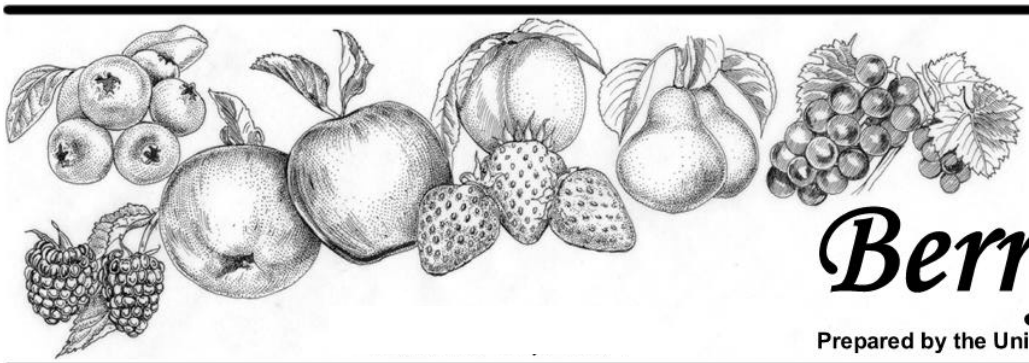

UMASS EXTENSION

Berry Notes

Prepared by the University of Massachusetts Fruit Team

MASSACHUSETTS BERRY NOTES

May 2003, Vol. 15, No. 5

Volume 15-- 2003

Berry Notes is edited and articles written by Sonia Schloemann except where other contributors are noted. Publication is funded in part by the UMass Extension Agroecology Program and grower subscriptions. A text version can be e-mailed to you if you contact Sonia Schloemann at 413-545-4347, sgs@umext.umass.edu. Please cite this source if reprinting information.

IN This Issue

Message from the Editor:

Indar 75WSP Approved: Massachusetts has received approval for the use of Indar 75WSP for the control of Mummyberry disease in highbush blueberries under a section 18 Emergency Exemption from US-EPA. This label is in effect until June 30, 2003. Applicators must have a copy of the Section 18 label in their possession when using this material for this purpose. Copies of the Section 18 label are available from your supplier or by contacting me at 413-545-4347 or sgs@umext.umass.edu.

Frost/Freeze Protection: This issue of Berry Notes contains some important information on protecting strawberries and blueberries from frost or freeze damage. Last year (2002) we had multiple frost/freeze events that damaged berry crops to varying degrees. This is an annual concern and growers need to be prepared with frost protection strategies and understand how and why these strategies work. If you have questions, please contact me for help in preparing for potential frost events during bloom.

Pollination: This is the period during which pollination is an important factor in fruitset, especially in blueberries. See the article on page 12 for information on pollination in fruit crops.

2003-2004 New England Small Fruit Pest Management Guide: The updated issue of the New England Small Fruit Pest Management Guide will soon be available online at www.umass.edu/fruitadvisor for downloading. The printed version will also be available soon. I will announce availability as soon as I know. We expect to also have it available on CD in limited quantities.

Strawberries

Frost Protection in Strawberries

Marvin Pritts, Cornell University

Strawberry growers can ensure a full crop of berries only if they exert some influence on temperature during the year. Temperature control is especially important during the winter and early spring when flowers are susceptible to frost. Of all the factors that negatively affect strawberry production, frost can be the most serious. Frost can eliminate an entire crop almost instantaneously. Strawberries often bloom before the last frost free date, and if a frost occurs during or just

prior to bloom, significant losses can result. The strawberry flower opens toward the sky, and this configuration makes the flower particularly susceptible to frost damage from radiational cooling. A black (rather than yellow) flower center indicates that frost damage has occurred.

Strawberry growers occasionally delay the removal of straw mulch in spring to delay bloom and avoid frost. Research has demonstrated, however, that this practice also results in reduced yields. Also, applying straw between the rows just prior to bloom will insulate the soil from the air. This will increase the incidence of frost injury as solar radiation will not be absorbed by the soil and re-radiated at night. If additional straw is to be applied between the rows in spring, delay its application for as long as possible before fruit set.

Overhead irrigation is frequently used for frost control because flowers must be kept wet during a freeze in order to provide protection. As long as liquid water is present on the flower, the temperature of the ice will remain at 32F because the transition from liquid to ice releases heat. Strawberry flowers are not injured until their temperature falls below 28F. This 4 degree margin allows the strawberry grower to completely cover a field with ice and yet receive no injury from frost. However, if insufficient water is applied to a field during a freeze event, more injury can occur than if no water was applied.

Several principles are responsible for the ability of ice to protect strawberry flowers from injury. First, although pure water freezes at 32F, the liquid in the strawberry plant is really a solution of sugar and salt. This depresses the freezing point to below 32F. Also, ice crystals need nucleators to allow them to form initially. Certain bacteria serve as nucleators. Sometimes, in strawberry flowers, the bacteria that allow ice to form are absent, allowing the freezing point to be lowered. The temperature of the applied water is usually greater than the temperature of the plants, so this serves to warm the flowers before heat is lost to the air. As long as liquid water is continually applied to the plants, the temperature under the ice will not fall below 32F. When one gallon of water freezes into ice, 1172 BTUs of heat are released.

