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Massachusetts Berry Notes Underwriters:

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IN THIS ISSUE:

SHORTS:

2013-14 New England Small Fruit Pest Management Guide – The 2013 edition of the NE Small Fruit Guide will be available in early April. In Massachusetts, copies can be ordered by going to the UMass Extension Bookstore at http://www.umassextensionbookstore.com/store.php?crn=238. For other states, contact your local Extension office for information how to get print versions in your state.

NRCS High Tunnel Initiative: NRCS is still funding high tunnel installations through the EQIP program in 2013 for eligible farms. In order to be eligible, the farm must already have a conservation plan on file. High tunnels may be important tools for managing **Spotted Wing Drosophila** (SWD) in some crops. If you are interested in finding out more, contact your local NRCS field office or check out the MA-NRCS website at http://www.nrcs.usda.gov/wps/portal/nrcs/site/ma/home/.

A new publication 'Diseases, Pests, and Beneficial Organisms of Strawberry, Raspberry, and Blueberry' is now available: Originally published in French, this versatile pocket guide has 126 descriptive entries with more than 700 high resolution color photographs and illustrations to help identify pest problems and better understand the beneficial organisms present in strawberries, raspberries, and highbush blueberries. It is an excellent visual scouting tool when viewing symptoms, but also provides information about life cycle, conditions, and best practices with background information on the main phenological stages of the crops, diseases, insects and other organisms, screening and diagnosis. A useful glossary is included. Priced at $47, this book is well worth including in your dashboard library! For ordering information, go to: http://www.apsnet.org/apsstore/shopapspress/Pages/02301.aspx.

See video on "**Tools for Small-Scale Crop Production**" at: http://www.youtube.com/watch?v=D6zNZYd7iNE&feature=youtu.be.

STRAWBERRY

Cyclamen Mite in Strawberry

Bob Tritten, Michigan State University Extension

Last spring [2011] a question came up during a phone call with berry extension specialists around the state—How prevalent are cyclamen mites in our strawberry fields? Summer 2010 presented a perfect chance to find this out in the southern tier. Since we were out taking soil and leaf tests for another project, I simply took another set of leaf samples on strawberry farms to examine for cyclamen mites.

Cyclamen mites are microscopic arthropods (technically not insects, just as spiders are not insects) that hide out in plants and make their living by sucking on plant cells. Ontario Ministry of Agriculture, Food, and Rural Affairs (OMAFRA) has a good fact sheet with pictures at their Ontario Crop IPM site click here.

In the past cyclamen mites have been considered a minor pest of old strawberry fields that ought to have been removed anyway. But in 2010, we found them with surprising frequency in young strawberry fields.

Cyclamen mites live in the crown of the strawberry plant, so you can usually only find them on the newest not-yet-unfolded leaves. Pick a leaf, gently spread it out, and look for almost-microscopic white graininess down by the leaf base. On heavily infested leaves I could see these white grains without a hand lens, but none of the farmers could. To reliably diagnose them you need a good hand lens, and I found a dissecting microscope came in very handy when finding small populations. My typical practice was to pick 25 baby leaves from each strawberry variety and examine them under the scope back at the office.

Strawberry plants heavily infested with cyclamen mites will be stunted with deformed leaves. Interestingly, we found those symptoms on only a handful of plants on 2 farms, while nearly every farm had cyclamen mites on symptomless plants. In fact, of the 8 strawberry farms we sampled, only one was free of the cyclamen mites.

What was even more surprising was that plants just planted in spring 2010 had cyclamen mites, sometimes as high as 40% of the leaves had mites, but typically they were at a somewhat lower level (10-20%). This suggests that the mites were coming with the plants from the nursery—and most of the growers were using quite reputable nurseries!

So what? You can't see them, customers can't see them, and I just said that it's hard to tell if you even have them by visual symptoms! The threshold for when their sucking activity takes a toll on the plant isn't completely agreed upon. In California, 1 mite in 10 new leaves is considered a potential problem while Manitoba uses 1 infested leaf in 15 as their threshold for treatment, with the added clarification that when you get to 45-65 mites per leaf it can cause a 1/3 yield reduction. These mites reproduce quickly, from egg hatch to adult in 2 weeks when conditions are right, and females don't need males to lay viable eggs. With this type of exponential growth, going from a couple mites to the levels that cause 33% yield reduction can happen really fast! Besides yield reduction, the mites can cause general reduced vigor and winter hardiness, compounding problems for the poor plant. Cabot is a variety that some growers love and others can't quite get to perform well after the first year, and coincidentally Cabot had some of the highest mite levels. Could the challenge with Cabot really be a cyclamen mite challenge at it's root?

What can you do if you have cyclamen mites? That's the problem, once you have them it's really hard to get rid of them since they reside way down in the protected crown of the plant. Endosulfan, a strong insecticide, is the only in-field treatment labeled in NY, and the label will end in 2016. It's supposed to be applied after renovation when the leaves have been mowed off, with high pressure and at least 200 gallons of spray/A. Anecdotally, growers haven't found even this treatment to be very effective. Usually the best thing to do for a serious infestation is to start over with clean plants.

