New York Berry News

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What's Inside

Spring has sprung here in New York and by now everyone is gearing up for the new growing season after what appears to be one of the mildest winters we have seen in our state in a very long time. Included in this issue of the New York Berry News is the latest take on berry production and pest management for the upcoming season.

March news briefs include information details on the new online version of the 2006 Berry Pest management guidelines and TracBerry software, the Spring 2006 Cleansweep NY program, a Spring Berry Chores checklist courtesy of the North American Bramble Growers Association (NABGA), and the newly granted section 18 for Indar use in control of mummyberry on blueberry in New York.

Our in-depth articles this month are from several sources. They include a research summary on sap beetle management progress in strawberries, select articles from the NABGA 2006 Conference Proceedings (some of which originated from the berry sessions at our Empire State Fruit and Vegetable Expo), and new and "renewed" articles from "old" and new authors!

UPCOMING MEETINGS

April 5-7, 2006- 35th New York Wine Industry Workshop. Lakefront Ramada Inn, Geneva, N.Y. http://www.nysaes.cornell.edu/fst/asev.

April 22-27, 2006- Refrigerated Warehousing & Logistics Convention & Trade Show, Orlando, Fla. (703) 373-4300, email@iarw.org, http://www.iarw.org.

April 26-29, 2006- Fresh-Cut Expo, Baltimore Convention Center, Baltimore, Md. (703) 299-6282, http://www.freshcutexpo.com/.

May 6-9, 2006 - United Fresh Fruit and Vegetable Association Produce Expo and Convention, McCormick Place, Chicago, (202) 303-3400, www.uffva.org.

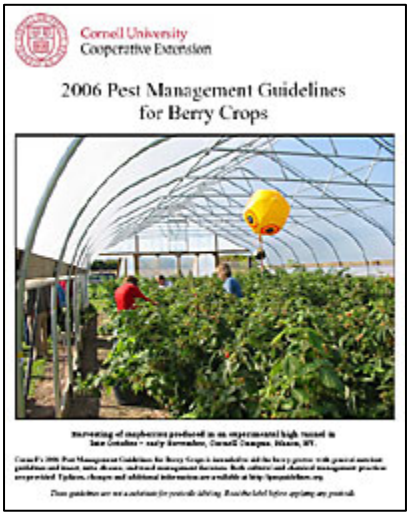
May 18-20, 2006 - Texas-Mexico Frozen Food Fiesta Marriott Casa Magna, Puerto Vallarta, Mexico www.affi.com/frozenfoodfiesta.

June 19-30, 2006- Post-Harvest Technology Short Course, University of California, Davis, Calif. (530) 752-6941.

2006 BERRY CROPS GUIDELINES NOW AVAILABLE ON LINE

The 2006 edition of the *Pest Management Guidelines for Berry Crops* is now available on line. The format remains the same as the previous year and chapters are available for viewing or printing as pdf files.

Download the entire publication. [90-page, 2 MB .pdf file]



Or download sections:
Front matter [471K .pdf] - Cover, acknowledgements, table of contents

Pesticide information [49K .pdf] Safety, regulations, environmental impact, etc.

General information [60K .pdf] Calculating rates, fumigation, nutrients, principles of weed, insect and disease management.

Blueberries [113K .pdf] Labeled fungicides, insecticides, miticides and pesticides. Timing of application for major pests. Weed management and registered herbicides.

Raspberries and Blackberries [117K .pdf] Labeled fungicides, insecticides, miticides and pesticides. Timing of application for major pests. Weed management and registered herbicides.

Strawberries [137K .pdf] Labeled fungicides, insecticides, miticides and pesticides. Timing of application for major pests. Weed management and registered herbicides.

Currants and gooseberries [66K .pdf] Labeled fungicides, insecticides, miticides and pesticides. Timing of application for major pests. Weed management and registered herbicides.

Supplemental information [84K .pdf]
Bird, rodent and deer management; harvest, handling, transport and post-harvest; faculty and Extension staff; other resources; pesticide emergency numbers.

GET ON TRACK WITH TRACBERRY SOFTWARE

What is Trac Software? Trac is an easy-to-use software program for growers to record their yearly spray and fertilizer treatments. From the master spray data sheet, Trac automatically generates the processor report forms, Eurepgap forms and EPA WPS Central Posting. Four Trac Software CDs are available: TracBerry© – Strawberry, Blueberry, Raspberry & Blackberry, and Ribes, TracApple© – Apple and Pear, TracGrape© – Grape. Each CD has a comprehensive, 22-page, Trac Software Manual. Use copy and paste to move information from 2004 or 2003 into Trac 2005. As always -Trac 2005 has the latest pesticide information, based on the 2005 Cornell Guidelines.

What hardware and software do I need? Microsoft Excel, a CD Rom Drive, and a printer.

How does Trac work? Those familiar with working on a spreadsheet will find it easy to use Trac Software, since it is written in MS Excel, a popular spreadsheet program. Very simply, the user "fills in the blanks." There are data entry worksheets, much like sheets of paper. One sheet asks for basic grower information, such as name and address. Another sheet allows the user to enter their spray information, such as the spray date and chemical used. From the data entry worksheets the program automatically completes the processor spray report forms.

Are there other benefits to using Trac? Trac has "drop down" lists for pesticides and pests that you can select from. This saves time and prevents typing errors. When you select a pesticide Trade Name from the drop down list the program automatically fills in the EPA registration number, REI, PHI and calculates the earliest harvest date. The software also generates drop-down lists specific to your farm operation. And it will automatically fill out an EPA WPS Central Posting form.

How often is Trac updated? Trac software is updated on a yearly basis. This means you get the most up-to-date information on pest management materials. Trac software information is based on the Cornell Pest Management Guidelines that are updated yearly.

Trac Software was developed and written by Juliet Carroll, Fruit IPM Coordinator, and, Judy Nedrow, Trac Programmer. Funding for Trac Software has been provided by: The New York State Department of Agriculture and Markets, The New York Wine and Grape Foundation, and the New York Agriculture Innovation Center

Orders may be sent to:
Michele Kaufman, 315 787 2419, mrk25@cornell.edu
Trac Software, NYS IPM Program, 630 West North St., Geneva, NY 14456

Online information is available at: http://www.nysipm.cornell.edu/trac/index.html

SPRING 2006 CLEANSWEEP PROGRAM

During the week of April 24, 2006, identified counties in New York will receive a one-time environmental benefit program for improved pesticide stewardship. This Spring CleanSweep Program will target the following counties: Wyoming, Genesee, Orleans, Niagara, and Erie. Residents outside of these counties may also participate, but the collection sites and outreach are limited to these five counties. The CleanSweep NY program will continue to move westward until either the funds are expended or the program begins again in the East and starts another cycle.

