu/

IPM Fact Sheets for Berry Crops
nysipm.cornell.edu/factsheets/berries/default.asp

New York Berry News
www.nysaes.cornell.edu/pp/extension/tfabp/newslett.shtml

Food Safety
www.gaps.cornell.edu/

National Clonal Germplasm Repository for Berry Crops
www.ars-grin.gov/cor/

New York State Berry Growers Association
www.nybga.org

Wildlife Management Information
wildlifecontrol.info

(Reprinted with permission from the North American Bramble Growers Association 2006 Conference Proceedings, p30-35.)

(***Source***: *New York Berry News, Vol. 5, No. 4, April 2006*)

BLUEBERRY

Gibberellic Acid Use on Blueberries

Eric Hanson, Michigan State University

Bloom is a critical time for blueberry producers. When bees are numerous and weather is warm and calm, 80 to 100 percent of flowers may set fruit. Pollinated flowers drop their corollas (petals) while they are still white and fruit begin growing rapidly. Berry set and growth is dependent on the production of gibberellin and perhaps other growth promoters in the ovary tissues and viable seeds. Berries appear to require a minimum number of seeds to attain full size. If pollination is adequate, most all berries contain 20 to 60 seeds, well over this minimum seed number. If pollination is limited, final berry size may be proportional to the number of seeds.

Cold and windy weather during bloom can prevent bees from transferring pollen to flowers or prevent the transferred pollen from fertilizing the ovaries of the flowers. Under these conditions, flowers may set no fruit while others set fruit that contain too few seeds to grow to full size. Under these conditions, bushes may benefit from supplemental gibberellin (GA) sprays. Several GA products (ProGibb, GibGro) are labeled for highbush blueberries. GA typically results in greater retention of some parthenocarpic (seedless) fruit that would have dropped and also increases the size of berries without a full complement of seeds. GA can be applied in a single spray during bloom (80 gram active ingredient per acre) or two 40 g sprays, one during bloom and the second 10 to 14 days later. Higher spray volumes (40 to 100 gallons per acre) may improve coverage and effects. Slow-drying conditions also increase absorption. Also make sure your spray water pH is not above 7.5. Since the response to GA can be inconsistent and subtle, leave non-sprayed rows so you can later judge whether the treatment was helpful.

Since the cost of 80 g of GA is over $100, it is important to know when pollination is limiting and GA may be helpful. If weather has been reasonable good for bee activity and the white corollas fall easily from the bushes, pollination is probably adequate. Keep in mind that blueberries can bloom over a long time, and often only a few days of good conditions is enough to provide adequate pollination and fruit set. Consistently cold, rainy and/or windy weather through bloom causes pollination problems. If the corollas stay on the bushes and turn red-purple before eventually dropping, pollination may have been inadequate. The corollas of pollinated flowers drop readily while still white. Varieties with fruit set problems (Jersey, Coville, Earliblue, Berkeley, Blueray) are most likely to benefit from GA. Jersey, for example, is relatively unattractive to honeybees, and berry numbers and size are often limited by inadequate pollination.

Rabiteye blueberry growers in the Southwest have found that GA may also help overcome slight freeze damage to flowers. The rabbiteye recommendation is to apply 24-32 oz ProGibb just after a damaging frost event and repeat the application in 10-18 days. There is some observational evidence that this can work in Michigan highbush as well. (***Source**: Michigan Fruit Crop Advisory Team Alert, Vol. 21, No. 4, May 2, 2006*)

GRAPE

Management of Grape Insect and Mite Pests – 2006
Part II

Greg English-Loeb, Cornell University

This is a continuation of an article from the last issue of Berry Notes…

Bloom to Mid-season

Grape Berry Moth. Grape berry moth is familiar to most grape growers in New York. It is considered our most important arthropod pest in Lake Erie and the Finger Lakes and much of our current IPM strategy centers around its control. Grape Berry Moth is typically not abundant on Long Island, although it can still be a serious problem especially for cultivars prone to bunch rots (see below). Grape berry moth (GBM) overwinters as a pupa in the leaf litter, emerging as adults in May and June to initiate the first generation of larvae that feed directly on young fruit clusters of wild and cultivated grapes. Depending on temperature, there can be one to three additional generations produced during the season. The larvae cause damage in three ways. First, they can reduce yield by 1) directly feeding on the flower clusters, 2) hollowing out the grape berry and 3) causing premature berry drop. Second, they contaminate the juice that can lead to rejection of entire loads at the processing plant. This is mainly a serious problem for native grapes grown for sweet juice. Third, their feeding activity on flowers/young berries (first generation) and green or ripe fruit (later generations) create good conditions for the development of bunch rots. This is particularly a serious problem for wine grapes, especially those with tight clusters.