Several factors affect the amount of water that is required to provide for frost protection, and the timing of application. At a minimum, apply water at 0.1 - 0.15 in/hr with a fast rotating head (1 cycle/min.) Water must be applied continuously to be effective. A water source of 45 - 60 gal/min-acre is required to provide this amount of water. Choose nozzle sizes to deliver the amount of water required to provide protection under typical spring conditions in your location. Under windy conditions, heat is lost from the water at a faster rate, so more water is required to provide frost protection. For every gallon of water that evaporates, 7760 BTUs are lost. The application rate then depends on both air temperature and wind speed (see Table 1).

Table 1. Water application rate (in/hr) for a given humidity and wind speed.

	Wind Speed				
Temp (F)	**0-1**	**2-4**	**5-8**	**10-14**	**18-22**
Relative humidity of 50%					
27	0.10	0.20	0.30	0.40	0.45
24	0.10	0.30	0.35	0.45	0.60
20	0.15	0.35	0.45	0.60	0.75
18	0.20	0.40	0.50	0.65	0.80
Relative humidity of 75%					
27	0.05	0.10	0.20	0.25	0.25
24	0.10	0.20	0.30	0.35	0.40
20	0.10	0.25	0.40	0.45	0.60
18	0.15	0.30	0.45	0.55	0.70
FROSTPRO model from North Carolina State University					

Under windy conditions, there is less chance of flower temperatures falling below that of the air because of the mixing of air that occurs at the boundary of the flower. Winds are beneficial if the temperature stays above the critical freezing point, but detrimental if the temperature approaches the critical point. Less evaporation (and cooling) will occur on a still, humid night. Under extremely windy conditions, it may be best not to irrigate because the heat lost to evaporation can be greater than the heat released from freezing.

Stage of development: Strawberry flowers are most sensitive to frost injury immediately before and during opening. At this stage, temperatures lower than 28F likely will injure them. However, when strawberry flowers are in tight clusters as when emerging from the crown, they will tolerate temperatures as low as 22F. Likewise, once the fruit begins to develop, temperatures lower than 26F may be tolerated for short period.

The length of time that plants are exposed to cold temperatures prior to frost also influences injury. Plants exposed to a period of cold temperatures before a frost are more tolerant than those exposed to warm weather. A freeze event following a period of warm weather is most detrimental.

Flower temperature: The temperature of all flowers in a field is not the same. Flowers under leaves may not be as cold as others, and those near the soil generally will be warmer than those higher on the plant. On a clear night, the temperature of a strawberry flower can be lower than the surrounding air. Radiational cooling allows heat to be lost from leaves and flowers faster than it accumulates through conduction from the surrounding air.

Soil also retains heat during the day and releases heat at night. It is possible that on a calm, cloudy night, the air temperature can be below freezing yet the flowers can be warm. Wet, dark soil has better heat retaining properties than dry, light-colored soil.

Using row covers: Row covers modify the influence of wind, evaporative cooling, radiational cooling, and convection. Because wind velocity is less under a row cover, less heat will be removed from the soil and less evaporative cooling will occur. Also, relative humidity will be higher under a row cover, reducing heat loss from evaporation. In addition, convective and radiational heat loss is reduced because of the physical barrier provided by the cover. Plant temperature under a cover may eventually equal that of the air, but this equilibration takes longer than with uncovered plants. In other words, row covers do not provide you with additional degrees of protection, but they do buy time on a cold night as flower temperatures will fall less rapidly inside a cover. Often the temperatures fall so slowly under a row cover that irrigation is not needed. If irrigation is required, less water is

needed to provide the same degree of frost protection under a row cover. Water can be applied directly over the row covers to protect the flowers inside.

Turning on the water: Since cold air falls to the lowest spot in the field, a thermometer should be located here. Place it in the aisle at the level of the flowers, exposed to the sky, and away from plants. Air temperature measured at this level can be quite different from the temperature recorded on a thermometer at the back of the house. The dewpoint temperature measured in the evening is often a good indication of how low the temperature will drop on a clear night, and is related to the relative humidity. Air temperature will fall less if the humidity is high. If the air is very dry (a low dewpoint), evaporative cooling will occur when water is first applied to the plants, so irrigation must be started at a relatively warm temperature. Most local weathermen can provide the current dewpoint, or it can be obtained from World Wide Web-based weather information services.

If the air temperature falls below 34F on a clear, calm night, especially before 3 A.M., it would be wise to start irrigating since flower temperatures could be several degrees colder (Table 2). On the other hand, if conditions are cloudy, it may not be necessary to start irrigation until the temperature approaches 31F. If conditions are windy or the air is dry, and irrigation is not turned on until the temperature approaches 31F, then damage can occur due to a drop in temperature when the water first contacts the blossom and evaporation occurs. Therefore, the range in air temperatures which indicates the need for irrigation at flowering is normally between 31 and 34F, depending on cloud cover, wind speed and humidity, but can be as high as 40F. Admittedly, these numbers are conservative. Flowers can tolerate colder temperatures for short periods of time, and irrigation may not be needed if the sun is about to rise. Obviously, one does not want to irrigate too soon since pumping is expensive, and excess water in the field can cause disease problems.

Table 2. Starting temperature for frost protection based on dewpoint

Dewpoint	Suggested starting air temperature
30 F	32 F
29 F	33 F
27 F	34 F
25 F	35 F
24 F	37 F
22 F	38 F
20 F	39 F
17 F	40 F

Turning off the water: Once irrigation begins, it should not be shut off until the sun comes out in the morning and the ice begins to slough off the plants, or until the ice begins to melt without the applied water.

Waterless frost protection agents: Future solutions to frost protection could lie in waterless methods, such as genetically engineered bacteria that do not promote the formation of ice. However, to date, these materials have not been consistently effective, so they are not recommended as the sole basis for frost protection.

