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What's Inside

Happy Friday the 13th! Hope your luck held out and the late spring frost last night wasn't a problem for your small fruit operation. Be sure to check for frost damage, especially with any crops that may have been at or approaching bloom.

Need more information? Check out the following article on frost protection in strawberries from Vol. 2 of NYBN.

We are gearing up for the season and this month's issue is brimming with information to help you get off to a good start. It starts off with a May checklist for small fruit growers, followed by an in-depth article by Greg English-Loeb on spring arthropod management (bugs, y'all). Other features include: an article by Andrew Landers on spraying strawberries; use of buckwheat cover crops for weed control in strawberries, by Thomas Bjorkman; a heads-up from Annemiek Schilder on cane anthracnose which was recently reported in Michigan; how to optimize pollination of fruit crops with bees by Rufus Issacs, Zachary Huang and Amy Iezzoni; strawberry disease fast facts by yours truly, and weather reports.

UPCOMING MEETINGS

June 13-14, 2005. *International Berry Health Benefits Symposium*, in Corvallis, Oregon. **For more information,** call Cat McKenzie, 541-456-2264, e-mail: cat@oregon-berries.com or go to: http://www.oregonstate.edu/dept/foodsci/berryhealth.htm

August 11-14, 2005. *Northeast Organic Farming Association 31st Annual Summer Conference.* Hampshire College, Amherst, Mass. (978) 355-2853, nofa@nofamass.org, www.nofamass.org..

August 17-19, 2005. *NASGA's 8th Annual Summer Tour, "Farming on the Urban Fringe"* in Fishkill, New York. See article below for more details.

October 14-15, 2005. *Passive Solar Greenhouse Workshop*. 1522 Lefever Lane, Spring Grove, Pennsylvania. **Contact:** Steve and Carol Moore (717) 225-2489.

October 14-15, 2005. *Highbush Blueberry Council (USHBC) Fall Meeting*, Amway Grand Plaza Hotel, 187 Monroe NW, Grand Rapids, Michigan. . **Contact**: 616-885-2000

December 6-8, 2005. *Great Lakes Fruit, Vegetable, and Farm Market EXPO*. DeVos Place Convention Center, Grand Rapids, Mich. www.glexpo.com.

December 1-7, 2005. *International Society for Horticultural Science 9th International Rubus and Ribes Symposium*, Pulcon, Chile. **For more information contact**: Pilar Banados, Facultad de Agronomia Ingenieria Forestal, Universidad Catolica de Chile, Casilla 306-22, Santiago, CHILE; fax: 56-2-55334130, E-mail: pbanados@puc.cl or online: http://www.faif.puc.cl/rubus-ribeschile.html

BERRY IMPORTANT DATES!

Cathy Heidenreich, Department of Plant Pathology, Cornell University, NYSAES

Here is a checklist to help remind you of seasonal things that may need doing this month. (No pun intended). For a full description of early to mid-season small fruit insect pests and their control, see the article that follows by Greg English-Loeb. For more information on the other small fruit production topics on this month's checklist, see the 2005 Pest Management Guidelines for Small Fruit and past issues of the NYBN.

Strawberries:

Frost protection
Weed management
Disease management
- Leaf spot, Scorch, Blight
- Gray Mold
- Anthracnose

Insect management
- Bud Weevil (Clipper)
- Tarnished Plant Bug
- Two-spotted Spider Mites
- Cyclamen Mites
- Spittlebug
- Sap Beetle

Brambles: Summer-bearing

Weed management
Fertilizer
- Full application
  or
- Split application #1

Disease management
- Anthracnose/Cane blight
- Orange Rust
- Raspberry Leaf Spot
- Powdery Mildew
- Gray Mold

Insect management
- Raspberry Fruitworm
- Raspberry Sawfly
- Tarnished Plant Bug
- Raspberry Cane Borer
- Raspberry Crown Borer
- Raspberry Aphids- large and small
- Two-spotted Spider Mites
- Japanese Beetle

Brambles: Fall-bearing

Weed management
Fertilizer
- Split application #1

Disease management
- Anthracnose/Cane blight
- Orange Rust
- Raspberry Leaf Spot
- Powdery Mildew

Insect management
- Japanese Beetle

Blueberries

Frost protection
Weed management
Fertilizer
- Split application #1

Disease management
- Mummyberry
- Phomopsis
- Botrytis Blossom/Twig Blight
- Anthracnose