The New York State Department of Environmental Conservation (DEC), in cooperation with New York State Agriculture & Markets (Ag. & Mkts.), Soil and Water Conservation Districts and Cornell Cooperative Extension is directing the CleanSweep NY Program for 2006 for the environmentally safe removal of cancelled, unwanted, or unusable agricultural or commercial pesticides, most forms of empty pesticide packaging and elemental mercury from dairy manometers.

Obsolete pesticides and improperly handled pesticide packaging, can pose a significant hazard to ground and surface waters of New York State. Furthermore, accidental exposures are a health risk to anyone who, unknowingly, comes into contact with old chemicals or spent packaging, whether that person is the property owner's family, first responders to emergencies (particularly fires), or handlers at any solid waste facility. Yet, the DEC recognizes that farmers and other holders of old pesticides have been, in many respects, responsible environmental stewards, since they have not had many legal opportunities, to safely dispose of these agricultural pesticides. This program provides that opportunity.

This CleanSweep NY funding was specifically earmarked for the benefit of New York agriculture. For this reason, there is no charge and no limit to the quantity of obsolete pesticides or mercury that can be returned by farmers, former farm owners, and commercial applicators involved in production agriculture. Commercial pesticides *will* also be accepted free of charge from governmental and non-agricultural commercial applicators *provided* that no more than 100 pounds are returned. For each pound above 100 lbs., these same holders will be charged at the current CleanSweep NY contract rate on a per pound basis. This rate ranges from $1.25 to $1.65 depending on the state of the packaging. This low rate is still substantially less than the service fee that any individual company would have to pay for privately negotiated, legal disposal.

CleanSweep NY does *not* allow routine homeowner participation. However, retail establishments selling either agricultural, commercial, OR home/garden pesticide products may also participate with the same 100 lbs. payment threshold in effect.

Since proper disposal or recycling of empty, rinsed containers is supported from separate sources, there is no limit to the quantity of metal or plastic pesticide containers, nor any restriction on the source of the plastic containers, other than the crop protection and other pesticide restrictions imposed by the industry supported Agricultural Container Recycling Council as listed at http://www.acrecycle.org or instructions available from contacting 1-877-952-2272.

Collection Sites for Spring 2006

Note: No one admitted to site without Pre-Registration

Contact CleanSweep NY for Registration Forms info@cleansweepny.org or 1-877–SWEEPNY (1-877-793-3769)

Deadline for Registration: Friday, April 14, 2006

Friday, March 31, 2006 unknowns/missing labels greater then 50 lbs or 5 gallons

Note: Sites may be combined if insufficient participants register. Wyoming County site is tentative. Saturday, April 29 is reserved as backup date if any day is cancelled due to unsafe weather conditions.

Wyoming County

Date: Monday, April 24th (Site is tentative, awaiting DOT approval)

Location: Wyoming County, NYSDOT
3879 Route 19
Warsaw, NY 14569

Genesee County

Date: Tuesday, April 25th

Location: Genesee County Highway Department
153 Cedar Street Batavia, NY 14020

Orleans County

Date: Wednesday, April 26th

Location: Orleans County Fairgrounds
21960 Route 31
Albion, NY 14411

Niagara County

Date: Thursday, April 27th

Location: Niagara County Fairgrounds
4487 Lake Avenue
Lockport, NY 14094

Erie County

Date: Friday, April 28th

Location: Erie County DOT
14299 Route 62
Gowanda, NY 14034

AZINPHOS-METHYL (GUTHION) USES FOR CANEBERRIES CANCELLED

EPA issued an order in the Federal Register on March 29, 2006, amending registrations of azinphos methyl (AZM) products to terminate the "Group 2" uses, which include **caneberries**, cotton, **cranberries**, peaches/nectarines, potatoes, and Southern pine seed orchards. This order follows up on an August 2005 notice of receipt of requests from the registrants to voluntarily cancel the Group 2 uses. **Under the existing stocks provisions, distribution or sale of AZM products for these uses is allowed until March 31, 2006, and use of these products is allowed until September 30, 2006.**

BRAMBLE CHORES THROUGHOUT THE YEAR - SPRING CHECKLIST

This checklist was developed by Dr. Gina Fernandez, Small Fruit Specialist at NC State University and reviewed by Dr. Marvin Pritts at Cornell. Chores and timing may be somewhat different for our area or for your cropping system.

Plant growth and development

- ❑ Plants deacclimate quickly
- ❑ Bud differentiation (additional flowers formed)
- ❑ Bud break
- ❑ Flowering
- ❑ Primocane emergence

Pruning and trellising

- ❑ Finish pruning and make sure all floricanes are tied to the trellis before budbreak.
- ❑ Rotate shift trellises to horizontal position before budbreak; rotate to upright position immediately after flowering.

Weeds

- ❑ Weed growth can be very vigorous at the same time as the bramble crop peaks. Don't let weeds get out of control.
- ❑ Weed control is best done earlier in the season before harvest commences.
- ❑ Hand-weed perennial weeds in and around plots.

Insect and disease scouting

The period of time in the spring when the plant is flowering is the most important season for control of insects and diseases. Know what your pests are and how to control them.

Water management

- ❑ Bramble plants need about 1"-2" water/week. This amount will be especially critical during harvest.
- ❑ In the South consider installing an overhead system for evaporative cooling. Turn on once or twice a day from 10 am to 3 pm for short periods of time (approx. 15 minutes) until mid afternoon.

Nutrient management

- ❑ Apply second half of nutrients if doing split application.

Marketing and miscellaneous

- ❑ Service and clean coolers.
- ❑ Make sure you have enough containers for fruit in the coming season.
- ❑ Prepare advertising and signage for your stand.
- ❑ Contact buyers to finalize orders.
- ❑ Hire pickers.
- ❑ Prepare signage for field orientation; it is easier to tell pickers where to go if rows are numbered

Brought to you courtesy of: **North American Bramble Growers Association (NABGA)**, Debby Wechsler, Executive Secretary, 1138 Rock Rest Rd., Pittsboro, NC 27312. E-mail: nabga@ mindspring.com, Phone: 919-542-3687, Fax: 919-542-4037

SECTION 18 GRANTED FOR INDAR ON BLUEBERRY

March 16, 2006: The Environmental Protection Agency has issued an emergency exemption (FIFRA Section 18) to New York State for the use of fenbuconazole (Indar) to control mummy berry disease in blueberries.