GBM has been effectively managed over the past 15 years, while at the same time reducing overall pesticide use, through 1) the recognition that vineyards vary in risk to GBM, 2) the use of a reliable monitoring plan, and 3) judicious use of broad-spectrum insecticides. Note that this approach to GBM management was developed for native grapes and although it can provide a useful guideline for wine grapes, more research needs to be done for these grape varieties. Categorizing vineyard blocks according to risk is a good place to start. High Risk vineyard blocks (vineyards with at least one side bordered by woods, prone to heavy snow accumulation, history of GBM problems) should be treated with insecticides shortly after bloom (first generation larvae) and in late July (second generation). They should be scouted for GBM damage in late August to see if a third insecticide application is required. Note that much of the problems with GBM from 1999-2002 were from late-season egg-laying. Too often growers put their sprayers away after early August and do not check for GBM. Pay attention to email crop updates for alerts on GBM (and other pests). For Low Risk vineyard blocks (lack of woods, low amounts of snow, little history of GBM problems) you can probably safely ignore GBM for the first generation but remember to scout in late July and it may even make sense to scout in late August as well. For vineyard blocks that fall in between high and low risk (Intermediate Risk) we recommend an insecticide treatment for first generation (immediate post bloom) and scout for GBM at the end of July and end of August. The current thresholds are 6% cluster damage for late-July and 15% at the end of August. These thresholds have been developed for native grapes bound to processing plants. Thresholds for vinifera are probably less due to the additional risk of bunch rots associated with GBM feeding injury and their higher value.

There are several options available for chemical control of GBM. The most commonly used product is Sevin, although Danitol and Imidan are also effective broad-spectrum materials. Note, though, that Imidan is not quite as effective against leafhoppers as the other two. There has been some evidence of control failures with Sevin in the Lake Erie area

due to resistance. Although such problems have not been documented in the Finger Lakes or Long Island, it is something to pay attention to and rotation among pesticides is usually a good idea. More and more growers are turning to pyrethoids (e.g. Danitol, Capture, now Baythroid outside of NY) for control of several different arthropod pests, including berry moth. These pyrethoids are effective materials but as noted above, I have concerns about their overuse leading to spider mite problems

There are some additional, more narrow-spectrum, materials registered for use against GBM. Dipel is one option that has been around for a number of years. The toxin produced by the *Bacillis thuringiensis* (Bt) bacteria is specific to Lepidoptera. In our trials it has been less effective than the broad-spectrum insecticides but has the advantage that it conserves predators and parasitoids in the system. We have found that 2 applications of Dipel per GBM generation (immediate post bloom and mid-July), improves efficacy. Use sufficient water to achieve good coverage of fruit since the larvae must consume the Bt as they enter the berry for it to be effective. Good coverage is an issue for all the GBM materials. Mating disruption, using large releases of the GBM sex pheromone, is another control option to consider. The idea is to prevent mating by artificially releasing so much sex pheromone that males have difficulty locating the female moths. This technique has been around for a number of years and is being used by a small percentage of growers. It is probably most effective for intermediate and low risk vineyards or in years where berry moth densities are low. However, these are the areas that often times do not require an insecticide application for GBM every year. Plastic twist ties impregnated with sex pheromone is now the main method for realing pheromone. The older version of the Isomate GBM twist tie releaser is no longer being sold. However, there is a new product called Isomate-GBM Plus, which lasts the entire growing season. The older product was thought to run out of pheromone by the end of the season in some years thereby leaving the vineyard unprotected. We have just started large-scale field trials to test the efficacy of Isomate GBM plus in collaboration with researchers in Pennsylvania and Michigan. Finally the insect growth regulator Intrepid from Dow Corporation has an EPA label for use on grapes and is available in Pennsylvania and most other states. It has not received DEC approval for New York and we don't expect it to happen this field season. Intrepid is a selective material active against the larvae and eggs of many species of Lepidoptera including GBM. We are still learning how to best use this new material but it seems it needs to be applied a bit earlier than other insecticides (bloom instead of immediate post bloom, for example).

Grape Leafhoppers. There is actually a suite of leafhoppers that feed on grapes. The Eastern grape leafhopper *Erythroneura comes* (pale white in summer) mainly feeds on native cultivars like Concord while several additional species feed on *V. vinifera* and hybrids including *E. bistrata/vitifex*, *E. vitis*, *E. vulnerata*, and *E. tricinta*. All these Erythroneura leafhoppers have similar life-cycles. They overwinter as adults and become active as temperatures warm up in the spring. They move on to grapes after budbreak, mate and begin laying eggs around bloom. There is one full generation during the summer and a partial second. In warm years there is a potential for a nearly full second generation of nymphs and adults. Both nymphs and adults cause similar damage; removal of leaf cell contents using sucking mouthparts. Hence, moderate densities can reduce photosynthesis, ripening and yields. Severity of damage is increased in dry years, assuming irrigation is not available. The last few years have been low grape leafhopper years, probably due to cold winters and cool temperatures during spring and early summer.