Insect management
- Fruitworms-Cranberry and Cherry
- Leaf Rollers
- Plum Curculio
- Blueberry Tip Borer

Currants and gooseberries

Weed management
Fertilizer
- Application #1

Disease management
- White Pine Blister Rust
- Leaf spot/Anthracnose

Insect management
- Currant Aphid
- Imported Currant Worm
- Currant Borer
- Currant Stem-girdler
- Gooseberry Fruitworm

SPRING ROUND UP OF SMALL FRUIT ATHROPOD PESTS

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

Management of arthropod pests begins in earnest as the temperatures increase and the growing season gets under way. Before reviewing the list of **potential** arthropod pests for each of the major berry crops, I want to summarize some changes in chemical control options included in the 2005 version of the Pest Management Guidelines for Berry Crops. Over the next few years, use of Azinphos-methyl (Guthion 50WP) will be restricted or lost. New labels have been developed to reflect these changes and product with the old labels could only be sold up until November 2003. Growers can continue to use older labeled product if registered in New York State until its used up, but be aware that only five Azinphos-methyl labels are currently registered. Check the following web site:

http://pmep.cce.cornell.edu/pims/current/. Azinphos-methyl products currently registered in NY include: Guthion Solupak 50WSB (EPA# 3125-301, discontinued and expires 9/30/06), Guthion Solupak 50WSB (EPA# 264-733), Azinphos-M 50 WSB (10163-78, discontinued and expires 9/30/05) and Azinphosmethyl 50W (51036-164). Strawberries are no longer labeled. Caneberries will probably only be supported through 2005 and only for one pest (raspberry crown borer). Guthion can still be used on blueberries (for maggot, fruitworms, plum curculio, lecanium scale) through the 2005 field season at least, but EPA is reviewing use on blueberries and it is possible there will be an extension. U-pick operations should be aware that the general public is not allowed to enter a Guthion-treated blueberry field within 30 days of application. Thanks to Dan Gilrein, CEE from Suffolk County for updated information on aziphos-methyl as well as other pesticide related news.

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

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

Blueberries

A number of species of **scale insects** feed on the twigs of blueberry and can greatly reduce plant vigor. Look for the hard-covered female scale on small branches early in the spring. A dormant oil spray (2-2.5%) applied at bud swell, but before the first leaf stands out, can be effective in reducing scale populations. **Cranberry Fruitworm** and **Cherry Fruitworm** are the main blueberry arthropod pests in the spring and early summer. These moths overwinter as fully-grown larvae. They pupate in the spring and begin flying in late May and early June (around the time of flowering). Egg laying begins at around petal fall with eggs being placed at the base of newly set fruit. A sex pheromone is available to monitor the flight activity of adult **cranberry fruitworm** (Great Lakes IPM, www.greatlakesipm.com, 989-268-5693). Two applications of an insecticide such as Confirm or Guthion, starting at petal fall and 10 days later, are required for sites with heavy pressure. Research in New Jersey indicates that in areas of moderate pressure, one application 5 to 7 days after petal fall provides as good control as two applications. Other pests to keep an eye out for are **plum curculio** (notice crescent-shaped scar created from egg-laying on young fruit), **leafrollers** (larvae make shelters by silking together terminal leaves), and **blueberry tip borer** (larvae bore into stem causing shoot tips to die back). Of course, later in the summer you need to be alert for **blueberry maggot flies**, **blueberry stem borer**, and **Japanese beetle** (more on these in next newsletter).

Raspberries

There are a number of potential pests of raspberries to be concerned with early prebloom to postbloom. Be on the alert for feeding damage from the adult **raspberry fruitworm** (a beetle, light brown in color) on foliage and fruit buds. The larvae of this beetle pest feed inside flower buds and young fruit. Adult feeding damage on foliage creates a skeletonized appearance somewhat similar to the feeding damage caused by larvae of **raspberry sawfly** (pale green caterpillar-like body with many long hairs). Both the fruitworm and the sawfly appear during the prebloom period. Carbaryl [Sevin] is labeled for both of these pests and the timing is similar as is Spintor [spinosad]. **Tarnished plant bug (TPB)** is another potential problem for raspberry growers during the period from bloom to harvest. Both the adults and their nymphs can cause deformed fruit, although the deformities are not as obvious in raspberries as in strawberries where TPB is also an important pest (see below). We do not have a good estimate of the economic threshold for TPB in raspberries but a rough guide would be 10 to 20% of canes infested with adults or nymphs. Carbaryl is labeled for control of TPB on raspberry. Its