But clean plants from where? This year we found disturbingly high levels of cyclamen mites on 2010 plants, which suggests that they might have come infested from the nurseries, and reputable nurseries at that. Hot water dips for dormant crowns used to be recommended (110˚F for 30 minutes, with tight control on the exact temperature achieved), but varieties are different in their heat sensitivity and many new ones haven't been tested.

This is one of those areas where we don't have enough information. Ideally nurseries would have techniques in place to assure that they're shipping clean plants, but

that's easier said than done. More research is needed to establish where the infestations are coming from and to find environmentally sound controls. Juliet Carol from the NYS IPM program has written a grant to do this research, we'll find out if it's funded in March 2011.

In the mean time, take a look at your plants this spring, bring leaf samples to your local extension office where you can use a microscope to examine them, and check out the fact sheet mentioned above for excellent pictures of what you're looking for. The first part of the solution is identifying the problem. (***Source**: New York Berry News, Vol. 10 No. 2, February 2011*)

Frost/Freeze Protection in Strawberries

Jeremy Pattison, Virginia Tech

Even though the coldest part of the season has past, beware of temperature fluctuations during bloom that can plunge below freezing and damage emerging flowers. Strawberry crowns are fairly tolerant of low temperatures when fully dormant. However, as the plant awakens, re-hydrates tissues and begins to grow there is a concurrent loss of cold tolerance. Additionally, flower structures begin to emerge from the crown, which are sensitive to low temperatures, and will require some form of protection to avoid damage.

Not all frost/freeze events will be similar and strategies to protect your crop can be modified appropriately based on the weather conditions and stage of crop development. There are generally two types of freeze conditions strawberry plants will experience in the field, radiation and advective freezes. Radiation freezing results when heat from the atmosphere and ground is lost continuously to a cloudless sky on a cold, windless night. Advective freeze events occur when temperatures drop below freezing and are accompanied by high winds. The latter presents growers with a challenge in protecting the crop and alternative strategies are required if freeze damage is to be avoided.

Under radiational type freezes, overhead irrigation is the typical strategy employed for frost protection. Protection is provided to the emerging blossoms via the continual freezing of water on the plant. As water cools and freezes, two sources of heat are released, sensible heat and latent heat of fusion. Freezing of liquid water is an energy releasing processes and can generate up to 144 btu's for every pound of water frozen (latent heat of fusion).

A significantly less amount of heat is given to the environment by water cooling (sensible heat). Therefore, under conditions of radiational freezing, irrigating the fields and allowing the physical process of water freezing to occur on the plants can afford a great deal of protection and moderation of the temperature experienced by the blooms. For this method to be effective, uniform irrigation patterns and subsequent continuous freezing of water is required on the surface of the plant. Sprinkler heads spaced either 40' x 40' or 30' x 30' is optimum and uniformity of coverage is a function of sprinkler type and available water pressure. Traditional impacts require higher water pressure and can operate well at larger spacing. Wobblers can operate at lower pressures, have faster rotation compared to impacts but have a limited range and require closer spacing (30' x 30'). The key to successful frost protection is to optimize the irrigation layout to match the specifications of your system (i.e. proper spacing based on irrigation heads and water pressure provided by the pump).

A more challenging situation occurs when weather forecasts predict a large cold front with sub-freezing temperatures and high winds (advective freeze). Under these conditions it becomes increasingly difficult to provide your crop with the necessary conditions of uniform irrigation patterns and continual heat release. Protecting the strawberries using overhead irrigation can do more harm than good as uneven watering patterns and frequent freezing of the irrigation nozzles can lead to the crop experiencing colder temperatures than the ambient due to evaporative cooling. As water freezing is a heat releasing process, the opposite is true when liquid water becomes a gas (evaporative cooling). This can be the case even under freezing temperatures when frozen water can change phases directly from a solid to a gas (sublimation) during cold temperatures and high wind velocities.

Some rules of thumb for frost protection during radiation freeze conditions have been presented through various extension outlets and will be re-emphasized. Things to keep in mind for effective crop protection is when to start irrigating, the proper volume of water to use and when to stop. Different plant tissues and stages of crop development have varying critical temperatures associated with them when damage is experienced.

Table 1. Critical temperatures of strawberries at various stages of flower development

Stage of Development	Critical Temp. (°F)
Tight bud	22.0
"Popcorn"	26.5
Open blossom	30.0
Fruit	28.0

Source: Perry, K.B. and E.B. Poling. 1986. Field observation of frost injury in strawberry buds and blossoms,Advances in Strawberry Production 5:31-38.