Rules of Thumb

1. Store sufficient water for 2 or 3 consecutive nights of frost protection
2. Use small diameter nozzles (1/16 – 3/16 in. diameter)
3. A 30 X 30 ft. staggered spacing of nozzles is preferable
4. Use metal sprinklers to minimize icing
5. Minimum rotation of once per minute

(***Source**: New York Berry News, Vol 2., No. 4. April 16, 2003*)

Botrytis Fruit Rot in Strawberries

Paul Pecknold and Bruce Bordelon, Purdue University

The most important sprays for control of Botrytis fruit rot (gray mold) of strawberry are those applied at bloom - starting at 10% bloom. There have been some major changes in fungicide registrations for Botrytis control in strawberries. Ronilan and Rovral can no longer be used on strawberries. Elevate received registration in 2000, and Switch received registration in 2002. Both should provide excellent control of gray mold. So, the options for Botrytis control are Elevate, Switch, Benlate, and Topsin M. [**Note**: Existing stocks of Benlate may be used until Dec. 31, 2003.] None of them should be used alone for season-long control of Botrytis because of the potential for development of resistant pathogen strains. Benlate cannot be used on strawberries once the crop has been turned into "U-Pick" or "Pick- Your-Own" or similar operation. However, it can be used preharvest (bloom) and post- harvest as long as the field is not open to U-Pick. (***Source**: Facts for Fancy Fruit, Vol. 03, No. 03, April 28, 2003*)

Eastern Flower Thrips

Rick Foster and Bruce Bordelon, Purdue University

One of the factors we believe may be associated with problems with eastern flower thrips on strawberries is having sustained, strong southerly winds early in the growing season. These winds may blow eastern flower thrips to

Indiana from southern areas. It would be prudent for strawberries growers to watch for thrips as we approach bloom. We recommend looking at the early flowers, especially on early varieties. Although an exact threshold has not been established for Midwest conditions, data from elsewhere suggest that control is warranted if counts exceed 2 to 10 thrips per blossom. This is a wide range, but more precise information is not available. Lorsban or Thiodan are probably the best choices among conventional insecticides, and Brigade and Danitol or SpinTor also are likely to work well. Growers may also want to consider using an insecticide containing neem extracts (Align or Neemix) that is less toxic to bees. (***Source**: Facts for Fancy Fruit, Vol. 03, No. 03, April 28, 2003*)

Brambles

Managing Cane Diseases of Raspberry

Bill Turechek, Cornell University

Anthracnose, spur blight, and cane blight are three diseases where early season management is critical to their control. All three diseases cause lesions on the cane and can seriously impact the health of the planting. Anthracnose is caused by the fungus *Elsinoe veneta*. Symptoms of anthracnose appear as small purple spots scattered on young canes and tends to be much worse on black and purple raspberries than reds (Fig 3). Spur blight is caused by the fungus *Didymella applanata* and is problem mainly on red raspberries. Symptoms of spur blight are centered around individual buds and appears as purple to brown blotches in mid-summer (Fig 4). Even though symptoms are not evident until later in the season, infection occurs early and infected buds fail to grow. Cane blight is caused by the fungus *Leptosphaeria coniothyrium* much more of a problem on black and purple raspberries due to tipping practices, but can be equally problematic on red raspberries. Cane blight can be confused with spur blight. However, cane blight is much more likely to involve the entire cane (not just the buds) and infection sites are typically associated with pruning wounds or other injuries (Fig 5).

Managing these diseases begins with pruning or removing the diseased canes before new canes emerge in the spring. A dormant application of lime sulfur or copper is also critical where any of these diseases are problematic. Liquid lime sulfur at 20 gallons per acre should be applied when new leaves are exposed 1/4 to 3/4 inches; if you are late in your application and don't spray until a few leaves have unfolded, cut the rate to 10 gallons per acre. Thorough coverage of the canes is critical to achieving control so be sure that this application is done on a calm day. A note of caution: This spray may be phytotoxic if applied after ½ inch green, particularly on a warm day. A dormant lime spray is not needed on fall bearing raspberries because the previous year's canes should be mowed down and removed.

Several states, but not including NY [or MA], have applied for and received a special local needs registration (FIFRA 24(c)) for captan for control of anthracnose and spur blight. This spray is used in addition to the delayed-dormant application of lime sulfur. This special registration may be pursued in the future if the demand for it is great enough. (***Source**: New York Berry News, Vol. 2, No. 4, April 2003*)

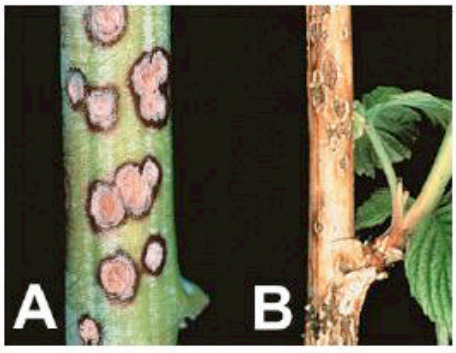

Figure 3. Anthracnose on **(A)** primocanes and **(B)** floricanes.

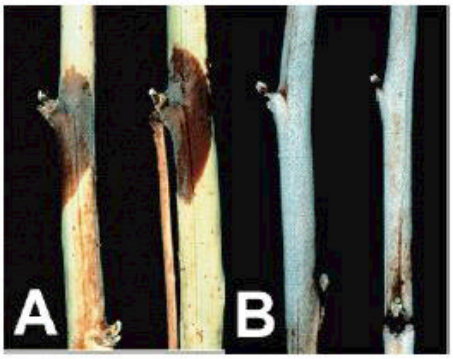

Figure 4. Spur blight **(A)** primocanes and **(B)** floricanes.