not the most effective material on plant bugs but pretty much all we have with plant bugs specifically on the label. Malathion can be effective against TPB, but I have yet to find a product registered in NY with plant bug on the label for caneberries. Note that weedy fields aggravate TPB problems. **Raspberry cane borer** and related beetle species make their appearance during this period. The adults emerge in the spring, mate and start laying eggs. Larvae bore into canes during the season and for some species, the next season. They cause injury and death to canes and potentially entire crowns. The best time to kill adults is during the late prebloom period (for summer-bearing raspberries), although note that there is nothing specifically labeled for it now that methoxychlor [Marlate] is no longer available. As an alternative to insecticides, during the season remove wilted shoot tips below the girdled stem (two rows of punctures around an inch apart) where the egg of the raspberry cane borer has been placed. Also, during the dormant season remove and destroy canes with swellings. Another pest that can cause serious injury to canes and the crown is the **Raspberry crown borer**. The larvae of this moth feed at the base of the cane and into the crown over a two-year period. The first signs of a problem often appear during fruit maturation. The withering of and dying of canes, often with half matured fruit, can be a symptom of feeding damage at the base. Canes with these symptoms, and the associated crowns, should be removed during the growing season and destroyed. The adult moth actually does not appear until later in the summer (early August). It is a very attractive moth, which superficially resembles a yellow jacket. Guthion is labeled for use against raspberry crown borer larvae through the 2005 season. Apply to lower parts of canes and soil only in spring to summer (you are only allowed 2 applications per season, at least 10 days apart). As noted above, the general public is not allowed into the planting within 30 days of application. During the spring and into the summer you may find two species of aphids that attack raspberries, **large raspberry aphid** and **small raspberry aphid**. Feeding damage by aphids causes leaf curling and reduced growth of shoots. The more important injury comes from viruses transmitted by the aphids (raspberry mosaic virus by the big aphid and raspberry leaf curl virus by the small aphid). This can be a particular problem for nursery plants. Both Malathion 57 EC and Di-Syston (disulfoton) are labeled for aphids, but Di-Syston is restricted for use for nursery stock. Finally, I should mention **two-spotted spider mite (TSSM)** as a potential pest. These tiny spider-like arthropods can become very numerous on foliage, causing white stippling on leaves. They seem to be most problematic in dry sites and/or in mild growing areas such as the Hudson Valley and Long Island. As of a couple of years ago there is a miticide registered in New York for control of TSSM (Savey DF). Predatory mites can also provide control of TSSM. These beneficial mites are frequently naturally present in raspberry fields, especially where few broad-spectrum insecticides are used, but can also be purchased from a supply house. For both Savey and predatory mites, it's important to start control actions early before you see lots of severe injury to foliage (bronzing). Additional arthropod pests that might show up later in the season (bloom to harvest) include **Root weevil, Japanese beetle**, **picnic beetle**, and **potato leafhopper**.