The first step in beginning to prepare for a protection event is to know what stage of development the plants are and what the forecasted low is to determine what strategy is needed. When flower buds are still tucked into the crown and weather forecasts predict a low of 29°F then no protection will be needed. However, if a significant amount of flowers are open and forecasts are predicting lows in the mid 20's, the crop will certainly need protection and addressing when to turn the system on becomes the next consideration. As was mentioned, two opposing energy processes are influencing the temperature of the crop. The latent heat of fusion (water freezing) will release heat (approximately 144 btu's/lb of water), meanwhile evaporative cooling (absorbing approximately 1,044 btu's/lb of water) will absorb heat (energy) from the plant and lower plant tissues below the ambient. Therefore a problem arises important to the initial start-up of irrigation. That is, the first water to come into contact with our crop will actually cool tissues greatly due to evaporative cooling and plunge plant tissues several degrees below the ambient air temperature. As a result, overhead irrigation should be initiated when temperatures are a few degrees above the critical temperature for the structure you are trying to protect (i.e. open blooms, start at 340F under light wind) in order to compensate for the energy (heat) lost during evaporation. Table 2 shows some suggested precipitation rates under varying environmental conditions to ensure uniform ice formation.

Table 2. Irrigation rates, in/hr, for critical temp of 28°F and relative humidity of about 70%

	Wind Speed (mph)			
Min. Temp.(F)	0-1 mph	2-4 mph	5-8 mph	9-14 mph
27	0.10	0.11	0.14	0.16
26	0.10	0.13	0.16	0.17
25	0.10	0.14	0.18	0.21
22	0.10	0.18	0.24	0.29
20	0.11	0.21	0.28	0.34
18	0.12	0.23	0.31	0.38
15	0.13	0.26	0.35	0.43

Source: Perry, K. 1998. The strawberry grower. Vol. 5 No. 2.

An emerging area of research in frost/freeze protection deals with the use of floating row covers. Dr. Allen Straw, of the University of Tennessee, recently presented some preliminary data at the National Berry Growers meeting in Nashville looking at row covers used in conjunction with overhead irrigation for frost protection. Allen has shown that combining overhead irrigation with row covers can significantly moderate the plant canopy and keep temperatures substantially above the ambient. This method appears to be most useful during advective freeze conditions when protection from overhead irrigation is unpredictable and the use of row covers alone may not provide the needed protection.

Row covers have traditionally been used in strawberry plasticulture to 1) extend the fall season promoting additional branch crown development, 2) provide winter protection from cold temperatures and wind and 3) spring use for advancing flowering and early harvest. When temperatures are forecasted to be in the mid to low 20's during bloom, row covers alone have been thought to not provide adequate protection. The amount of cold protection provided by floating row covers is a function of its weight with the highest weight fabrics providing the most protection. Or is it? Allen's preliminary data indicated that using a double layer of 1 oz/sq yd cover provided adequate crop protection (30°F) when ambient temperatures went as low as 25°F and was more effective than using a single layer of 2 oz/sq yd cover. Charlie O'Dell also has some experience indicating that this double layer effect is not simply additive and may involve other 'insulating' effects. More research is needed into this area; however, these results are promising and could possibly result in conserving water during the spring season, decreasing early season flower loss and increasing the average hours of sleep for the farm manager. Research trials looking at the repeatability of this layer effect will help to provide a working set of protocols for the use of row covers as a possible alternative to traditional frost protection.

In order for any strategy to be effective, we need to be prepared and informed about the conditions affecting our location. Setup a weather station in the lowest section of the field wired to an alarm system to notify you when temperatures are approaching levels that will require action to be taken. Timely setup of irrigation pipes and preventive maintenance on critical equipment will help to ensure success when action is taken. And most of all, we have to deal with what Mother Nature throws at us. GOOD LUCK! (***Source***: *Virginia Cooperative Extension Fruit News, April, 2009*)

Notes on New Day-Neutral Strawberries

K. Demchak, Dept. of Plant Science; H. Swartz, Five Aces Breeding; W. Lantz, Univ. of MD

In 2012, demonstration plots of an assortment of day-neutral varieties were established in PA, MD, and WV. Here are some notes on their performance in PA, should anyone want to try a few.

'Monterey' strawberry, Rock Springs, 2012.

Varieties included some from the U.C. Davis breeding program (Portola, San Andreas, and Monterey), and a variety from Lassen Canyon Nursery (Sweet Anne). Plants were planted in a plasticulture system on June 7, and unfortunately, due to a little miscommunication (oops), blossoms were removed a little longer than intended, so harvest didn't begin until Sept. 13, and was terminated earlier than usual due to hitting 21 degrees on Oct. 18. Considering the brevity of harvest (we should have been picking at least twice this long), either these were impressive producers, or maybe taking off the blossoms for that long wasn't such a bad thing. Here's a summary of each variety's performance.

Portola was the most productive of the group (0.8 pounds per plant), with fairly soft large berries (24 grams/berry = 19 berries/pound) that were also lacking in flavor. Only about 65% of the berries were marketable, due to a tendency for berries to develop soft areas quickly where they stayed wet after a rain. But, it was crazy productive…

San Andreas started producing later than Portola, so its yields were lower, at ½ pound per plant. Flavor was very good, and size was even larger, at 28 grams/berry = 16 berries/pound. It had nice firmness and shape, though some berries tended to be asymmetrical, and it ripened unevenly, though berries ended up evenly red. Besides the unevenness in ripening, it didn't have any particular problems or susceptibilities, with about 75% of the fruit being marketable. Of the varieties we tried, San Andreas was my overall favorite. One grower told me he gets better yields from Albion than San Andreas, though for us, Albion hadn't been very productive in the past. So, if you want to try these newer day-neutrals, you might want to try both Albion and San Andreas.