Figure 5. Cane blight

Blueberries

Protecting Blueberries From Frost

Eric Hanson, and Mark Longstroth, Michigan State University

After watching blueberry growers protect against widespread frosts in 2002, the [Michigan] blueberry team focused some of their winter programming on using sprinklers to reduce spring frost damage in blueberries. We discussed irrigation for frost control in detail during the

Great Lakes EXPO last winter and in a workshop last month. Here are some important points to consider.

Know how much protection your sprinkler system can provide

The system's irrigation rate and uniformity determine the freeze protection that sprinkler systems can provide. More water is needed to protect at lower temperatures and higher wind speeds (see Table 1). Most systems in Michigan are designed to deliver 0.12 to 0.15 inches of water per hour. These systems can protect to 22°F under very still conditions, but only to 26°F if there is a slight breeze (2-4 mph). If you do not know your delivery rate, catch water in 6 to 8 cans placed on the ground throughout the planting. Most systems cannot easily be changed to deliver more water and protect to lower temperatures.

Table 1. Irrigation rate (inches/hour) to protect buds under different wind and temperature conditions

Temp (°F)	Wind speed (mph)		
	0-1	**2-4**	**5-8**
27	0.10	0.10	0.14
26	0.10	0.16	0.30
24	0.12	0.24	0.50
22	0.16	0.30	0.60
18	0.20	0.40	0.70

(*from U. of Florida Ext. Circ. 287*)

Increasing the operating pressure is not advisable because the volume is not increased substantially (increase from 60 psi to 80 psi may provide only 15 percent more water). Higher pressure can also break lines. Higher pressures also generate considerable mist and change the uniformity of application. Larger nozzles can be installed in some systems but only if the capacity of the mainlines, well and pump can handle the added volume. For example, 9/64-inch nozzles that deliver 0.12 inches water per hour require 60 gallons per minute per acre of blueberries. Switching to 5/32 inch nozzles would deliver 0.15 inches per hour but require 68 gallons per minute per acre. Even if systems can provide adequate volume to protect from temperatures in the low 20's, breakage from ice accumulation can be considerable.

When to attempt to frost protect

Blueberry flower buds and flowers become more sensitive to cold as they develop. Swollen but closed buds tolerate 15 ° -20 °F. At tight cluster or early pink bud (individual flowers are visible but still tight in bud), injury will occur between 18 o and 23° F. Once flowers have separated from one another but the corollas (petals) are still closed, 22°-25°F may be lethal. By the time the corolla is half their full length, they are damaged at 25° to 26°F. Fully open flowers are killed at 27°F. The most sensitive stage is just after the petal fall, when 28°F may cause damage.

Dr. Mike Mainland from North Carolina State University provided a useful rule of thumb during our workshop last month. He suggested not even attempting frost control until at least a few flowers are open. He reasons that most flowers are tight enough to tolerate 22 °-24°F until the first flowers open, so protecting before the first bloom is not useful. This rule of thumb is especially useful when there is a wide difference the emergence of buds on a shoot. If most of the flower buds on a shoot are terminal (at the end of the shoot) and are opening at the same time, then you might want to frost protect in late pink bud. But there is no reason to try and protect flower buds at temperatures below 23 ° or 24°F.

Another consideration is wind. Don't attempt to frost protect if the combination of wind and temperature will exceed to capacity of your system to protect (see accompanying table). Dr. Mainland suggested studying the weather forecast closely, and hanging colored flagging in the field to indicate wind strength.

How early in the evening should I start irrigating?

When irrigation begins, air temperatures are initially reduced due to evaporative cooling. The amount of cooling depends on the relative humidity. If the air is very dry (dew point 15 ° -20°F), start the irrigation when the air temperature drops to 36°F. If the relative humidity is high (dew point above 24°F), start irrigating when air temperature falls to 34°F.

When can I stop irrigating?

Stop irrigating when the ice is melting and temperature is rising. Ice breaking free from branches indicates water is forming under the ice and it is likely safe to quit. Normally this is when temperatures are above freezing and rising. Beware of sudden dips in the temperature soon after sunrise.

Soil surface considerations

Some frost avoidance can be gained by keeping the soil surface clean of vegetation, moist and packed. Moist soils have a large capacity to capture and store heat energy during sunny days, and release heat to maintain air temperature during cold nights. Weeds, sod, and plant residues insulate the soil from the sun and reduce heat capture. In addition, tall grass and weeds raise the effective ground level. This is important since cold air is heavier than warm air, and settles along the ground and in the lowest areas of fields. If fields are covered with foot tall grass or weeds, flower buds a foot higher in the canopy may be injured during a frosty night. Mowing fields with tall weeds is worthwhile.

Another consideration is that moist soils have a higher heat capacity than dry soils, and packed soils absorb more heat than recently cultivated soils. It is not worthwhile to cultivate just before a frost. Some growers attempt to irrigate during the day prior to predicted frosts in order to increase the capacity of the soil to absorb heat. This may be of some value if water is applied early in the day, and there is ample sun to warm the wet soil. Irrigating late in the day or on cloudy days will not increase soil temperatures and provide more heat at night. The bottom line is that clean, moist, and packed soil surfaces absorb the most radiant

energy during the day, and protect from frost by releasing this heat during the night. (***Source**: Michigan Fruit Crop Advisory Vol. 18, No. 4, May 6, 2003*)

Blueberry Freeze Injury or Phomopsis?