The section 18 expires June 30, 2006. The product Indar 75 WSP, EPA Reg. No. 62719-421 (formerly EPA Reg. No. 707-239) (containing 75% fenbuconazole) and manufactured by Dow AgroSciences LLC may be used. Existing sticks purchased from the previous registrant, Rohm and Haas, EPA Reg. No. 707-239, may also be used.

All applicable conditions and restrictions on the federally registered product must be observed along with use directions set forth in the section 18 Specific Exemption. A copy of the use directions and label are available from the Pesticide Management Education Program website at http://pmep.cce.cornell.edu/regulation/sec18/2005/index.html.

Indar 75 WSP may be applied by ground at a maximum rate of 2 ounces product (1.5 ounces active ingredient) per acre. A maximum of 5 applications are permitted; do not apply more than 10 oz. of product (o.47 lbs a.i.) per acre per growing season. Do not apply Indar within 30 days of harvest. Do not graze livestock in treated fields or offer treated material as a livestock food item. Applications are not permitted within 75 feet of streams, rivers, ponds, lakes, or reservoirs.

BLUEBERRY DISEASE FAST FACT SHEET

Mummy berry

Dena Fiacchino[1], Cathy Heidenreich[2], and Wolfram Koelle[2]r

Figure 1

Figure 2

Figure 3

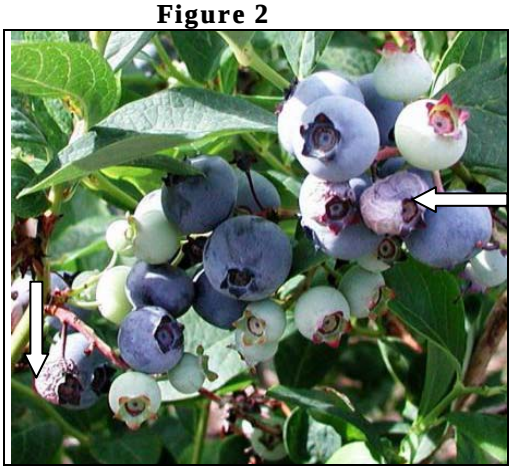


Figure 4

What: Mummy berry is caused by the fungus, Monilinia vaccinii-corymbosi, and is one of the most important blueberry diseases in New York State. If left untreated, mummy berry can reduce yields by 30-40%. Early control and detection is necessary to reduce the impact of this disease.

When: The fungus overwinters in infected berries, or "mummies" on the soil under bushes. Mushroom-like structures (apothecia) grow out of the mummies (Figure 1). In early spring, ascospores are released from the apothecia to infect the newly emerging leaf tissue. These spores are disseminated by wind and rain. This step is the primary or shoot blight phase of the disease. Shoot blight symptoms typically develop 2 weeks after infection. Infected shoots and leaves wilt, turn brown, and die (Figure 2). Masses of secondary spores (conidia) are produced on infected shoot surfaces (Figure 3), which then infect flower blossoms, starting the second phase of the disease.

Where: Mummy berry occurs in most regions where blueberries are commercially grown. This fungus only infects cultivated blueberries and a few wild blueberry species. Generally, the disease is introduced from neighboring infected plantings or from wild blueberries in nearby woods.

How: Under moist conditions in early spring, apothecia begin to form from mummified fruit remaining on the soil surface. The apothecia slowly develop as moisture levels and temperatures rise. At low temperatures such as 35° F, spores mature slowly taking 10+ hours to release, however at an increased temperature of 61° F, apothecia take about 4hrs to fully mature.

Conidia form on infected shoots, then are carried to flower blossoms by wind and pollinating bees (who are tricked by color changes and sugar secretion into thinking that the infected leaves might be flowers). Once the fungus has been introduced to the flower, it will germinate with the pollen and slowly infect the developing fruit. Evidence of blossom infection does not appear until the fruit begins to ripen. As normal berries ripen, the infected berries begin to shrivel and turn a pinkish color. (Figure 4) These "mummy berries" become filled with fungus, and have a hard grayish white center. They fall to the ground, shrivel up becoming pumpkin-shaped, and turn dark brown or black. These serve as an inoculum source the following spring when apothecia form and disease cycle begins again.

Control Strategies: Mummy berry can be a difficult disease to control. An integrated pest management program including both cultural and chemical control strategies is needed for best results. The best time to achieve control of this disease is during the primary infection phase.

- Rake or disk soil beneath the blueberry bushes or cover the fallen mummy berries with a 3-4 inch mulch layer before apothecia appear in the spring.
- Apply 200lbs/A of 50% urea to burn out apothecia.
- Fungicides may be used to control this disease during both disease phases. For control of the primary infection phase applications should begin at green tip and continue on 7-10 day intervals when conditions favor infection. For secondary infection control, make applications beginning at bloom on the same type of schedule. Different fungicides are required to control primary vs. secondary infections.

For more information see Cornell Pest Management Guidelines for Berry Crops. Apply all pesticides according to label rates and instructions.

References:

1. Caruso, F.L., and Ramsdell, D.C. (eds.) 1995. Compendium of Blueberry and Cranberry Diseases. APS Press, St. Paul Minn.
2. DeMarree, J.B., and Wilcox, M.S. 1947. Fungi Pathogenic to Blueberries in the Eastern United States. Phytopathology 37: 487-506.
3. Pritts, M.P. and Hancock, J.F. (eds.) 1992. Highbush Blueberry Production Guide. Northeast Regional Engineering Service, Ithaca, NY.
4. Schilder, Annemiek. 2005. Michigan Blueberry Facts: Mummy Berry. http://www.blueberryfacts.org/mummyberryguide.html.

[1]*Cornell Cooperative Extension of Oswego County, Mexico, NY*
[2]*Department of Plant Pathology, Cornell University's New York State Agricultural Experiment Station, Geneva, NY*

BLUEBERRY FREEZE DAMAGE AND PROTECTION MEAURES

Bill Cline and Gina Fernandez, Extension Horticultural Specialists, Department of Horticultural Science, North Carolina State University

Freeze-Prone Sites

Commercial blueberries are generally planted in low areas with high organic-matter content. These sites satisfy the cultural requirements of blueberries for a constant and uniform moisture supply. However, on cold, still nights when radiation frosts occur, heavy cold air from higher surrounding areas "drains" into the low areas causing lower temperatures. Also, the high organic content, especially if the soil is dry, acts as an insulator to restrict heat in the soil from moving up around the plants. The cultural requirement for a uniform soil moisture makes selecting higher sites that are less subject to radiation frosts much less practical than with other fruit crops. Although there is almost no wind during a radiation frost an occasional gentle breeze will occur. Removal of trees and brush from around the field to improve air circulation will allow these breezes to penetrate the field at bush level. The cold air will be displaced or mixed with the warmer air from higher locations and less temperature drop will occur.