Sampling for leafhoppers corresponds to sampling for grape berry moth. At the immediate post bloom period sucker shoots should be examined for evidence of stippling (white dots on leaves caused by leafhopper feeding). If you see stippling throughout the vineyard block an insecticide treatment is recommended. Note that for vineyards at high or intermediate risk of GBM damage, you would probably already be applying an insecticide at this time. If you use a broad-spectrum material such as Sevin or Danitol you will also control leafhoppers. Thus, sampling for leafhoppers at immediate post bloom is only necessary for low risk vineyards. The next sampling period for leafhoppers is mid to late July and focuses on abundance of first generation nymphs. Monitoring for leafhoppers is only necessary for low and intermediate risk vineyards, assuming a broad-spectrum material is used to control GBM in high risk vineyards. At this time check leaves at the basal part of shoots (leaves 3 through 7) for leafhopper nymphs or damage, on multiple shoots and multiple vines located in the exterior and interior of the vineyard. Use a threshold of 5 nymphs per leaf or 10% of leaves with at least moderate stippling to determine need for treatment. The third time for sampling for leafhoppers should occur in late August. This focuses on nymphs of the second generation. Follow a similar sampling protocol as used at the end of July, using a threshold of 10 nymphs per leaf. Note if you have made previous applications of insecticides for leafhopper or GBM it is very unlikely that it will be necessary to treat for leafhoppers in late August. If you do not observe much stippling it is not necessary to more carefully sample for leafhopper nymphs.

There are several choices of pesticides to use against leafhoppers. The carbamate Sevin has been a standard for many years and is still effective except in isolated pockets of Concord and other native grapes around the Finger Lakes

where we have observed control failures suggesting emergence of resistance. There are several effective alternatives to Sevin including Danitol, Capture, Lannate [methomyl], and the two neonicotinoids Provado and Assail. Lannate is in the same chemical class as Sevin so there is potential for cross-resistance. The carbamates (Sevin and Lannate) and pyrethroids are hard on predatory mites. The neonicotinoids are mainly effective against sucking insects like leafhoppers and not as hard on natural enemies as the broad-spectrum insecticides. Note that a half label rate of Provado (0.5 oz.) was as effective as the full rate in controlling leafhoppers in our trials.

Potato Leafhopper. The potato leafhopper is quite distinct from grape leafhoppers discussed above. One big difference is that potato leafhopper originates each year from the southeastern US (it can not successfully overwinter in upstate NY) while grape leafhoppers are indigenous to our area. The overwintered, winged adults ride north on warm fronts and usually arrive in our area sometime after bloom. When and where they arrive is not very predictable and some years are worse than others. However, they tend to arrive on Long Island before the Finger Lakes or Lake Erie region. Vineyards adjacent to alfalfa sometimes get an infestation of potato leafhopper right after the alfalfa is mowed. The adult potato leafhopper is iridescent green and wedge-shaped while the nymph is usually green and moves sideways in a unique manner when disturbed. Instead of feeding on cell contents of leaves like grape leafhoppers, potato leafhopper adults and nymphs use their sucking mouthparts to tap into the phloem vessels (the tubes used by plants to transport products of photosynthesis) of a number of different species of plants including grapes. In the process of feeding, they introduce saliva into the plant that causes, to varying degrees, distorted leaf and shoot development. Some cultivars of vinifera grapes seem particularly sensitive as does the French-American hybrid Cayuga White, but Labrusca cultivars also show symptoms. Feeding symptoms in grapes include leaves with yellow margins (more reddish for red Vinifera grapes) that cup downward. Often these symptoms are noticed before the leafhoppers themselves.

Potato leafhopper is a sporadic pest, although it can be serious in some places and some years. Long Island seems particularly hard hit. We currently do not have good estimates for an economic threshold. We do know that shoots will recover from feeding damage once the leafhoppers are removed. Several insecticides are registered for its control in grapes including Sevin, Danitol, Lannate, Assail and Provado. Note that Provado is now a restricted use pesticide. Potato leafhopper is fairly mobile and it may require several treatments over the season as new infestations occur.

European Red Mite. There are actually two species of spider mites that attack grapes in the Eastern US, two-spotted spider mite and European red mite (ERM), but ERM presents the more serious threat. Problems with ERM on grapes in New York have historically been concentrated on Long Island where the longer season and dryer climate are more conducive to population growth. However, vineyards in the Finger Lakes can also experience mite problems. ERM overwinters as eggs on one-year and older wood. Around budbreak eggs hatch and larval mites move to young leaves. The immature and adult mites feed on cell contents causing stippling of leaves and when abundant, leaf bronzing. The eggs of ERM are red to brown red in color, the immatures and adults are pale brown to red. ERM are very small in size (a fraction of an inch) and best observed with a 10 to 15X hand lens. Under the right conditions (hot and dry, lack of natural enemies), they can reach high populations and cause serious injury to grapes. Cultivars of *V. vinifera* and French-American hybrids appear most susceptible but native varieties can also develop large populations. With rare exception, ERM typically does not become a problem until mid to late summer when conditions are most favorable for population growth and shoot growth has slowed down. Look for immature and adult mites on the top and bottom of leaves in the middle of shoots. The current economic threshold is about 7-10 mites per leaf, or 50% of the leaves infested.