Annemiek Schilder, Michigan State University

This spring, tip dieback is prevalent in some blueberry fields. In some cases, the damage seems to be due to freeze injury, while in other cases the Phomopsis fungus may be to blame. While the two symptoms are often difficult to tell apart, there are a few differences that may help you diagnose the problem.

If the dieback is due to Phomopsis, the infection would have taken place the previous year or the year before that if it wasn't pruned out. The infected twig or cane tends to be dark reddish brown with a gray-bleached area at the tip or farther down the twig or cane. Often, the border between the dead and live portions of the cane is fairly distinct. The bleached area may range from one to several inches long and may contain tiny black pimples, which are the fruiting bodies of the fungus. The fungus is most likely to sporulate in the bleached area. More recent twig infections may appear dark brown to almost black. The lesions may be enlarging down the twig from the tip or up and down the twig from an infected lateral bud, which will die before or during bud break. Also, if you notice that the lesions keep expanding, it is most likely Phomopsis and not freeze injury. The fungus can infect twigs and canes anywhere on the bush. Young green canes lower in the canopy often display reddish brown lesions (cankers) that may be flattened.

Freeze injury tends to turn cane tips a light reddish brown, without a bleached area, and the border between dead and healthy tissue is more gradual. Freeze injury may especially affect young green canes that did not harden off well last fall. Also, the damage may be widespread throughout the field and more severe in low-lying areas that are prone to frost.

Phomopsis twig blight incidence can be reduced by pruning out and destroying infected canes and twigs, which act as inoculum sources. Fungicide options for controlling Phomopsis twig blight are Topsin M or Benlate (tankmixed with Ziram or Captan), Bravo, Indar, and Cabrio. Benlate has been discontinued, but some growers may have remaining stocks. The Section 18 label request for Topsin M is still pending, but a decision is expected this week. (***Source**: Michigan Fruit Crop Advisory Vol. 18, No. 4, May 6, 2003*)

Awakened from the Tomb

Bill Turechek, Cornell University

Mummyberry is caused by the fungus *Monilinia vaccinii-corymbosi* and is one of the most serious diseases of blueberry in New York. The disease appears to be much more problematic in the Southern Tier, the Finger Lakes Region, and Western New York than in Eastern New York and the Champlain Valley. Nonetheless, if mummyberry occurs in your planting and you are growing a susceptible variety, control procedures are likely necessary since losses can exceed 30 to 40% when no control is practiced.

The fungus causing mummyberry overwinters in infected berries or "mummies" lying under the bushes. In early spring, infected berries produce the primary inoculum (i.e., ascospores) in a mushroom-like structure called an apothecia (Fig. 1A). These spores are disseminated by wind and rain and infect emerging leaf buds and shoots. Shoots are most vulnerable to infection by ascospores when they are between approximately 1/8 to 1.5 inches in length. Infection requires free water on the plant surface and can occur within 4 hrs under the optimum temperature of 57 F, but takes nearly 10 hrs at 35 F. Infected shoots and leaves wilt, turn brown and die; this is the shoot blight phase of the disease (Fig 1B). Its appearance is similar to, and sometimes confused with, frost damage. Symptoms typically develop 2 weeks after infection.

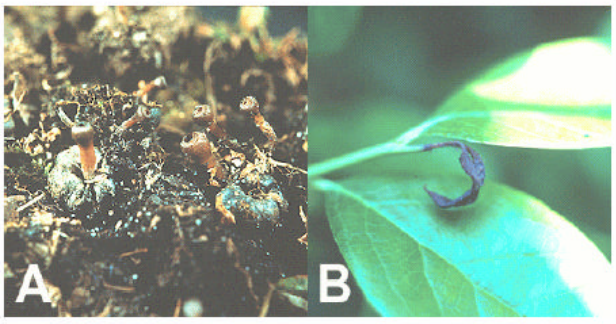

Figure 1. (A) Mushroom-like structures (apothecia) growing from mummified berries that produce the first spores of the season; **(B)** Shoot tip infection which will eventually lead to the production of secondary spores.

Infected shoots produce a second spore type, called conidia, that infect the blossoms. The formation of conidia requires high relative humidity. Conidia are disseminated to blossoms by both wind and pollinating bees. The bees are attracted to the masses of conidia at the ends of blighted shoots via the reflection of ultraviolet light off the surrounding necrotic tissue and by the "scent" of sugars secreted by the conidia. Once a conidium has been introduced in to the flower, it will germinate with the pollen and slowly infect the developing fruit. Blossom infections are therefore not evident until the fruit begins to ripen later in the season when the berries begin to shrivel and turn a pinkish color. These are the "mummyberries" and they have been colonized by the fungus. Infected berries eventually fall to the ground, shrivel, and turn dark brown in which they will serve as the primary inoculum source the following spring.

Mummberry can be a difficult disease to control even under the best management practices. Like the disease apple scab, however, the disease is more easily manageable if primary infections are well controlled. This can be done using cultural practices such as raking or discing the soil beneath the blueberry bushes or covering the fallen mummyberries with a 3-4 inch layer of mulch. Growers may also choose to apply 200 lbs/A of 50% urea prills directly under the bushes to hasten the degradation of the mummyberries. Remember, the formation of apotehecia is greatly enhanced when the mummies make physical contact with the soil. Burying these mummies disrupts their formation.