Cold Susceptibility

Blueberry blossoms and small berries are considered hardier than the blossoms of most fruits. Temperatures must drop below 28 °F for economic losses to occur on highbush blueberry (*Vaccinium corymbosum* L.). The temperature at which freeze injury begins to occur depends on the stage of development from dormant flower buds through young fruit. During the winter, dormant flower buds of highbush blueberries will survive temperatures as low as -20 to -30 °F while the less hardy rabbiteye (*V. ashei* Reade) have survived -10 °F but are often damaged below 0 °F. As flowerbud swell progresses, cold tolerance decreases. By the time individual flowers begin to protrude from the bud, temperatures below 20 °F will begin damaging the most exposed flowers. When corollas have reached half of their full length, temperatures below 25 to 26 °F will kill the complete flowers. However, at this stage, blossoms on rabbiteye blueberries may receive corolla damage at temperatures as high as 30 °F. The corolla withers, but usually remains attached. The withered, unopened corolla prevents bee pollination and otherwise undamaged flowers drop rather than developing into fruit. Corolla damage to unopened highbush flowers that prevents pollination is seldom a problem with highbush blueberries. When the blossoms are open, a temperature of 27 °F for more than a few minutes causes damage. Immediately after corolla drop and before the berry begins to swell is the most sensitive stage. A few minutes below 28 °F will result in damage. As the berry begins to enlarge, susceptibility is similar to the critical temperature of 28 °F for open blossoms.

Injury Symptoms

Cold damage is not always obvious. Following temperatures well below the critical level, the complete flower or small fruit will develop a water-soaked appearance, shrivel and drop. However, a very brief time at the critical temperature may damage only the pistil. All or a portion of the damaged pistil will develop a brown appearance and prevent pollination and fruit set. Ovules, which develop into the seeds within the berry, can also be damaged without any exterior symptoms. Healthy ovules are plump and white, but become black with cold injury. If a large number of ovules or young seeds are black, the flower or fruit will probably drop. If only a few are damaged, fruit development usually continues, but the fruit will be later ripening and of smaller size than berries with a larger number of healthy seeds.

Monitoring Temperature

Reliable and accurate thermometers that register current and minimum temperatures are essential if frost control measures will be used and also to help predict the extent of damage if no is provided. Most fields should have at least 3 thermometers placed at bush height in high protection (warm), low (cold) and average locations in the field. Hygrothermographs that constantly measure temperature and relative humidity placed in a weather shelter at bush height are also very helpful if frost protection measures are available. The plot of temperature and humidity as the night progresses on the hygrothermograph chart aids in making the best possible management decisions. It is much easier to determine the rate of temperature drop and predict the minimum temperature before sunrise from the hygrothermograph chart than from watching the thermometers and plotting temperature change. Thermometers in warm, cold and average locations in the field should be checked in addition to the hygrothermograph to determine differences across the farm. Relative humidity is usually 100% on radiation frost nights; however, occasionally lower humidity occurs. With sprinkler irrigation for frost control, the system must be started at a higher temperature when humidity is low to compensate for the evaporative cooling that will occur as the first water strikes the bushes. A sling psychrometer that measures wet bulb and dry bulb temperatures is a less expensive method for determining relative humidity than the hygrothermograph, however, unlike the hygrothermograph, there is no constant measurement or permanent record.

Sources of temperature monitoring equipment are listed in Table 1. Commercially manufactured temperature alarms are available or they can be assembled from a refrigeration thermostat and transformer. The thermostat should be set at a temperature high enough to awaken the irrigation manager in time to check field thermometers before the temperature drops below 35°F. Thermometers shielded from the open sky and placed at the height of the upper one-third of the bush give air temperature readings that can be related to the temperatures described in this leaflet.

Listening to weather reports is not a reliable method of monitoring current temperatures or determining what the low temperature will be in a blueberry field. Many of the official temperatures reported on radio or television are taken at airport locations. The large paved areas that hold heat and the aircraft mixing of air at airports makes them much warmer than surrounding areas on radiation frost nights. However, you may be able to develop a reasonably reliable adjustment factor for how much colder the blueberry field is than the local reporting station. Blueberry fields will often be as much as 10 to 12 °F colder on a radiation frost night than warmer locations such as airports.

Practices for Reducing Freeze Damage

Pruning -- Flower buds on short, small-diameter shoots will open and become susceptible to freeze damage sooner than flower buds on larger diameter shoots. Pruning to a balance of early blooming and later blooming shoots will help insure a crop. If no frost or freeze occurs, the early blossoms will develop into the early ripening, high priced fruit. If a frost or freeze occurs, there will still be some later fruit for a partial crop.

Avoid Cultivation -- Cultivation in late winter and early spring tends to increase freeze damage. Soil temperature on a radiation-frost night will be much warmer than air temperature. If the soil has been cultivated, the surface layer will contain more air and less water. With less water, the surface layer will hold less heat. Also, the increased soil air will cause the surface layer to be a better insulator which will decrease the amount of heat released from deeper in the soil. Bushes will probably stay 1 to 2 ^{o}F warmer on uncultivated soil than on cultivated soil. To avoid spring cultivation, adequate drainage should be established the previous fall, followed by herbicide application in late winter.

Maintain Soil Moisture -- Growers who have hose reel, hose pull, or small portable irrigation systems can benefit from maintaining a moist soil during the period when frosts are possible. By increasing the amount of water in the soil, the soil will absorb more heat during the day and conduct more heat to the surface for plant protection. Maintaining a moist surface on peat and muck soils is especially important. When these soils are dry, they hold very little heat and a dry surface acts as an excellent insulator to prevent beneficial heat release. Excess water for extended periods must be avoided to prevent flooding or Phytophthora root rot damage.

Sprinkler Irrigation --Permanent or solid set irrigation has been the most dependable frost control method. Depending on the design of the system, damage can be prevented when temperatures drop as low as 20 to 23 ^{o}F. The system commonly used in blueberries is a sprinkler spacing of 60 ft. x 60 ft with nozzles that supply about 5 to 6 gallons per minute (gpm) at 55 to 60 pounds per square inch (psi). This design requires 12 sprinklers per acre. The system is started when the temperature has dropped into a range of 33 to 38 ^{o}F and the grower expects the temperature to reach a minimum below 28 ^{o}F before warming begins after sunrise. The temperature to begin sprinkling depends on humidity. If the humidity is near 100% as it usually is on radiation-frost nights in southeastern NC, 33 to 34 ^{o}F is satisfactory. However, at 40% relative humidity the system should be started at about 37 ^{o}F to avoid evaporative cooling below 30 ^{o}F. A psychrometer or hygrometer as previously mentioned is needed to determine relative humidity.