Spider mites are often thought of as a secondary pest. In other words, something must happen in the vineyard that disrupts their natural control by predators, particularly predatory mites, before their populations can increase to damaging levels. Pesticides, that differentially harm predators but not spider mites, are the most typical cause of disruption and this seems to be the case for grapes in New York. We and other researchers have been looking at this issue for several years now. Some tentative conclusions can be made. The use of certain fungicides, particularly mancozeb products, suppresses predatory mites. Repeated use of a mancozeb product may promote outbreaks of ERM. In some situations, however, predatory mite populations are sufficient and/or conditions for ERM population growth are insufficient, such that outbreaks do not occur even with repeated use of a mancozeb product. Jan Nyrop and Wayne Wilcox have recently shown that one early-season application of Dithane had little effect on a well-established population of predatory mites. Several insecticides used in grapes, including Lannate, Danitol, and Capture can also suppress predatory mites. Danitol and Capture are also miticides so at present their use does not create an ERM problem. However, in the past, spider mites have been quick to develop resistance to frequent use of pyrethoids like Danitol and Capture. This may or may not happen with but it is worth keeping in mind. One of the first things to watch out for is initial good suppression of mites followed by a resurgence indicating the spider mites recovered more

quickly than the predatory mites. Overall, paying attention to conserving predatory mites can pay economic dividends since miticides are quite expensive.

We now have several chemical options available for mite control in New York: Kelthane [dicofol], Vendex [fenbutatin-oxide], Agri-Mek, Nexter (previously called and sold as Pyramite), Acramite, JMS Stylet Oil [aliphatic petroleum distillate], Zeal, Danitol and Capture. Note that Nexter is not allowed on Long Island. Kelthane and Vendex are the old standards that have been relied upon for a number of years. Kelthane is fairly hard on predatory mites while Vendex is not. My experience with Vendex is that it takes a bit longer to have an impact than Kelthane. Trials conducted by Tim Martinson demonstrated that 3 early-season applications of JMS Stylet Oil, being used primarily for control of grape powdery mildew, also reduced ERM populations by about 50%. JMS Stylet Oil is relatively benign to predatory mites. Read the label carefully since JMS Stylet Oil is not compatible with a number of other products including Captan, Vendex, and sulfur. Also, although Stylet Oil can help with ERM problems, it is not likely to provide complete control in problem vineyards. Nexter has been registered for use on grapes in New York (but not on Long Island) for a couple of years. It is very effective against ERM but higher rates may be necessary for two-spotted spider mites. Nexter is pretty soft on predatory mites except at high rates. It also provides some partial control of leafhoppers. Agri-mek currently has two-spotted spider mite on the label but not ERM. The Agri-Mek label recommends the use of a nonionic surfactant to improve wetting. Acramite, as indicated earlier, has recently received DEC approval for use in New York, including Long Island. The new label for Acramite includes both two-spotted mite and ERM. Acramite and Agri-Mek are relatively soft on beneficial arthropods. Note the different miticides vary in their re-entry interval and days to harvest requirements. It is good news that we now have several miticides to choose from for control of ERM in grapes. It's a good idea to rotate materials to help reduce pressure for resistance.

Japanese Beetle. Most of you are familiar with Japanese beetles and their fondness for grape foliage. Actually, the adults (1/2 inch body, metallic green in color) feed on a number of different plant species but they do seem to really get excited about grapes. Japanese beetles were introduced into the eastern USA a number of years ago and have been spreading throughout the Northeast and Great Lakes regions. Although the adults have broad diets, the larvae feed principally on the roots of grasses. Hence, we often find the most significant problems with adult Japanese beetles in areas surrounded by an abundance of turf. The adults emerge from the soil in mid-summer and begin feeding and then mating and egg-laying. In some years Japanese beetles can be fairly destructive (last year they were quite abundant in the Finger Lakes), removing significant amounts of foliage (10%). Fortunately, grapes are fairly tolerant of this type of feeding at this time of the season. Dr. Rufus Isaacs of Michigan Sate has been examining the economic impact of Japanese beetle for the last couple of years. Removal of up to 30% of leaf area on young Niagara vines at veraison did not cause significant decreases in growth or yield the next season. Note, though, that the actual impact of leaf feeding will depend on health and size of the vine. Young vines in growth tubes, for example, may be particularly vulnerable in that they have fewer reserves to draw upon to recover from damage and the beetles are protected in the tubes from insecticide sprays. You should make a special effort to regularly monitor vines inside growth tubes for Japanese beetles and apply insecticides directly into the tubes if treatment is warranted. Grape cultivars do seem to vary in resistance to Japanese beetle. Thick leaved native cultivars are the most resistant followed by hybrids and then *V. vinifera*.

There are several insecticides labeled for use against Japanese beetles on grapevines including Sevin, Imidan, Danitol, Capture, and Assail. These all are roughly similar in efficacy. The key fact to remember about controlling Japanese beetle is that the adults are very mobile and can re-colonize a vineyard block after being treated with an insecticide. Regular monitoring of the situation is recommended.

Multicolored Asian Lady Beetle (MALB). MALB was introduced into the US from Asia to help control aphid pests. It has spread to many areas in the southern and eastern US and into Ontario Canada and has generally been an effective biological control agent. However, it has the habit of moving into vineyards in the fall near harvest time. When disturbed, the adult MALB releases a defensive chemical out of its joints that helps it ward off enemies. Unfortunately, the defensive chemical has a nasty taste and bad odor that gets carried into the juice and wine. Relatively low densities of MALB (10 per grape lug) can cause off-flavors in juice and wine. MALB is sporadic both in where in shows up during a given year and from year to year. Vineyards in the Niagara Peninsula in Canada appear particularly vulnerable. Also, vineyards adjacent to soybeans in a year when soybean aphid is abundant may be more vulnerable. I recommend that you scout your vineyards before harvest to see if MALB is present. There could be several different species of ladybugs in your vineyard but probably only MALB would be at high densities on the clusters. You can recognize MALB by the black markings directly behind the head that look like an M or W depending on which direction you look from. The color or number of spots is variable. I would also pay attention to the crop updates to see if and when MALB is turning up in vineyards. If you do end up with a problem,