Monterey (see photo) started yielding really late, but ended up surpassing San Andreas, with yields of 0.6 pounds/plant. Berry flavor was terrific, though on some dates, it had a hint of apple in its flavor. Size was still large, at 20 grams/berry (23 berries per pound), with a shape that was longer and more conic than Portola or San Andreas. Berries developed a deep shade of red, and were nicely firm, but not hard. The big concern I had with this one was that it was very susceptible to fruit anthracnose. It also developed some powdery mildew (note the underside of the berry in the bottom left of its photo), though it wasn't any more susceptible to powdery mildew than Seascape typically was. But overall, disease susceptibility is the main issue that makes me cautious about this variety, and I'd like to see what happens any diseases next year.

Sweet Anne barely got off the starting block, but I don't think this was really a fault of the variety, since it behaved like one that had a carryover effect from tissue culture media. It was loaded with berries when we had to stop harvest. The flavor was absolutely knocks-your-socks-off, which means eastern producers may not have the market cornered when it comes to flavor if large commercial producers can ship this one East fully-flavored. Unfortunately, getting only 11 berries off of the plot before cold weather wasn't a lot to base an opinion on. However, those 11 berries averaged 33 grams each (14 berries per pound), which was larger than even the first berries off of the other varieties. I'm looking forward to seeing how this one does next year, along with Maika, a day-neutral obtained via Nourse Farms.

Of course, one question mark is the status of day-neutral strawberries now that Spotted Wing Drosophila is on the scene. Oddly enough, we had no damage at all from SWD in this planting, despite applying no insecticides to the plot, and having SWD in blueberries and raspberries that were about 500 feet away. I'm not certain why - maybe SWD liked those crops better and stayed put, since the area between the strawberries and those crops was planted to grass, buckwheat, or beans. I'm sure we'll find out more next year. (***Source**: Penn State Vegetable & Small Fruit Production News, March 1, 2013*)

Consumer Preferences for High-Tunnel Raspberry Varieties

Diane Brown, MSU Extension

How do we perceive flavors? Flavor is complex in that it is more than what our taste buds tell us – that a food is sweet, salty, sour, bitter or savory. Scientists are discovering that we have even more taste receptors than previously thought. Foods taste differently to different people; we have different preferences for foods. What we call flavor is a complex interpretation by our brains of how food tastes and smells, coupled with our reaction to its temperature and texture. Flavor is difficult to quantify, but people may have definite opinions about what they like or dislike.

Michigan State University Extension has grown fall raspberry cultivars in containers under high tunnels for two seasons at the Southwest Michigan Research and Extension Center (SWMREC) in order to compare productivity and quality. Part of the assessment is to find out which cultivars consumers prefer. On various days in late summer and fall, we offered samples of raspberries all picked on the same day to individuals and asked them to rate them for sweetness (data not shown), flavor and whether or not they liked the berry. People were asked to sample more than one berry of each cultivar and rate the flavor on a scale of 1 to 5 with 1= very poor to 5= excellent. The intent was to determine whether there were clear favorites among the different varieties.

We also asked tasters to make comments about the cultivars to help explain their ratings. Favorable comments included sweet, great flavor, strong raspberry flavor and good firmness. Negative comments included bitter, bland, mushy, flat, sour, off-flavor and seedy. Some comments on the appearance of the berries included color was too dark, poor color, uneven color, berry was pretty, berry shape was squat, fruit was glossy, bright red, etc. Berry appearance clearly was also a factor. The lone yellow fruited raspberry ('Anne') in the trial was rated as less sweet than several other cultivars even though a measure of its sugar levels (brix) actually indicated that it was sweeter.

In 2011, there were no statistically significant differences in the flavor of our eight cultivars. More cultivars were added in 2012 and evaluations were done early and late in the season. Early in the season in 2012, 'Jaclyn' was rated higher in flavor than 'Anne.' Toward the end of the 2012 season when the late season cultivars were included, 'Nantahala' was rated highest for flavor and 'Crimson Giant' was rated lowest. Results to date indicate that some of the most flavorful cultivars are 'Caroline,' 'Jaclyn,' Polka and 'Nantahala'.

Consumer flavor ratings of raspberry cultivars in 2011 & 2012.