Table 1. Some sources of temperature and humidity measuring equipment.

Company and Contact Information	Minimum Thermometers	Hygro-thermographs	Temperature Alarms	Psychrometers
Cole-Parmer 7425 N. Oak Park Ave. Chicago, IL 60648	X	X	.	.
Forestry Supplies, Inc. 205 W. Rankin St. P.O. Box 8397 Jackson, MS 39204 1-800-647-5368	X	X	X	X
Hummert International 4500 Earth City Expressway Earth City, MO 63045 1-800-325-3055	X	X	X	X

(Reprinted with permission from: NC State Horticulture Information Leaflet No HIL-201-E, 1998.).

STRAWBERRY SAP BEETLE: AN UPDATE ON PROGRESS TOWARD IMPROVED MANAGEMENT

Rebecca L. Loughner and Gregory English-Loeb, Dept. of Entomology, NYSAES, Cornell University, Geneva, NY 14456

The strawberry sap beetle (SSB) is a significant insect pest in strawberry in much of the Northeast. The small, brown adults are approximately 1/16 inch in length and appear in strawberry fields as the berries ripen. The adults and larvae prefer to feed on over-ripe fruit but will also damage marketable berries. Customers often report finding larvae after washing the berries at home. The beetles are widespread and present at all of 14 New York farms sampled in 2002, but seem to be a significant problem only in certain locations. Concern regarding SSB centers on the lack of effective control measures.

Current recommendations for control include applying pyrethroids, improving field sanitation, and renovating promptly after harvest. Labeled pyrethroids (Brigade [bifenthrin] and Danitol [fenpropathrin] in NY) have not provided sufficient control and are broad spectrum, potentially disrupting predatory mite populations that provide spider mite control. The beetles are not resistant to pyrethroids but rather tend to feed underneath fruit where they are unlikely to be contacted by insecticide. Even dilute sprays using up to 200 gallons per acre have not proven to be very effective.

Results presented here are a summary of data from three years of examining how cultural practices (plant structure and time of renovation) and habitat surrounding strawberry fields (wooded areas and alternate food sources) influence the size of the SSB population. This work has led to some initial progress in understanding SSB biology needed to develop a trap-and-kill management technique.

Overwintering habitat

A total of 5 adult SSB were found in the 220 soil cores collected from wooded areas in spring 2004, while no SSB were present in the 480 samples taken from fields of other crops during the same time period. All beetles in the samples came from wooded areas at one farm known to have high densities of SSB. More beetles were found after increasing the area sampled per field for overwintering SSB from 0.16 m^2 (wooded area) or 0.26 m^2 (crops) in 2004 to 2.03 m^2 in 2005. Beetles were found in both of the two wooded areas sampled, in blueberry, and in raspberry for samples collected before fruiting occurred and after fruit residue was present (Table 1). No SSB were found in any of the three strawberry fields for the overwintering sample, but beetles were found in samples collected when fruit began to ripen in the field. Absence of SSB from early season samples in strawberry confirms that most, if not all, beetles spend the winter outside of strawberry fields and move into berry fields as fruit ripens.

Strawberry plant structure

Sampling and manipulative experiments were designed to better understand how variation in plant structure of strawberry cultivars could impact fruit resources available to the SSB population. A sampling of 14 strawberry cultivars showed the proportion of berries held off the ground does vary with cultivar. Although there was a significant correlation between fruit being ripe and in contact with the ground, certain cultivars did not fit this trend. The cultivar 'Serenity' had a high proportion of fruit touching the ground before most of the fruit had ripened, while 'Evangeline' had a low proportion of fruit in contact with the ground at peak ripeness. The finding that berries on 'Evangeline' are less likely to come in contact with the ground fits with anecdotal reports that the cultivar tends to hold fruit off the ground and thus is less damaged by SSB in the field.

The hypothesis that plant structure may be useful in developing control tactics is based on the assumption that berries in contact with the ground are more likely to be damaged by SSB. To test this assumption, clusters of fruit in a field plot were staked up off the ground or pinned down to the ground, covered with a cage, and inoculated with adult SSB. The beetles both damaged and were present on fruit clusters staked up off the ground, showing beetles can feed on fruit in the plant canopy. The proportions of damaged fruit suggest that berries in direct contact with the ground are more likely to be damaged by SSB than berries in the canopy.

While proportion of fruit touching the ground may vary with cultivar, some fruit in all cultivars is in contact with the ground. The beetles may preferentially feed on fruit touching the ground and only damage fruit in the canopy when densities of SSB are high. Damage to fruit in the plant canopy has been reported in such situations at commercial farms. Overall, the potential is limited for directly impacting the SSB population by choosing a strawberry cultivar with a particular growth habit.

Time of strawberry plot renovation
A manipulative experiment was used to investigate the effect of time of renovation on the number of SSB emerging from strawberry. Plots within a strawberry planting were randomly assigned to either rototilling immediately after mowing (prompt renovation) or rototilling 7 to 10 days after mowing (delayed renovation). Emergence cages were placed in both treatments on the same day and the cages in the delayed rototilling removed briefly on the day tilling was done. Emerging adults were captured with attractive baits in the cages and the total number of adult beetles emerged over five weeks was determined.

Year was the primary factor contributing to variation in the total number of SSB adults emerging, while time of renovation had no statistically significant effect. Peak emergence occurred from late July to early August 2004, while emergence in 2005 resulted in much less of a peak with a smaller number of beetles overall. In contrast to data from Maryland (Dr. Galen Dively, University of Maryland) that showed significantly fewer beetles emerging from plots renovated promptly following harvest, this study suggests that prompt renovation does not consistently reduce the number of emerging SSB, at least in New York. Although prompt renovation does not appear to reduce the number of beetles in the next generation, current recommendations to renovate promptly still have value given other benefits such as improved weed control.