there are a few chemical approaches you can try. Note that we have yet developed a good estimate of the economic threshold for MALB. There are several pesticides now labeled for MALB: Sevin [carbarly], Danitol [fenropathrin], Aza-Direct and Evergreen [natural pyrethrins]. To use Sevin and Danitol in New York for this purpose, you need to have the 2(ee) label or a copy of the 2006 NY and PA pest management guidelines. Sevin and Danitol are toxic to MALB based on field and laboratory trials conducted by Roger Williams at Ohio State University. Aza-Direct, which is based on the active ingredient azadirahtin from the neem tree, appears to have a repellent effect on MALB, again based on trials by Roger. Based on a trial last year by Tim Weigle, Evergreen appears to have both toxic and repellent effects on MALB. Note that Danitol has a 21days to harvest restriction, Sevin has a 7 days to harvest restriction, and Aza-Direct and Evergreen have no days to harvest restrictions. For Aza-Direct, pH in spray water should be 7 or less (optimum is 5.5 to 6.5).

Some final comments

There are a large number of potential arthropods pests of grapes and it is possible to get overwhelmed with information on biology, symptoms, control options, etc. Here are a few points to keep in mind to help simply things.

Although there are a large number of potential pests, there are relatively few that consistently represent a major threat (grape berry moth, leafhoppers, mites, and a few others). And of those that can cause significant injury, they may not become a pest at a particular site or a particular year. Generally speaking, with arthropod pests you have time to make management decisions based on what is present in the vineyard rather than before it develops. There is a distinct time of the season when particular pests may turn up in your vineyard. In other words, you can focus your scouting on a limited number of pests at a given vine phenology. Look for steely beetles and climbing cutworm at budswell; plant bugs and plume moths when shoots are between 5 and 10 inches; grape rootworm, rose chaffer around bloom; grape berry moth, leafhoppers, leaf phylloxera, Japanese beetle, and spider mites after bloom to late August. Don't put your sprayer away too early in the season. Watch out for late-season damage from grape berry moth. Read extension pest alerts available through the grape extension programs. If you don't have access to email, see if you can get someone who does to makes copies for you. To sign up for either of the electronic newsletters, Tim Martinson's Finger Lakes Vineyard Update or The Lake Erie Regional Grape Program The Crop Update, please contact either program directly. Although the FQPA review process is starting to limit the use of some materials, for the most part, we have good chemical control options available. But be smart about using them. Pay attention to label restrictions and review recommendations in the pest management guidelines. Be aware of the potential for grape berry moth and grape leafhopper resistance to Sevin. Rotate among materials to reduce development of resistance. Be aware of consequences for natural enemies. The cheapest material to apply on a per acre basis may not always result in the lowest cost because of unintended consequences. Most important, only use pesticides or other control options when it makes economic sense to do so (monitor and apply economic thresholds where available. If you have questions or concerns please let me know.

Pest Management in Frost-damaged Vineyards

Rufus Isaacs and Annemiek Schilder, Michigan State University

Introduction

The damaging weather conditions in southern Michigan vineyards this spring has created a need for growers to consider an adjusted insect and disease control program for frost-damaged vineyards. The comments below are intended to help growers reduce pest management costs while maintaining a program to address critical needs for vine protection.

Even though the current yield loss estimates are high, it should be kept in mind that the actual remaining yield potential will not become apparent until after the secondary buds have pushed and clusters have appeared. These guidelines are therefore dependent on managers making decisions about the level of crop remaining. If shoots were heavily damaged by frost but there are enough clusters to harvest some fruit, the focus should be on minimizing the cost of pest management inputs while maintaining quality and yield of the remaining fruit. In a year with a small crop load, the foliage will easily be able to produce sufficient sugars for maturation of the fruit as well as buds and wood for next year. Therefore, the need to protect the foliage from damage by insects and diseases is much lower. In fact, increased canopy size can become a problem due to increased shading, which leads to reduced formation of fruit buds.

Scouting

If a crop is to be harvested from a vineyard, regular scouting can help avoid any more surprises. At the very least, checking vineyards post bloom, in mid-July, and in early August can provide the minimum of information regarding development of key insect pests and diseases. If the cost of hiring a scout seems too much, try negotiating a lower price

before canceling this service. Alternatively, walking the rows once a week can help you keep up to date on vine and pest development and will cut down the cost of this service. This might take about 1 hour per week. It may not seem worth it to spend any time in some badly affected vineyards, but consider this an investment in the long-term future of the vineyard. A form to help with keeping records of your scouting is available at www.isaacslab.ent.msu.edu/grapescout/scout.pdf