Ratings are on a scale of 1 (very poor) to 5 (excellent)

Cultivar	2011	08/15/12 – 09/13/12	09/22/12 – 10/24/12
Jaclyn	3.7 a	3.5 a	3.3 ab
Caroline	3.6 a	3.3 ab	3.5 ab
Polka	3.5 a	3.1 ab	3.5 ab
Joan J	3.4 a	2.8 ab	3.2 ab
Josephine	3.0 a	3.2 ab	3.3 ab
Himbo Top	2.9 a	3.0 ab	3.0 abc
Autumn Britten	2.9 a	3.0 ab	2.5 abc
Anne	2.8 a	2.7 b	3.2 ab
Nantahala	NA	NA	3.8 a
Joan Irene	NA	NA	2.6 abc
Nova	NA	NA	2.5 abc
Erika	NA	NA	2.2 bc
Crimson Giant	NA	NA	1.5 c

Numbers followed by a common letter are not differentTukey LSD test(p=0.05)NA = not available

*(**Source**: Michigan Fruit Crop Advisory Team News March 4, 2013)*

Raspberries from the SWMREC high-tunnel container berry production project, 2012

Control of Winter Moth Damage in New England Blueberries

Sonia Schloemann and Robert Childs, UMass Extension

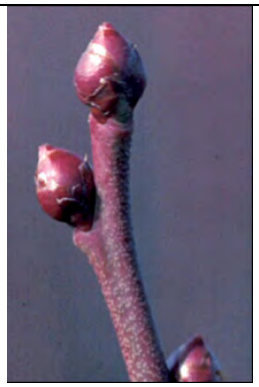
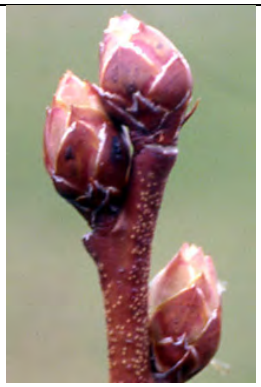
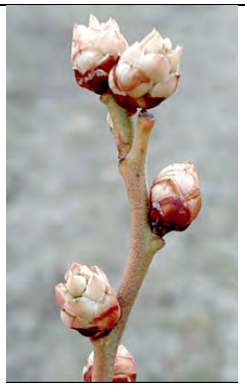
Winter Moth (*Operophtera brumata*): This is a new and important pest of blueberries and other deciduous plants, especially in Southeastern New England. They can severely defoliate bushes. Moths emerge from the soil usually in late November and may be active into January. The male moths are light brown to tan in color and all four wings are fringed with small elongate scales that give the hind margins a hairy or fringed appearance. The female is gray, almost wingless (brachypterous) and, therefore, cannot fly. Females are usually found at the base of trees or scurrying up tree trunks. Winter moth caterpillars are pale green caterpillars with a white longitudinal stripe running down both sides of the body. They are "loopers" or "inchworms" and have just 2 pairs of prolegs. At maturity, the caterpillars will be approximately one inch long, whereupon they drop to the soil for pupation. Pupation occurs from late May into early June. Winter moth caterpillars are often found in association with both the fall and spring cankerworms, which look and have similar feeding patterns to the winter moth caterpillar.

Life Cycle: After mating, the female deposits eggs loosely in bark crevices, under bark scales, under lichen, or elsewhere. The adult moths then die and the eggs over- winter. Eggs are dark-colored at first but turn orange within 3-4 weeks. In March, just prior to hatching, they turn red and eventually a deep, shiny blue just prior to hatching. Eggs hatch when temperatures average around 55℉. It is believed that egg hatch in Massachusetts occurs when 20 Growing Degree Days (base 50) have accumulated, which is historically during the second week in April but earlier if temperatures are atypically warmer, depending. This means that egg hatch occurs just at or right before bud break of most of the host plants. After hatching, the larvae wriggle between bud scales of newly swelling buds of such hosts as: maples, oaks, ash, apples, crabapples, blueberry, cherries, etc. and begin feeding.

Damage: Caterpillars feed within both flower and foliar buds. Once a bud has been devoured from within, the caterpillar will migrate to other buds and repeat the process. Destruction of the flower buds leads to greatly diminished harvest on fruit crops. Older larvae feed in expanding leaf clusters and are capable of defoliating trees and other plants, when abundant.

Management: A dormant oil spray to the trunks and branches of bushes may be helpful to kill the overwintering eggs before they hatch. However, some eggs are under bark flaps and loose lichen and may be protected from oil sprays. Caterpillars may also invade host plants by ballooning onto them after treatment has been applied. Several insecticides are labeled for use against either Winter Moth or Spanworm or both and are outlined in the table below.

Additional information can also be found at: http://extension.umass.edu/landscape/fact-sheets/winter-moth-overview

Blueberry Bud Stage ***Image and Description Source***: *Michigan State University Blueberry Facts website*.		
		
Dormant **Description:** No visible swelling of the fruit buds. Bud scales tightly closed. No visible signs of growth.	**Bud Swell** **Description:** First sign of growth as plant growth begins in the spring. Visible swelling of the flower buds; outer bud scales begin to separate at the tip revealing paler interior bud scales. This bud stage can usually tolerate cold temperatures of 10 - 15°F.	**Budbreak** **Description:** Flower buds open and the individual flowers can be seen between the bud scales. Can tolerate cold temperatures of about 20°F.
Recommendation for Controlling Winter Moth or Spanworm		
Dormant oil, 2-2.5% **plus** Esteem 35WP, 5 oz/A **or** Confirm 2F, 16 oz /A **or** Asana XL, 4.8-9.6 oz/A	Dormant oil, 2-2.5% **plus** Confirm 2F, 16 oz/A **or** Delegate 3-7 oz/A **or** Assail 70WP, 1.9-2.3 oz/A **or** Asana XL, 4.8-9.6 oz/A **or** Esteem 35WP, 5 oz/A	NO OIL AFTER BUDSWELL Confirm 2F, 16 oz **or** Delegate 3-7 oz/A **or** Asana XL, 4.8-9.6 oz **or** Esteem 35WP, 5 oz

Where brand names for chemicals are used, it is for the reader's information. No endorsement is implied, nor is discrimination intended against products with similar ingredients. Please consult pesticide product labels for rates, application instructions and safety precautions. Users of these products assume all associated risks.