Development of trap-and-kill technique
Modifying cultural practices seems unlikely to significantly reduce the SSB population or damage to marketable fruit. While selecting certain cultivars, applying a border spray, and changing the time of renovation may not be practical options for controlling SSB, the earlier capture of beetles along wooded edges near fields offers an alternative approach to SSB management. Sap beetles have a male-produced aggregation pheromone that could be included in a trap along with a food odor and insecticide. These traps should be attractive to male and female beetles and would be placed near fields in early spring to capture and kill SSB before they enter strawberry fields. In laboratory flight tunnel assays, female SSB are much more attracted to whole wheat bread dough when male SSB are present with the dough. We have also had some female response in the flight tunnel to volatiles collected from male SSB feeding on bread dough. We are currently working to collect enough of the attractive material to be able to identify the chemical components of the SSB specific aggregation pheromone and to begin testing blends of synthetic pheromone in our flight tunnel.

Table 1. Mean total ± standard error and range for adult SSB collected in wooded areas and crops before and during fruiting in 2005.

Crop/Habitat	*n*	Mean total SSB[a] (before fruiting)	Range SSB (before fruiting)	Mean total SSB[a] (fruit present)	Range SSB (fruit present)
Blueberry	3	2.3 (1.2)	0 – 3	223.0 (52.3)	131 – 312
Raspberry (summer)	2	0.5	0 – 1	908.5	566 – 1251
Raspberry (fall)	1	1.0		194.0	
Strawberry	3	0.0 (0.0)		177.7 (148.7)	25 – 475
Wooded areas	2	21.5	5 – 38	na[b]	na[b]

[a]Standard error of the mean shown only for crops with >2 fields sampled
[b]Late season samples were collected only from crops and not wooded areas

FROST PROTECTION IN STRAWBERRIES

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*(**Editor's note**: Support your local berry grower association! As always, rowcover can be purchased from the New York State Berry Growers Association. For more information or to purchase row cover contact: James Altemus, (716) 657 5328, Fax: (716) 657 4642, or email goodberries@aol.com)*

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. Excessive summer temperatures inhibit growth as well.

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 (Table 1). 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.

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 Univ.

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 periods.

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.

Rules of thumb

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

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 (see article below).

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. 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 (F)
30	32
29	33
27	34
25	35
24	37
22	38
20	39
17	40

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.

RASPBERRY PLANT TYPES AND RECOMMENDED VARIETIES

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Raspberry varieties are classified as floricane (summer) or primocane (fall) bearing. (A few weak primocane bearing types are described as everbearing, which produce a small fall crop and can be managed in a double cropping system.) Raspberries are naturally biennial with a perennial crown. Primocanes grow the first year, go dormant in fall, get chilled in winter, and fruit the following summer (the primocanes are now called floricanes, which die after fruiting). New primocanes are growing as the floricanes fruit. Floricane varieties must be pruned in the spring to thin the fruiting canes and remove dead canes for better disease management and fruit size.

Primocane varieties fruit on the first year's growth in the fall of the year. The strength of fruiting varies widely from tips only on some floricane varieties to nearly the whole cane in varieties such as 'Autumn Bliss' and 'Polana'. Later primocane varieties such as 'Ruby' and 'Heritage' can have yield reductions from early frosts. Pruning in these varieties is done by mowing to the ground before primocanes emerge in early spring.

New varieties are actively being developed in about 11 public breeding programs around the world with the majority suitable for production in the northeast U.S. coming from Cornell University ('Heritage', 'Encore', 'Prelude', 'Titan', 'Ruby', 'Taylor'), University of Maryland ('Caroline', 'Anne', 'Jaclyn') and Ag Canada in Nova Scotia ('Nova', K81-6). Increasingly, new varieties from European programs are being introduced in to the U.S. ('Autumn Bliss', 'Autumn Britten', 'Polana' and others). New cultivars are released all the time, and the vast majority of them fail to catch on for various reasons including poor adaptability to diverse growing regions, unforeseen disease or insect susceptibility, or fruit characteristics that are unacceptable to the buying public. No cultivar will work well in all locations, soil types, and productions systems, but many have proven to be useful in many different situations. This list is by no means complete but should address most situations. By planting a series of cultivars, it is now possible to have fruit from mid to late June until frost (or longer with protection) in much of NY and the northeastern U.S. with only a short late-summer lag in production.

Early Season

Boyne and **Killarney** (sibling varieties from Manitoba) These two varieties perform very similarly. Both have are early season with small to medium sized fruit with good eating and freezing quality but can be somewhat dark and soft. The plants are spiny and produce many suckers. They have excellent winter hardiness but are susceptible to anthracnose. Boyne is moderately resistant to late yellow rust and tolerant to Phytophthora root rot and crown gall, but is susceptible to raspberry fireblight. Killarney is moderately resistant to Phytophthora root rot and is susceptible to mildew.

Prelude (Cornell University-NYSAES, Plant Patent #11,747) is the earliest summer fruiting cultivar available. The fruit is medium sized, round, and firm with good flavor. It is very resistant to Phytophthora root rot and has good cold hardiness. A moderate fall crop is large enough to warrant double cropping. It is the best early season cultivar available for the northeast.

Mid Season

Canby (Oregon) canes are tall, nearly spineless, and moderately productive. The fruit ripens mid season, is medium to large in size, firm, and bright red with excellent flavor. It has moderate to poor cold hardiness, and buds may winter kill in cold climates. It is susceptible to Phytophthora root rot.

Nova (Nova Scotia) is vigorous and upright with long, fruiting laterals. The canes have very few spines. The fruit ripens in mid-season and is medium sized, bright red, firm, and somewhat acidic in taste. It is considered to have better than average shelf life. The plants are very hardy and appear to resist most common cane diseases, including rust. It will set a late fall crop.

Titan (Cornell University-NYSAES, Plant patent # 5404) produces large canes with very few spines with suckers that emerge mostly from the crown, so it is slow to spread. It is susceptible to crown gall and Phytophthora root rot but is extremely productive. Fruits ripen mid to late season and are extremely large and dull red, with mild flavor. Berries are difficult to pick unless fully ripe. With only fair hardiness, Titan is for moderate climates. It is resistant to the raspberry aphid vector of mosaic virus complex.

Late Season

Encore (Cornell University-NYSAES, Plant patent # 11,746) is one of the latest summer fruiting raspberries available. It produces large, firm, slightly conical berries with very good, sweet flavor. The fruit quality is considered very good. It is moderately susceptible to Phytophthora root rot and has good cold hardiness.

K81-6 (Nova Scotia) produces canes that are medium tall with spines only at the base. The fruit is very large with good flavor that ripens very late summer with average firmness. It is resistant to late yellow rust but is susceptible to leaf curl virus and raspberry fire blight. Hardiness is judged adequate for most areas.