Insect management

Foliage pests. Decisions for insect control will depend on the expected yield from each vineyard. If it is expected to be close to normal, a typical insect control program should be maintained to guarantee the expected yield and quality. If a lower than normal crop will be harvested, juice grapevines can tolerate leaf damage and still ripen the reduced crop. Because of this, it will be much less important to control Japanese beetle, rosechafers, and leafhoppers than normal. If no post-bloom insecticide application is made, leafhopper infestation can be checked in mid-July to determine the need for controlling this pest. The threshold for juice grapes with a full crop at this time of the season is ten percent of leaves infested. Although thresholds have not been developed for situations with a reduced crop, they are likely to be much higher as the crop load decreases. As mentioned above, the need for foliage protection will be low this year, so only those vineyards where a high leafhopper infestation is discovered will need treatment. If no crop will be harvested this year, the cost of protecting vines from leafhoppers and beetles is unlikely to be economical in juice grape vineyards. Hybrid and Vinifera vines are less tolerant of insect feeding than juice grape varieties. If bearing vineyards of these varieties are infested by foliage pests, leaf protection remains important for achieving fruit ripening and vine maturation. Regular scouting can be used to determine the need for, and timing of, interventions to control foliage pests. See above for a link to a scouting form.

Cluster pests. A program for control of grape berry moth, which is the main pest of grape clusters, should remain a priority if any grapes are to be harvested. This will help minimize crop loss this year, and will reduce the risk of high infestations next year. Application of a post-bloom insecticide to vineyards that have a history of high GBM infestation is warranted if the vineyard will be harvested. Sampling again in the first half of July (same time as leafhopper samples above) can be used to determine whether the cost of further insecticide applications is warranted. It is worth keeping the sprayer on hand after veraison, in case populations of grape berry moth continue to develop close to harvest. If this occurs and berries are at risk from infestation, a well-timed effective insecticide may be warranted prior to harvest to minimize risk of infestation in harvested berries. If grape berry moth infestation is restricted to wooded borders, cost savings may be achieved in some vineyards by applying border sprays to the outer ten rows. Cluster sampling in mid-July can help identify vineyards where this strategy would be worthwhile.

Disease management

Foliar diseases. The main foliar diseases that are important in Michigan juice grapes are powdery mildew in Concord and downy mildew in Niagara grapes. If no fruit will be harvested, foliar diseases are the only diseases that need to be considered. As with insects, vines with a small crop load will be able to tolerate more foliar disease. In Concord grapes, control of powdery mildew may not be needed at all, unless there a concern about excess inoculum production for next year. In that case, one or two mid- to late-season applications of a sterol inhibitor fungicide will probably be sufficient to reduce further infections and production of cleistothecia. Sulfur (for non-sulfur-sensitive varieties) and JMS Stylet Oil are lower-cost alternatives for control of powdery mildew. JMS Stylet Oil has the added benefit of killing powdery mildew colonies on contact. Downy mildew can be more harmful than powdery mildew, as it can lead to severe defoliation and reduced winter hardiness of the vine. Even though vines with a small crop load can withstand more downy mildew than heavily cropped vines, it should not be allowed to go completely out of control. This is also important from the standpoint of overwintering inoculum for next year.

I would recommend scouting of vineyards in mid-July. If downy mildew lesions are observed, an application of Ridomil can be made to eradicate the disease and stop further spread. Scout again 2 to 3 weeks later to check if further control is needed. Less costly alternatives are copper products (for non-copper sensitive varieties), phosphorous acid fungicides (e.g., Phostrol, ProPhyt) and Ziram. Coppers and Ziram are strictly protectants, whereas phosphorous acid products have strong curative activity and will stop disease development for up to 6 days after an infection has started (this is when the lesions are just starting to show). They don't have much residual activity, however, so they may need to be tank-mixed with Ziram to get longer protection. The phosphorous acid products also have good activity against Phomopsis and moderate activity against black rot. For growers that have already applied dormant sprays, you can expect a reduction in powdery mildew if you applied sulfur, and a reduction in downy mildew if you applied a copper fungicide. In small plot trials in Michigan, reductions of 40-60% were observed compared to untreated plots.

Fruit rot diseases. Black rot and Phomopsis are the main cluster diseases to be considered if there is sufficient fruit to harvest, especially if there is a lot of overwintering inoculum (fungi are not affected by a freeze). Luckily, most

vineyards experienced low disease pressure in 2005, so fungicide applications may not be as critical this year. Black rot control should be focused around bloom, with the first and second post-bloom sprays being most important. There is generally no need to protect the fruit beyond the second postbloom spray, because the berries become naturally resistant to infection about 4 to 5 weeks after bloom. Elite + Ziram or even Elite alone will suffice. Other options are strobilurins, such as Abound. Phomopsis control becomes important as soon as the flower clusters become visible, which will happen a little bit later this year as we will rely more on the secondary buds. Phomopsis spores will be released during most rain events from budbreak until about bunch closing. A peak in spore production usually occurs around the first and second week in May, which may be a good time to protect shoots from infection. The amount of overwintering inoculum can be estimated from the number of lesions on current-season shoots and leaves. During dry spells, fewer sprays will be necessary. In many years, we have not seen a benefit from sprays beyond the first post-bloom spray. Mancozeb is a cost-effective material for use against Phomopsis prior to bloom, and Ziram can be used after bloom. For growers that have already applied dormant sprays, you can expect a substantial reduction in Phomopsis through the season. The only other sprays that may be needed are an Abound spray at bloom or first postbloom, and if a wet spring, a mancozeb pre-bloom. Pristine may be a cost-effective option in Niagara, but the label claims a risk of phytotoxicity on Labrusca-type grapes. Botrytis bunch rot is primarily a concern in tight-clustered Vinifera and hybrid grapes. Protection may be needed if conditions are wet in the period between bunch closure and harvest, with veraison being a critical time. A bloom spray usually is not cost-effective. One or two applications of a fungicide like Vangard are most effective for control of this disease. Scala may be a lower-cost alternative for Botrytis control.