GRAPE

Warm Weather and Deaaclimation

Joe Fiola, University of Maryland

Many fruit growers get understandably concerned in January and February when we get a run of "warm' weather like we have been experiencing. When a deciduous vine or tree experiences weather warm enough to start the deacclimation process, there is an increased risk of winter damage to buds and wood. Here is a simplified model of dormancy.

Dormancy

- Deciduous vines go through various phases as part of their winter survival:
- **Acclimation** – As temperatures drop in the fall, the vine begins to "go dormant" and slowly become more and more tolerant to lower and lower temperatures.
  - If you remember correctly, this past fall temperatures slowly went down and we did not have a hard frost until well into November in most locations in the state – that was premium acclimation conditions leading to good cold tolerance.
  - Tony Wolf at VA Tech reported that the MLTE values he got from testing Traminette and Viognier were all very good, indicating very good acclimation in fall and early winter.
- **Dormant** - When vines have reached "full dormancy" they then need to experience a certain period of time of temperatures around 40 degrees Fahrenheit to satisfy their "rest."
  - This year December was colder than average, so most vines and fruit trees received enough cold to satisfy their rest requirement by the end of the year.
- **Deacclimation** - After their rest is satisfied, they then require another period of time with conditions above a specific temperature to come out of dormancy and begin a new growth cycle.
  - During this period, grapevines in the Mid-Atlantic typically experience a series of deacclimation and

deacclimation periods caused by periods of alternating warm and cold weather. This is what many refer to as the "fluctuating temperatures" of January and February.

- **Vines are more sensitive to cold damage when they have recently experienced a period of deacclimation, especially when temperatures drop very low and quickly shortly after the warm spell.**
  - For example is a dormant vine can normally tolerate down to 0 degrees with no bud damage, after a period of deacclimation above 50, the vine may only be able to only tolerate +5 degrees with no damage and will experience a percentage of bud death at 0 degrees.
  - If temperatures drop down gradually slowly after the warm spell, the vines have the capacity to "re-harden," possibly even down to their previous low temperature tolerance (in this example back down to 0 degrees).

Let's all hope for a gradual change back to "reasonably cold" weather - for the vines and fruit trees at least. (***Source**: Maryland Timely Viticulture, Dormant Season*)

GENERAL INFORMATION

ARS Works Toward Control of Brown Marmorated Stink Bug

Sharon Durham and Dennis O'Brien, USDA Agricultural Research Service

The brown marmorated stink bug (BMSB) is wreaking havoc in U.S. homes, gardens, and agricultural operations, causing personal and economic woe. Agricultural Research Service scientists are exploring various aspects of monitoring and control of this increasingly important insect pest, which is an invasive Asian species known as a sporadic pest of many tree fruit crops in China, Korea, and Japan. Along with being a household nuisance, it is a major economic threat to producers of orchard fruits such as apple, peach, and pear; garden vegetables and row crops; and many ornamental species. Since its detection in the northeastern United States a decade ago, the BMSB has been detected in 38 states and has earned the distinction of being classified as the top invasive insect of interest by the U.S Department of Agriculture. With economic losses to the apple industry estimated at $37 million in 2010, the bug's threat to apple growers prompted a Member of Congress to organize a public hearing in western Maryland. There is also concern about the potential damage it could cause to vineyards in California and other states.

Tracy Leskey, with the Appalachian Fruit Research Station in Kearneysville, West Virginia, is the principal investigator of the research group, which includes several scientists in ARS's Invasive Insect Biocontrol and Behavior Laboratory in Beltsville, Maryland; Jana Lee, an ARS entomologist in Corvallis, Oregon; and Kim Hoelmer, director of the USDA-ARS European Biological Control Laboratory in Montpellier, France.

A major project led by Leskey, funded through the USDA-National Institute of Food and Agriculture's Specialty Crop Research Initiative Program, is called "Biology, Ecology, and Management of Brown Marmorated Stink Bug in Orchard Crops, Small Fruit, Grapes, Vegetables, and Ornamentals."

While this is a mouthful, it goes to the heart of the damage that can be caused by this pest. The project is funded for 3 years with $5.7 million in federal funds and $7.3 mil- lion in matching funds. The group includes ARS, Pennsylvania State University, Washington State University, North Carolina State University, Virginia Polytechnic Institute and State University, Rutgers University, Northeastern IPM Center, Oregon State University, University of Maryland, University of Delaware, and Cornell University. The project will take advantage of research that ARS scientists have conducted on BMSB since it was detected in the United States in 2001. The project's progress can be followed on its website, www.stopbmsb.org.