Fall Bearing

Anne (University of Maryland, Plant patent # 10,411) produces large, conic, pale yellow fruit with very good flavor and texture in mid to late season. It produces tall upright canes but does not sucker adequately for good stands. It is resistant to Phytophthora root rot.

Autumn Bliss (Great Britain, Plant Patent #6597) is an early ripening raspberry with large, highly flavored fruit. It ripens 10 to 14 days before Heritage. Much of the crop is produced within the first two weeks of harvest, which is an advantage in northern climates. It produces short canes with few spines. The fruit is somewhat dark fruit. It is susceptible to raspberry bushy dwarf virus.

Autumn Britten (Great Britain, Patent Pending) is early ripening with large, firm, good flavored fruit. It is taller than Autumn Bliss with better fruit quality but slightly lower yields. It is a day or two later than Autumn Bliss.

Caroline (University of Maryland, Plant patent # 10,412) is a large, good flavored, conical fruit. It produces tall upright canes. The short fruiting laterals can be challenging to pick, but yields are very good for the fall. It has moderate to good resistance to Phytophthora root rot.

Kiwigold (New Zealand, Plant patent # 11,313) is an amber sport of Heritage, similar in all characteristics except fruit color. Fruit blushes pink when fully ripe.

Heritage (Cornell University-NYSAES) is considered the standard for fall bearing cultivars. These tall, rugged canes have prominent thorns and are very high yielding. The primocane crop ripens relatively late. Fruit is medium-sized and has good color and flavor, firmness, and good freezing quality. It is resistant to most diseases. Due to its late ripening, this cultivar is not recommended for regions with cool summers or a short growing season with frost before September 30.

Jaclyn (University of Maryland, Plant Patent #15647) is an early season variety with large firm berries ripening 2 weeks before Heritage. Plants are vigorous and erect but susceptible to yellow leaf rust. Fruit is dark red and adheres tightly until fully ripe.

Polana (Poland, Patent Pending) is a very early season cultivar that ripens 2 weeks before Heritage. It produces short productive canes with multiple laterals per node. The fruit is medium sized fruit with good flavor. Susceptible to Verticillium wilt and Phytophthora root rot. It needs extra nitrogen to perform well.

Ruby (Cornell University-NYSAES, Plant patent # 7067) is moderately vigorous with good productivity. The primocane crop ripens slightly ahead of Heritage. The fruit is large with a mild flavor. Ruby is susceptible to Phytophthora root rot. The cultivar is suggested for fresh market or shipping in areas with longer growing seasons. It is susceptible to mosaic virus complex and resistant to late yellow rust and powdery mildew.

Greenhouse Production

Tulameen (British Columbia) has been shown to be superior for greenhouse production. It produces very large fruit, and high yields. The fruit is glossy and firm. It is resistant to aphid vector of mosaic virus complex. Plants are not adequately hardy for field production in the Northeast.

On The Horizon

There are many new named varieties that are being tested but are not yet available yet from most commercial nurseries. Summer varieties include 'Emily', 'Esta' and 'Claudia' from Maryland and 'Moutere' from New Zealand. Fall bearers include 'Josephine' and Alice (yellow) from Maryland, the early season 'Polka' from Poland, and 'Himbo Top' from Switzerland. Many varieties are available from the west coast programs but have not been tested widely in the east. Most of these have insufficient cold hardiness for much of the northeast but may work in certain situations. As always, experiment with new varieties on a small scale first to judge suitability in individual situations.

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MANAGING RASPBERRY CANE DISEASES

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As most growers could tell you, the stock-in-trade solution for controlling cane diseases of brambles has always been a "delayed dormant" application of lime sulfur or copper based products. While this practice is an important part of your early season arsenal for cane disease management, it is by no means a sinecure (there is more work to be done!). An integrated approach to disease management is usually the most successful and begins at planting, with cultural practices and production methods which minimize disease introduction and development. After plantings are established, frequent scouting, and continued used of cultural and chemical methods come into play to keep cane disease development in plantings to a minimum.

A Review of Cane Diseases

Anthracnose (*Elsinoe veneta*) This disease is much more severe on black and purple raspberries than on red raspberries. Severe losses may occur from defoliation, wilting of lateral shoots, death of fruiting canes, and fruit infections.

Symptoms appear in spring as small, purple spots scattered over young canes. These spots enlarge to about 1/8 inch in diameter, become sunken in the center, and turn gray with a purple border. Many spots can run together to form large sunken diseased areas on the cane.

Infected drupelets remain small, are pitted, and slow to ripen. Leaves may also be infected and develop a "shot hole" appearance.

Early spring wetting periods favor development of this disease.

Spur Blight (*Didymella applanata)* Spur blight is more of a problem on red raspberries than on black raspberries. Yield losses occur most frequently in overgrown, excessively vigorous plantings- avoid excessive nitrogen.

In mid to late summer, chocolate brown to purple blotches appear centered around individual buds on canes. Buds within the discolored areas either fail to grow or produce weak shoots the following year.

Wet conditions during early spring (April-May) favor disease development. It is important to note with this disease that infections occur in early spring but do not become visible until mid to late summer.

Cane Blight (*Leptosphaeria coniothyrium)* It is interesting to note this disease first described at Geneva Experiment Station in Geneva, New York in 1902 by F.C. Stewart, whole later went on to become a very famous plant pathologist...All species of Rubus are susceptible to cane blight. It is most common in black and purple raspberries due to tipping practices. Red raspberries appear equally susceptible. Damage caused by this disease may include bud failure, lateral shoot wilt, and cane death.

Dark brown to purple cankers appear on main canes or branches below wilted foliage, and may extend several inches along the cane. Cane blight is more likely to involve whole stems than spur blight as it is not as confined to areas surrounding buds. Infection sites are often associated with pruning wounds or injuries, which may not be obvious.

Cane blight infections most often occur from late April to early May.

(Cane blight photos courtesy of Wayne Wilcox, NYSAES Cornell University)

Cultural control - Exclude, Inhibit or Limit, and Eradicate! Starting with disease free plants is an important part of your disease management plan. If you are propagating your own materials, be sure to select only disease free stock plants!

Always check to see if disease resistant cultivars are available and use them if feasible. That said, unfortunately resistant cultivars have not yet been identified for any of the 3 cane diseases. Cultivars less susceptible to spur blight include 'Brandywine', 'Killarney', 'Latham', and 'Newburgh'. Particularly susceptible cultivars are 'Royalty', 'Titan', 'Canby', "Skeena', 'Willamette', 'Reveille', and 'Sentry'.