Coverage

Because cluster protection is the main focus of a reduced insect control program, it is best to target sprays to the fruiting zone to maximize the effectiveness of sprays. For effective grape berry moth control, spray deposits must reach the whole cluster. This becomes more challenging as the vine canopy grows and so as the season progresses, spray volume should be increased and every row should be treated. Field trials with an airblast sprayer have shown that a spray volume of 50 gpa achieved substantially better disease control, particularly with protectant fungicides, than a spray volume of 20 gpa. The same result was found for control of grape berry moth – increasing gallonage to 50 gallons provided better control than 20 gallons. Although this will take more time, getting the maximum effect out of every spray is particularly important when yield is expected to be low.

Product selection

Under times of financial challenge, the temptation may be to choose the least expensive option to achieve control. This may seem the best choice, but it is good to keep in mind other factors. For example, is the product effective under the current and predicted weather conditions; how long does it last; and how well will it control the target pest or disease? In the long run, it may be more cost effective to use a slightly more expensive product that lasts longer than the cheapest option. Depending on existing pest and disease pressure, a lower labeled rate may be used, though.

Timing

When cutting back on sprays, make every one count. Making sure that applications are made at the optimal stage for control of your target pest is another way to help cut costs. It may take a little more time to check vineyards closely every few days, but doing this can be a cost-effective way to improve the impact of your spray program. By doing this, you may also find that pests and/or diseases are not as bad as expected, and the cost of an application can be saved.

Insect and disease control approaches in frost-damaged Concord or Niagara vineyards.

Timing	No harvest	Partial harvest
Budswell/1-2 inches of shoot growth	Sprays of sulfur or copper at this time may be an inexpensive means to reduce powdery and downy mildew during the season and inoculum production for next year.	Sprays of sulfur or copper at this time can provide a substantial reduction in Phomopsis and black rot at harvest; powdery mildew will also be reduced by sulfur, and downy mildew by copper.
Pre-bloom	No insect or disease control needed	Control of Phomopsis needed only if it was a problem last year.
Bloom/Post-bloom	No insect or disease control needed.	Controls only needed if history of GBM pressure in that vineyard. If field has history of black rot and/or Phomopsis, this is the best time to apply at least one spray for control. First post-bloom most important.
Mid-season	Foliage protection from insect pests is unlikely to be needed. Scout for downy mildew and treat if infections are common.	Check clusters for GBM infestation. Treat only if infestation is detected. If controlling black rot and Phomopsis, stop after 2nd post-bloom spray. Scout for downy mildew and powdery mildew and treat if infections are common.

Late-season	Foliage protection from insect pests is unlikely to be needed. Scout for downy mildew and powdery mildew and treat if infections are common.	Check clusters for GBM infestation. Treat only if infestation is detected. Scout for downy mildew and treat if infections are common. At this time, it is probably too late for powdery mildew to have a negative impact.

(***Source**: Michigan Crop Pest Advisory Alert, Vol. 21, No. 4, May 2, 2006*)

General Information

Soil – The Basis of Life (The Physical Factors)

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Soils form the base of the biotic pyramid. Most plant and animal (including human) life depend on soils for their existence. The physical and chemical properties of soils control to a large extent the amount and type of plant growth and the capacity of the soil to support animal and human populations. For plants, the soil represents a medium for plant root growth and a supply of essential plant nutrients. Soils provide a place for plants roots to anchor, support upright plant parts, insulate roots from drastic changes in soil moisture and temperatures, and are storage areas for water, air, and plant nutrients.

Many physical characteristics of soils are revealed by an examination of the soil profile. The soil profile, a vertical section of soil extending from the surface into the parent material, is composed of layers (roughly parallel to the soil surface) known as soil horizons. Individual soil horizons differ in properties and characteristics from adjacent horizons below and above. For small fruit crops (blueberries, strawberries, brambles), the horizons in the top 12-15 inches are the most crucial, although horizons at deeper depths are also important, especially those that affect drainage. Since many crop management decisions, such as site selection, crop selection, etc., are made on the basis of the physical features of soils, the proper evaluation of soil profile characteristics is an important key to producing high yields of quality fruit.

Soil texture: The textural class of a soil is determined by the relative amounts of sand-, silt-, and clay-sized particles (particles less than 2 mm in diameter). Gravels, rocks, boulders, and other large particles that often influence the use of a particular soil are not considered in the textural classification. Since soil texture does not readily change in the field, fruit growers should consider the textural classification as a major factor when choosing a suitable planting site. The best soils for production of small fruit crops are those that have good drainage, moderate water-holding and good nutrient supplying capacities. Soil textural classes such as sandy loam, silt loam, loam, and sandy clay loam identify soils that have these favorable characteristics.