Setting the Trap

Growers need as much in- the-field information as possible to find ways to manage BMSBs. "Monitoring tools are used to assess the presence, abundance, and seasonal activity of pests and natural enemies to determine the need for and timing of insecticide applications," says Leskey. "Specifically, our group evaluated responses of brown marmorated stink bugs using different visual stimuli, compared the effectiveness of commercially available traps from Asia with a black pyramid prototype trap, compared relative attraction to different doses of odor attractants, and conducted a field cage experiment designed to establish how often the brown marmorated stink bugs reproduce."

Leskey has focused on visual stimuli that can, in addition to odor stimuli, attract the BMSBs to traps that will help farmers monitor the level of infestation in fields. We used pyramid-shaped traps of different colors— black, green, yellow, clear, white. In field trials in 2009 and 2010, we found significantly more stink bug adults and nymphs captured in the baited black pyramid traps than in the other traps," says Leskey. "Further, more adults and nymphs were captured in a trap placed on the ground than in a commercially available baited trap from Japan that we hung from a tree limb."

"We also found that in 2010 and 2011, brown marmorated stink bugs produced two generations in 1 year in Kearneysville, based on presence of eggs and newly molted adults in field cage experiments," says Leskey. "Although it has been reported that these bugs produce only one brood in eastern

Pennsylvania, it appears that in more southerly locations within the Mid- Atlantic, they can produce two generations."

The brown marmorated stink bug is easily recognized by many because it's invading our homes. But the pest, shown here feeding on an apple, is also a major economic threat to fruit crops, garden vegetables, and many ornamentals. ARS scientists are fighting back by developing traps, sequencing the bug's genome, and testing parasitic wasps as biocontrols. **(D2709-1)**

Adult and late-instar nymph stink bugs, *Halyomorpha halys,* feed on a Honey Crisp apple, a popular cultivar among consumers. **(D2709- 6)**

Secrets of Attraction

Researchers at the ARS Invasive Insect Biocontrol and Behavior Laboratory (IIBBL) in Beltsville, Maryland, are leading the pivotal pheromone research efforts and genomics studies and partnering with Leskey on field tests of potential attractants for use in commercial traps. Scientists at IIBBL were working on the BMSB long before it became such a huge problem in the United States. Aijun Zhang, an analytical chemist, started looking for the BMSB pheromone in 2003, along with Ashot Khrimian, a synthetic chemist, and Jeff Aldrich, an entomologist who retired in 2011. Khrimian and Aldrich published results in the *Journal of Agricultural and Food Chemistry* and in *Tetrahedron,* showing that a compound identified as a pheromone of another stink bug was also a late- season attractant for the BMSB. When the BMSB emerged as a major pest in the United States, Aldrich and Khrimian began helping U.S. manufacturers develop traps with the attractant.

Support scientist Starker Wright (left) and entomologist Tracy Leskey inspect traps baited with experimental pheromone lures. The lures are being tested for brown marmorated stink bug attraction. **(D2707-4)**

"Our work has already led to successful commercial products now on the market. But what we now have is only a late-season attractant, and because that doesn't help growers as much as we would like, we still have work to do," Khrimian says. In 2010, the team of scientists at IIBBL found an "aggregation pheromone" that shows promise as the main pheromone attractant for BMSB. This pheromone is released by males when they feed, and it attracts both males and females. The scientists are trying to determine the chemicals that make up the pheromone. They are working on identifying the specific isomers (structurally related chemicals) that the stink bugs may be releasing to attract other stink bugs to feeding sites. They are trying to identify the various combinations or ratios of attractant isomers that will produce an affordable and efficient lure, Khrimian says.

The mixture and components were also evaluated in field trials this summer in Beltsville, Kearneysville, and elsewhere. Don Weber, who is overseeing the Beltsville field studies, set up traps with the different candidate formulas and twice each week counted the numbers of male, female, and nymphal (immature) stink bugs they attracted. These pyramid traps, based on those designed by Leskey, are similar to those developed for weevils and pests of woody fruit. They have a screen funnel that allows the stink bugs entry, but inhibits exit. Lures with the experimental formulas hang alongside kill strips inside clear plastic containers.

A provisional patent application was filed, and the researchers hope to include results from the summer field trials in supplemental data that will be filed as part of the completed patent application.

A female parasitoid wasp, *Trissolcus mitsukurii,* from Asia. This species is one of several parasitoids being evaluated as potential bio-controls of brown marmorated stink bug. **(D2730-1)**

Help From Genes and Natural Enemies Dawn Gundersen-Rindal, research leader of the ARS Beltsville group, has been working with scientists at Baylor College of Medicine to sequence the stink bug's genome. The sequencing is part of an international effort, known as the "i5K Project," to sequence the genomes of 5,000 insects. Because it is such a nuisance to home- owners, a threat to agriculture, and rapidly spreading in the United States, the BMSB is one of the group's top priorities, she said.

"Sequencing the genome will tell us about the genes that give this insect its defense mechanisms and its ability to respond to threats, such as pathogens that we might want to use against it. It might give us clues, for instance, how it may develop resistance to insecticides," she says.