Select sites, soils and planting designs carefully to maximize air and water drainage. Promote good air circulation by keeping fruiting rows narrow, spacing canes adequately, and controlling weeds. Maintain plant health by properly managing soil nutrition and irrigation, and minimizing plant wounding. In terms of cane blight management, time pruning and tipping operations to allow 4 or 5 days of healing before a rain. A fungicide application is advised after pruning in heavily infected plantings. Avoiding or minimizing the use of overhead irrigation will help limit cane disease development and spread, especially anthracnose.

Managing cane diseases in your planting continues after establishment by reducing/limiting any overwintering inoculum. This means pruning out old diseased canes before new canes emerge in the spring. Remove and destroy debris from pruning operations immediately.

Chemical control - A dormant application of lime sulfur or copper is critical where cane diseases are problematic. Liquid lime sulfur (Miller's Lime Sulfur Solution or Sulforix) 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 essential for control so be sure this application is done on a calm day in a sufficient amount of water to soak the canes completely. A note of caution- this spray may be phytotoxic if applied after ½ inch green, particularly on a warm day. Alternatively, several copper products are also labeled for use as a delayed dormant spray for raspberry cane diseases. These include various formulations of both copper sulfate and copper hydroxide. Consult labels for application rates and timings for specific products. Note that this delayed dormant spray is not necessary on fall bearing red raspberries if the previous year's canes are mowed and removed from the planting or thoroughly shredded.

A captan/fenhexamid mixture (Captevate 68WDG) is also labeled for control of anthracnose and spur blight on raspberries, starting at 8-10" shoot growth. Only 2 sequential applications of this product may be used before switching to a different group of fungicide chemistry.

Another group of fungicides labeled for control of cane diseases in NY state are the strobilurins, which include azoxystrobin (Abound), pyraclostrobin (Cabrio EG and a pyraclostrobin/boscalid mixture (Pristine WG). These products should be used at disease onset. Check product labels for specific information on rates and timings of applications. Pay

careful attention to label restrictions for these products. Like Captevate, no more than 2 sequential applications of these products may be made before switching to an alternate chemistry.

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

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

NEW DEVELOPMENTS IN EFFICIENT PESTICIDE APPLICATIONS IN BERRY CROPS

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Introduction

Control of pests depends on 1) correct identification of the pest, 2) selection of an appropriate means of control, 3) selection of the proper chemical(s) if chemical control is to be used, 4) application of the correct amount of chemical per unit of area or unit of volume, 5) sufficient coverage to completely and uniformly control the pest and 6) prevention of drift that may cause damage outside the target area.

Pest control is often difficult to achieve under optimum conditions. A very important factor in obtaining optimum control is application of the correct quantity of active ingredient (A.I.) per unit of area. Excessive rates may cause damage to present or succeeding crops, harm animals, or result in environmental concerns. Applications rates less than those recommended may likely result in inadequate pest control, leading to decreased crop yields. Excessive or inadequate application rates increase the cost of production because expensive chemicals are wasted.

Although good pest control depends on applying the correct amount of active ingredient per acre (A.I.A.), adequate and uniform coverage is also necessary. That is, the chemical must be properly mixed with water (in the case of sprays) and enough gallons per acre (GPA) of the mixture applied to obtain control. Thus, the right quantity of chemical and the recommended number of gallons per acre must be uniformly applied. The correct amount of material may be applied on each acre but the material may be so unevenly distributed that pest control is not obtained. In addition, some pesticides can cause damage if they drift outside the target area.

The amount of chemical applied, the adequacy of coverage and the prevention of drift depend on proper selection and use of equipment. In berry crops, and especially in strawberry cultivation, it is difficult to obtain a good coverage of spray solution, particularly when spraying against grey mould (Botrytis cinerea).

Alternatives

The traditional boom sprayer either with hollow cone or flat fan nozzles is the most widely use piece of equipment for pesticide applications to strawberries. Research conducted using this equipment (Nordmark, 1994) shows that the energy of droplets from this sprayer is too small to penetrate into the inner parts of the canopy, obtaining 16 times more spray solution on the upper leaves than on the lower leaves. In comparison, air assisted sprayers offer the best results in terms of deposition and uniformity.

According to Bjustad and Sonsteby (2004), the use of air injection (AI) nozzles and drift guard (DG) nozzles do not guarantee better applications. They found the best results using conventional flat fan nozzles when applications were made using a band sprayer covering the whole width of the vegetation. But there is still much to be done on the use and positioning of these nozzles in relationship to crop target (Landers, 2004).

Because the plant canopy increases considerably during the growing season, Bjustad and Sonsteby concluded it is necessary to adapt the volume rate according to this change in mass. But is there any quantitative method to determine the optimal volume rate to be applied? In 2001, Ruebb and Back began a research project with the aim of adapt to Crop Adapted Spraying (CAS) system to strawberries, when of fungicides and insecticides were applied in Switzerland.

The concept of CAS is established in 2 components: 1) adaptation of the dose of pesticides to the planting density and leaf area of the growing crop based on measurements of the leaf area of the crop at consecutive growth stages and 2) application of the appropriate dose of the product with a properly calibrated machine adjusted to the strawberry crop. CAS was tested on farms with different types of sprayers (knapsack sprayers, air-assisted sprayers, and boom sprayers). IN all cases, CAS as compared to conventional spraying gave equally good pest and disease control with a savings of 25 to 50% on the total cost of pesticides and residues lower than those obtained with conventional spraying. The CAS technique used in determining optimal volume rate for bush berries also seems well adapted.

The use of air-assistance can increase both penetration and coverage, especially in later crop stages. In early season spraying a bad adjustment (high speed) can increase the risk of drift.

In general, we conclude a good combination of number and type of nozzles (including the use of newly developed AI or DG nozzles), correct orientation to the top and side parts of the plants, adequate air flow according to crop stage, and a more defined volume to apply provide tools for a more effective and efficient pesticide application in berry crops.

References:

Bjustad, N. and Sonsteby, A. 2004. Improved spraying equipment for strawberries. International Advances in Pesticide Application. In: Aspects of Applied Biology 71:335-342.

Landers, A. (2004) Spraying Strawberries. New York Berry News 4(1):5-6.

Nordmark, L. (1994) Spray technology for improving the deposition in field vegetables and strawberries. In: Engineering for reduced pesticide consumption and operator hazards. Acta Horticulturae 372: 103-110.

Ruegg, J. and Back, H. 2001 Towards Crop Adjusted Spraying (CAS) in Berry Crops. Pesticide Outlook June 2001. http://www.researchinformation.co.uk/pest/2001/B104686C.PDF

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Check out the NYSAES Tree Fruit and Berry Pathology web site at:
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