If you are planting blueberries this year and are concerned about mummyberry, you should avoid planting in areas of the field that are prone to frost (i.e., frost pockets), that are wet, and/or are slow to dry as these areas tend to have more problems with mummyberry. A number of resistant varieties are available. A table of susceptible varieties is presented below. The table was compiled from resources at Michigan State University and the Northwest Berry & Grape Information Network (Oregon State University).

		Oregon				**Oregon**	
	Michigan	*Primary Infection*	*Secondary Infection*		**Michigan**	*Primary Infection*	*Secondary Infection*
Berkeley	S	MR	MR	Elliott	R	R	R
Bonus	MR	n/a	n/a	Jersey	MR	MR	S
Bluecrop	S	S	MR	Lateblue	R	MR	MR
Bluegold	S	n/a	n/a	Little Giant	n/a	n/a	n/a
Bluehaven	S	n/a	n/a	Nelson	n/a	n/a	n/a
Bluejay	R	R	R	Northblue	R	n/a	n/a
Blueray	S	S	MR	Northcountry	n/a	n/a	n/a
Bluetta	**S**	R	MR	Northland	S	S	S
Burlington	R	n/a	n/a	Patriot	n/a	n/a	n/a
Chippewa	n/a	n/a	n/a	Rancocas	MS	S	S
Collins	S	S	R	Rubel	S	R	S
Coville	MR	S	MR	Sierra	S	n/a	n/a
Darrow	R	R	MR	St. Cloud	n/a	n/a	n/a
Dixi	n/a	R	R	Spartan	MR	R	R
Duke	R	n/a	n/a	Sunrise	n/a	n/a	n/a
Earliblue	S	S	S	Toro	n/a	n/a	n/a
				Weymouth	S	S	S

Fungicides are often necessary to manage disease on susceptible varieties or under high disease pressure. A key to efficient control with fungicides is to realize that the two spore types are managed differently. Unfortunately, there are no fungicides currently available that have excellent activity against the primary spores. A green tip application of triforine (Funginex) is the most effective chemical treatment for the disease, unfortunately, this fungicide is no longer being produced. Echo 720 and Echo 90DF (manufactured by Sipcam Agro) are chlorothalonil products (like Bravo WeatherStik) which have just received labeling on blueberry for control of mummyberry (as well as anthracnose). These products have not been tested in New York but, in trials conducted in other states, chlorothalonil has been largely ineffective in controlling mummyberry. Many states in the northeast have obtained a Section 18 Emergency Exemption for the use of Indar (or the closely related fungicide Orbit) against the shoot blight phase of the disease.

To control the blossom blight/fruit rot phase of the disease, an application of Captan 50WP plus Topsin M (at 5 lb/1 lb per acre, respectively) repeated at a 7 - 10 day interval is recommended. Currently, Topsin-M is not labeled in New York. Last year we received a section 18 for Topsin-M and we applied for, and anticipate, receiving another one this year. This is also an important spray for controlling Botrytis fruit rot when conditions favor disease develeopment. As bloom progresses the effectiveness of fungicide applications will decline as these fungicides cannot "cure" infections that have already occurred. For maximum control, fungicide applications should made prior to mid-bloom and should not be applied post bloom. (***Source**: New York Berry News, Vol. 2., No. 4, April 16, 2003*).

Grapes

Early Grape Sprays

Bruce Bordelon, Purdue University

Grapes are at budbreak to 2 inch shoots in Lafayette and further ahead in southern areas. Growers should make their first fungicide application soon. This early spray (1- to 3 inch shoot) is primarily for Phomopsis cane and leaf spot, so mancozeb or captan are effective materials. Because these materials are protectants, they must be applied prior to infection periods, so growers should spray before any forecast rains occur. Over the next two weeks shoots should double in length and addition of one of the sterol inhibitors (e.g. Nova, Rubigan, etc.) should be considered for control of black rot and powdery mildew. The most important sprays of the year for fruit rot control are the sprays surrounding bloom. Plan now to have one of the strobies on hand for those sprays. Refer to the Commercial Small Fruit and 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. 03, No. 03, for April 28, 2003*)

Grape Fertilization Update

Alice Wise, Cornell University

With the recent changes in fertilizer prices and availability, it pays to review what's now available for ground applied N.

Ammonium nitrate (34% N) is available but expensive because one of the world's major processing plants in Europe burned down (recently resumed production) and high natural gas prices forced US producers to switch to other products. The ammonium part of this compound is converted to the nitrate form by microorganisms in the soil. This occurs within 1 - 2 weeks of application. It does not render NH4NO3 a "slow release" N fertilizer. NH4NO3 is considered to be an acidifying compound which reinforces the need for monitoring soil pH. Some volatilization of the ammonia component may occur.

Calcium nitrate (16% N) prices and availability have remained stable. As all the N is in nitrate form, it is available immediately to the vine. Calcium nitrate is impractical as a source of calcium. If calcium is needed, go with a high cal lime rather than dolomitic or try gypsum. Gypsum is calcium sulfate but will not affect soil pH.

Urea (46% N), while more expensive per lb., is higher in N and therefore a better buy per unit of N. Losses into the air can occur, incorporation or irrigation soon after application can reduce this.

Ammonium sulfate (21% N) – Not a traditional grape fertilizer, it is finding some use for economic reasons. The sulfur component is minor in terms of soil acidity.

It may in fact offer some nutritional benefit. Some sources recommend rapid soil incorporation due to the risk of volatilization.