Soil structure: Soil structure refers to the combination of primary soil particles into clusters called soil aggregates or peds. The soil structure is identified by aggregate strength (e.g., weak, moderate, strong), size (e.g., very fine, fine, medium), and shape (e.g., granular, sub-angular blocky, blocky). The arrangement of soil aggregates in relation to pore space (voids between aggregates) greatly influences water movement, heat transfer, aeration, and plant root growth. Although soil structure is the result of several biological and biochemical processes, growers can improve (and destroy) the soil structure by management practices. One of the best ways to improve soil structure is to incorporate organic matter into the planting site. As the organic matter decomposes (mineralized by microbes), soil aggregate formation increases and aggregate stability is improved. Mulching the plant rows will also help improve soil structure while simultaneously improving water/air conditions around plant roots. On the other hand, soil structure can be destroyed by tilling or cultivating when soils are too wet, resulting in hard "cloddy" soils with unsuitable conditions for plant root growth.

Bulk density and pore space: Soil bulk density and % pore space are greatly influenced by both soil texture and structure. Bulk density reflects the denseness or compactness of soils and is inversely related to % soil porosity, i.e., high soil bulk densities results in low % pore space. High soil bulk densities in the surface horizons are often caused by human activities such as compaction from traffic (cars, trucks, tractors, etc), animal (and human) paths, and from tilling or plowing the same depth year after year (plow pans). Other horizons with high bulk densities, such as fragipans and clay pans formed by natural processes during soil development, may be found in deeper subsurface horizons. Regardless of the depth of the compacted area, high soil bulk densities reduces the amount of pore space and therefore interferes with water/ air movement and plant root growth. Deep plowing or tilling has proven effective in breaking up many high bulk density, compacted areas, especially those found in the upper 15 inches of soil. On the other hand, fragipans and clay pans are more difficult, if not impossible, to alter by normal cultivation practices, but still

must be considered as a major factor in growing plans since they affect water and air movement (and sometimes root growth) and drainage. Another excellent way to reduce the bulk density and increase the % pore space of surface horizons is by incorporating organic matter. The organic matter lowers the weight per unit volume of soil, thereby reducing the bulk density and increasing % pore space. (Adding organic matter provides multiple benefits for the growth of plants; improves aggregate stability, increases pore space, improves water/air relationships, supplies many nutrients, etc.). An "ideal" soil for growing small fruit crops should have approximately 50 – 60% pore space with a corresponding bulk density of 1.1 to 1.3 g/cm3.

Color: The color of soils has little impact on plant growth or production, but provides valuable clues to other soil conditions. Organic matter contents are normally higher in the upper soil horizons and therefore the surface horizons will be darker in color. As the organic matter content decreases at deeper depths, other colors associated with parent materials and clays become more apparent. Soil color is most useful to small fruit growers as an indicator of soil drainage conditions. Bright red or brown colors, implying that air and water move with ease in these horizons, are typically found in well-drained soils. The presence of gray, bluegray, and gray-green (gley) colors are indicators of drainage problems due to excessive amounts of water in the soil profile. Subsurface horizons in poorly-drained and very poorly-drained soils are often uniformly gray in color. In other soils, the gray colors may only appear as spots or splotches (mottles). Mottles also indicate some problem(s) with drainage; the more mottles and the closer they are to the soil surface, the greater the problem...

Summary: Physical and chemical properties of soils both play major roles in the production of small fruit crops. Small fruit crops require soils with good physical properties. While some physical limitations for growing small fruit crops can be overcome by slight modifications of the soil, others (at least not economically) cannot. Identifying these limiting factors is important and can often be "seen" by examining the soil profile. While soil survey reports (available from NRCS and local Soil and Water Conservation Districts) are useful starting points for identifying the best soils for small fruit production, an on-site evaluation by a horticultural or fruit grower specialist gives valuable insights in "fine tuning" the process. After all, growing fruit crops on the best available soil is often the difference between black and red ink at the end of the harvest season. (***Source**: The Missouri Berry Basket Newsletter, Spring 2006*).

Upcoming Meetings

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

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

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

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

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

Additional Speakers:
Mike Kocsmiersky of Kosmo Solar installed the system and will share his expertise.
Bruce Howden, Howden Farm, Sheffield - Howden Farm currently uses a 1.1 kilowatt solar electric system to power drip irrigation for growing fruits and vegetables on their farm

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

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

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

Lion Spring is a small diversified farm, now engaged in the breeding of Massachusetts Thoroughbred horses. The farm also grows vegetables and herbs for local gourmet restaurants and have a collection of chickens who supply farm fresh eggs for retail sales. On site there is a 4.8 kilowatt photovoltaic system and 3.1 kilowatt wind turbine all feeding a battery bank.

Additional Speakers:

Henry Dupont, Lorax Energy Systems on licensing and choosing turbines

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

Don Campbell, Consultant, Donald Campbell Associates

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

Field Corn Biomass for Heating Greenhouses
Wednesday, October 4, 2006
3:00 PM – 6:00 PM
Kosinski Farm, Westfield, MA
Host: Mike Kosinski, Kosinski Farm

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

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

Additional Speakers:

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

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

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

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

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