An adult parasitoid insect emerging from an egg of a stink bug. After a parasitoid female wasp lays an egg into a stink bug egg, the parasitoid offspring (one per egg) develops inside the egg, eating it from the inside out.

Separate from the sequencing project, Gundersen-Rindal is looking for genes that might be unique to the stink bug or make it vulnerable to specific treatments. "We hope we can find critical genes and use them against the stink bug by developing molecular biopesticides that address some weakness unique to its genetic makeup," she says.

Another approach to reducing the population of BMSBs is classical biological control—using its natural enemies to help keep its populations in check. Hoelmer continues work he began at the Beneficial Insects Introduction Research Unit in Newark, Delaware, to find parasitoid insects that may lend a hand. Surveys conducted in the United States found that native stink bug parasitoids are not capable of controlling BMSBs, so it is important that more effective biological control agents from Asia be identified, tested, and eventually imported to the United States. Hoelmer has collected some of these parasitoids during foreign exploration in collaboration with the USDA-ARS Sino-American Biological Control Laboratory, in Beijing, China, and is now testing them in quarantine culture in Newark to deter- mine their specificity for the BMSB.

Each of these research disciplines is needed to control BMSB populations in the United States, which will help farmers and homeowners alike. The project is an example of how USDA and ARS have the organization, infrastructure, and expertise to move quickly toward solving an emergent problem for agriculture.

This research is part of Crop Protection and Quarantine (#304) and Methyl Bromide Alternatives (#308), two ARS national programs described at www.nps.ars.usda.gov.

To reach scientists mentioned in this article, contact Sharon Durham, USDA-ARS Information Staff, 5601 Sunnyside Ave., Beltsville, MD 20705-5129; (301) 504-1611.

*(**"ARS Works Toward Control of Brown Marmorated Stink Bug"** was published in the **January 2013** issue of Agricultural Research magazine.)*

UPCOMING MEETINGS:

March 14-15, 2013 - *2013 Eastern Apple Precision Orchard Management SUMMIT*. Ramada Geneva Lakefront, Genevay NY. For more information, see: http://blogs.cornell.edu/fruit/files/2013/02/apple_summit_brochure-1iwuvgk.pdf.

March 23, 2013 – *Small Fruit Pruning Demonstration*, 10am – 1pm. Small Fruit Farm - 117 Mt. Moosilauke Hwy., Wentworth NH. For more information see: http://extension.unh.edu/events/files/7CF5BF71-C908-CA5E-D4A4F5C1B6948243.pdf.

March 26, 2013 - *Invasive Plant Certification: Part A1 - Principles & Fundamentals of Weed Science*, 9:00am to 3:00pm. Double Tree Hotel, 11 Beaver St., Milford Massachusetts 01757. Cost: $75. For more information go to http://extension.umass.edu/landscape/events/principles-and-fundamentals-weed-science-a1.

April 11, 2013 – *UNH Spotted Wing Drosophila Management Meeting*. 5pm – 7pm. Hill Library Center, 1151 Parker Mtn Rd, Strafford, NH 03884. *There is limited space at this venue; please pre-register with Suzanne Hebert 862-3200 suzanne.hebert@unh.edu. For more information see http://extension.unh.edu/events/files/4B7171FD-E48F-5C6F-D6440129BC345674.pdf.*

April 15, 2013 – *UNH Spotted Wing Drosophila Management Meeting*. 5pm – 7pm. Meeting Room A, Meredith Community Center, 1 Circle Drive, Meredith, NH 03253. *For more information see http://extension.unh.edu/events/files/4B7171FD-E48F-5C6F-D6440129BC345674.pdf.*

April 16, 17, 18, 2013 – *UMass Fruit Team Spring Twilight Series*. Locations have not yet been announced for these meetings but should be soon. Go to http://extension.umass.edu/fruitadvisor/ to check for locations and other information.

April 15, 2013 – *UNH Spotted Wing Drosophila Management Meeting*. 5pm – 7pm. April 19, 2013, 5-7PM. Claremont Savings Bank, 145 Broad St, Claremont NH 03743.. *For more information see http://extension.unh.edu/events/files/4B7171FD-E48F-5C6F-D6440129BC345674.pdf.*

April 15, 2013 – *UNH Spotted Wing Drosophila Management Meeting*. 6pm – 9pm. Hillsborough County Cooperative Extension, 329 Mast Rd, Goffstown NH *For more information see http://extension.unh.edu/events/files/4B7171FD-E48F-5C6F-D6440129BC345674.pdf.*

WEBINARS OF INTEREST:

National Sustainable Agriculture Information Service (ATTRA) webinars and videos can be found at: https://attra.ncat.org/video/.

Northern Grapes Project recorded webinars can be found at: http://northerngrapesproject.org/?page_id=257

Northeast Sustainable Ag Research & Education (NE-SARE) Video Vault can be found at: http://www.nesare.org/Dig-Deeper/Pictures-Stories-and-Video/Video-vault

If you know of an event or resource that would be suitable for this list, please forward to sgs@umext.umass.edu

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