Nitrogen solutions – There are different liquid N's on the market, many contain ammonium nitrate and urea nitrogen. Advantage is easy application through irrigation lines or herbicide sprayer. Disadvantage is that some may be corrosive to certain materials. Corrosion inhibitors may be added to the product. Since urea and ammonium nitrate may be components, some references discuss the need to shank the product below soil surface to avoid losses to air.

Footnote on volatilization: according to Grapevine Fertilization and Nutrition in the San Joaquin Valley, volatilization of ammonia varies with soil pH, texture and temperature.

Acidic (pH 5-6.9) sandy loams actually lose much less ammonia than sandy alkaline soils. Most volatilization occurs in 7-10 days, with half occurring within 3 days after application.

Organic products – Many growers are interested in organic fertilizers. There are a number of N sources including peanut meal (8% N), blood meal (12% N), proprietary blends and more. Mined Chilean nitrate (16%) or sodium nitrate is allowed on a limited basis in organic agriculture. Expense can be an issue with organic products as can lack of practical information on application and use of these materials in a perennial crop like grapes. On the other hand, they may benefit organic matter and have other nutritional components which benefit vines.

Compost and composted manure – N can be released from decomposition of these materials though it can span several years and is almost impossible to predict.

Analysis of the material helps but does not provide all the answers. Still, periodic compost application on sandy soils will improve organic matter hence nutrient and water retention as well.

Cover crops – Growing and especially incorporation of cover crops, particularly N-fixing legumes, can supplement N in a vineyard. There are formulas which can be used to roughly estimate the amount of N being incorporated but they still yield best guesses rather than a hard and fast amount.

Thanks to Lailiang Cheng, Cornell, and Carl Key, LICA, for their input.
References: Christensen, Kasimatis and Jensen. 1978. Grapevine Fertilization and Nutrition in San Joaquin Valley, Univ. of CA publ. No. 4087; California Fertilizer Association. Western Fertilizer Handbook, 7th ed. Interstate Printers & Publishers, Danville, IL, 61832-0594.

(***Source**: Long Island Fruit and Veg. Update, No 9, May 9, 2003*)

Powdery Mildew

Alice Wise, Cornell University

The disease on everyone's mind right now, there was some review, some interesting tidbits and a best guess at what happened last year. Mid-60's - mid-80's temperatures are ideal for germination. Rain is not required. While optimum relative humidity is 85%, it is not nearly as important as temperature. Still, it is a factor with some growers last year noting that PM was worse in parts of the vineyard near water. In California, computer models that tell growers when powdery mildew pressure is low-med-high are in large part based on the fact that >90F, the fungus is inactive. Not the case in NY – a vast majority of our summer is spent in the optimum temperature and humidity zone.

Did the mildew last year provide us a huge pool of overwintering inoculum? Not necessarily. Cleistothecia, the black dots within a healthy PM infection on a leaf, are the more important contributor to overwintering inoculum. Inoculum from fruit contributes a lot less. This is a bright spot as vineyards with fruit infections had some leaf infections but by no means was it widespread.

Another comparison

- in CA, PM is known to overwinter in buds. The infected buds produce what are called "flag shoots" in the spring. These are shoots that emerge completely covered with PM sporulation, very alarming. It is possible (emphasize possible i.e. this is a guess) that the warm winter of 2001-2 allowed PM that might have been overwintering in buds to survive. Perhaps there were a few flag shoots around and we didn't notice them, the significance being that they are little spore factories. Another possible contributor to last year's infections
- the finding that resistant fungal populations are "predisposed" to resistance even with a chemically different material. This does not constitute cross resistance, rather, it is more of a sensitizing effect.

The problem: serious PM cluster infections, multiple sites on Long Island and in upstate NY. Mostly Chardonnay (confirmed now as highly susceptible) and a few other whites were affected.

Abound was applied alone during the critical period in early postbloom. In a few cases, not all though, coverage was compromised. The scary part is that it is unclear if last year was a worst case scenario or just the tip of the iceberg.

What to do? If PM was not a huge issue in your vineyard (we all get some at the end of the season), then take some precautions but strobies can still be part of the repertoire.

For PM, Abound is less effective than Sovran is less effective than Flint. Minimize the number of applications – actually the label has been changed to 3 apps instead of 4. Use a higher rate of material, make sure coverage is excellent and tank mix with sulfur. It is not advisable to use any of the strobies alone for PM control. Stick to a 10 day interval instead of a 14 day. Abound should still work for black rot and downy, so there are reasons for some growers to continue using it. Sidebar: the strobies don't do so well on phomopsis. Other options – sulfur works well. Remember its limitations: short intervals and it washes off. The DMI's (sterol inhibitors such as Nova, Elite, Procure, Rubigan) still have some resistance issues as well. It is somewhat site specific but certainly keep your eyes open if using them. Apparently there was a report from France indicating that when tank mixed, sulfur reduced activity of the DMI's. Wilcox was skeptical about this but not 100% sure.

Contact materials are the final group. Coverage, coverage, coverage. Of JMS Stylet Oil, Kaligreen, Nutrol, Oxidate and Serenade, only JMS Stylet Oil has provided consistantly acceptable PM control. It too has its limitations – incompatibilities with other materials and a very real phytotoxicity risk if applied in temperatures >85F. There are also research results (from Wilcox, Tony Wolf in VA and Doug Gubler in CA i.e. significant research programs) indicating that late season sprays may reduce Brix. While all angles have not been examined, it seems prudent to use Stylet Oil early season then after bloom only for PM clean up or perhaps for its miticidal effect. Past anecdotal experience indicates that Stylet Oil is an excellent end of the season spray, providing better long term control of PM than sulfur. If the latter part of the season is cool, Stylet Oil would not be advisable. It is not known if Stylet Oil affects any components of ripening besides Brix. (***Source**: Long Island Fruit and Vegetable Update, No 8, May 2, 2003*)

General Information

Using Bees for Pollination of Small Fruit Crops

Rufus Isaacs, Michigan State University

Value of pollination

According to calculations developed by Robinson and co-workers in 1989, the annual value of honey bee pollination to agriculture in the United States is as high as $US 14.6 billion. In Michigan alone the total value to the main fruit and vegetable crops dependent on honey bee pollination is about $270 million per year. Bee pollination provides the essential cross-fertilization of plants that promotes larger, earlier berries and increased percentage of fruit set.

Use the "late" strategy for small fruit crops

Generally, flowers of small fruit crops are less attractive to honeybees than some other flowers due to the shape and the relatively low 'reward', so a different strategy is required that you might use for apples which need bees early. You want to have your crop starting to bloom before bringing bees in so that bees tend to forage more on your crop. If brought in too early, bees will learn to forage eleswhere and when your crops bloom, they are not attractive enough to get the bees "back" to where you want them. Blueberry flowers have about 3 days to be pollinated after the flowers open, but you want the bees to stay in the field, so move bees into blueberry fields after 5% bloom but before 25% percent of full bloom. The "late" strategy is especially important for cranberries, which is not very attractive to bees. Luckily, craneberry flowers will stay open for a while if not pollinated, and the petals will turn to a rosy color if not pollinated in time. In cranberries, it is better to wait until 10% bloom in order to maximize the yield. If you see too many flowers turning rosy, this means you did not have enough pollinators, so make sure you increase the number of bee hives next year.

Prices for pollination

Expect to pay anywhere from $40-60 per colony for spring fruit pollination. There is a range here because if you only need 10 hives, you might be expected to pay a higher price than the other grower who is renting 500 hives. Colonies might be also of different strengths. Try to deal with the same beekeeper year after year in your area so you know what to expect and can build a good working relationship. If the beekeeper is new in the pollination business, make sure he/she knows your requirements and make sure you sign an agreement for pollination purposes.

Hive densities

The invasion of Varroa mite has decimated the numbers of feral (unmanaged, wild) honeybee colonies that used to contribute to pollination in addition to rented colonies. The proportion of pollination caused by feral bees relative to managed colonies is unclear, but it is safe to say that we need higher densities today than when feral bees were present. Recommended densities of managed bees are 3 hives per acre for cranberries, and 1 hive per acre for strawberries and raspberries.

Research in blueberries has shown variation in their needs for bee pollination. This is mainly because cultivars with short open flowers and good nectar production are easier to pollinate. Because of this, varieties like Rubel require 1 strong hive on 2 acres, whereas Jersey may benefit from increasing hive densities to 5 per acre. The average is around 2 hives per acre. In general, a good rule of thumb is that you'll need 4 to 8 bees per plant in the warmest part of the day during bloom to achieve good pollination.

Do not cut corners with respect of putting enough bees in your crops. Investing some money to have enough colonies there at the right time will provide returns in the form of improved yields.

Hive placement

If possible, place the colonies in a sheltered location with the entrances facing east. This will encourage earlier activity as the hive warms in the morning sun. Hives should be spread out around the field to maximize floral visitation, with a maximum of 300 yards between colonies.

Native pollinators

Many other helpful insects are active in your fruit crop, and with 20,000 species of bees, some local native bees are probably active in Michigan's small fruit crops providing free pollination. Bumblebees and other native species can be seen looking for flowers already in and around fruit crops, and their activity generally remains high when weather conditions turn too cold or wet for honeybees. These native bees may be insufficient to provide adequate pollination for good yields, however, and cannot be relied on to stand alone as your sole pollination source. By providing the right nesting habitats, and food for the bees after your crop has flowered, you can enhance the local populations of native bees around your crop. This is a long-term process and you'll need several years of experimenting before these bees can become a reliable part of your pollination planning. For more information on native bees, visit the ATTRA (Appropriate Technology Transfer for Rural Areas) website: http://attra.ncat.org/attra-pub/nativebee.html

Pest management during pollination

Do not apply broad-spectrum insecticides when flower buds are open or you may kill a significant number of pollinators. Beehives should be removed immediately after pollination if post-bloom pesticide applications are planned. By monitoring for pest problems carefully during bloom, growers can help minimize the need for pest control. If an insecticide application is necessary during bloom, the compounds that are least toxic to bees should be used, with careful observation of the pollinator-restrictions on the label. Two insecticides that can both be applied during bloom for control of moth larvae in blueberry and cranberry are the *Bacillus thuringensis* (Bt) products, and the insect growth regulator tebufenozide (Confirm®). Good coverage is required for both, and a spreader/sticker should be used to improve effectiveness.

Pollination book available online

Although it is a little outdated (printed in 1976), the book Insect Pollination of Cultivated Crop Plants covers nearly all crops (fruits and vegetables) and is the best reference available for pollination to-date. It has been out of the print for many years, but the book is available free online at http://gears.tucson.ars.ag.gov/book/. (***Source**: Michigan Fruit Crop Advisory Team Alert, ol. 18, No. 3, April 29, 2003*)