Strawberries

During the prebloom period the **strawberry bud weevil (clipper)** is the main arthropod pest to watch out for. In recent years, we have learned that many strawberry cultivars, such as Jewel and Seneca, can tolerate a fair amount of bud loss from this pest, although at sufficient densities, it can still be a problem. As a rough rule of thumb, treat for clipper when you observe more than one clipped primary or secondary flower bud or more than 2 tertiary buds per truss, on more than one truss per foot of row. Note that once flowers are open they are no longer at risk from clipper. Clipper often is a more severe problem along borders of plantings, near woods. Lorsban [chlorpyrifos] and Brigade [bifenthrin] are labeled for clipper in New York. Also during the prebloom period, and extending through harvest, and sometimes after renovation, the **two-spotted spider mite** can be a problem in some plantings. Look for whitish or yellowish stippling on leaves. Current threshold is 5 mites per leaf or about 25% of leaflets have at least 1 mite. This is likely a conservative threshold for a healthy planting. There are several compounds labeled for mites on strawberries in New York: Kelthane [dicofol], Vendex [hexakis], Agri-mek [abamectin], Savey [hexthiazox], Zeal (etoxazole). Acramite (non bearing crops), Danitol [fenpropathrin] and Brigade. Kelthane, Danitol, and Brigade are hard on predatory mites. Agri-mek label calls for 2 applications, 2 weeks apart. For all these materials, coverage is very important, especially on the underside of leaves. **Tarnished plant bug (TPB)** is the key insect pest of strawberries during bloom to near harvest. Both adult bugs and the nymphs cause injury (deformed fruit) but nymphs are probably of the greatest concern for June-bearing cultivars. The economic threshold is half a nymph per flower cluster (you sample by tapping cluster over a white plate and counting nymphs that fall off). It is worth sampling for this pest on a regular basis since it varies in population size from place to place and from one year to the next. *Spraying a pesticide when nymph counts are below threshold costs you money and may kill beneficial arthropods unnecessarily*. Good weed management can help reduce problems with TPB. **Cyclamen mite** is a potentially serious pest that seemed to show up in more fields than usual three years ago but was not very prevalent recently. The mites get active in the spring with populations peaking after bloom. The mites like to feed on young leaf tissue (just as the leaves are unfolding). The mites themselves are difficult to see without a good hand lens. Cyclamen-damaged leaves tend to be stunted and crinkled. Prior to bloom or after renovation are good times to treat for this pest. Kelthane and Thiodan [endosulfan] are labeled for use against cyclamen mites. Use lots of water for thorough coverage. Two more insect pests deserve mention at this time. The first is **Strawberry sap beetle (SSB)**. This small, brownish beetle seems to be increasing as a pest in New York strawberries. Both the adult beetles and the larvae feed on ripe and overripe fruit. We still are exploring the best ways to control SSB. Two pyrethroids are labeled in New York for its control: Danitol and Brigade. Note that Brigade does not have a preharvest interval while for Danitol it is 2 days. However,

Brigade is more expensive. For both materials, good coverage is likely to be important for its control. Note that SSB probably does not move into strawberry fields in significant numbers until fruit begins to ripen. **Spittlebug** starts appearing on leaves, stems, and flowering racemes about this time (bloom) and extending into harvest. They overwinter as eggs in the soil and hatch out as temperatures rise in the spring. The nymphs crawl up the plant and begin feeding on the xylem tissue (the water conducting vessels of the plant). There are not a lot of nutrients in xylem and therefore nymphs need to process a lot of sap, extracting the few nutrients out for their use and excreting the remaining water. This water is frothed into white spittle, which helps protect the nymphs from desiccation and natural enemies. You can often find several nymphs within a spittle mass. Feeding by spittlebugs, if extensive, can stunt plants and reduce berry size. Perhaps more importantly, the spittle masses are a nuisance to pickers. Threshold for spittlebug masses is 1 mass per foot row. Thiodan, Brigade, Danitol, and Provado are labeled for use against spittlebugs. Weedy fields tend to have more problems with spittlebugs. **Root weevil** (there are several species) is the last strawberry pest I want to discuss in this issue. The larvae feed on roots and crowns and when abundant can cause serious damage to plantings. Beds with heavy infestations show distinct patches or spots that appear stunted and have reduced yields. Drought stress aggravates the injury from larval feeding. Chemical control (Brigade) is targeted at the adults that emerge in mid to late June. Look for characteristic adult feeding damage on leaves (notching from the edge) to help determine timing. The adults feed for a few days before starting to lay eggs. Some growers have also had success controlling root weevil larvae using parasitic nematodes. These can be applied either in the spring (late April and early May) and/or in the fall. Use sufficient water to get good penetration. Rotation out of strawberries is the best remedy for root weevils. They are wingless and do not move a great distance. However, new plantings should be placed 50 meters or more from an infested planting.

Currants and Gooseberries

Over the past few years we have been seeing a fair amount of leaf cupping caused by the **Currant Aphid**, especially on red currant plants. In addition to leaf cupping, rounded galls form on the topside of the leaves in response to the presence of aphids in pockets on the underside. An economic threshold for currant aphid has not been worked out. Malathion is labeled for currant aphid on currants, applied as leaf buds are opening. Recently Provado has been labeled for currants and should be quite effective against aphids. **Imported Currant Worm** (ICW), when present, can cause considerable injury to foliage. The adult, which becomes active in the spring, is wasp-like in appearance (indeed its in the wasp group, but part of a primitive line called sawflies that are herbivorous as larvae). Eggs are laid along the midrib or on the undersides of the leaves. Larvae of the first brood appear in spring, shortly after leaves are out. They initially feed in colonies but as they become larger, feed singly. A second brood of larvae is produced in early summer and in some years a partial third brood is produced later in the summer. Malathion is labeled for use against ICW. Another currant and gooseberry pest to be on the look out for in the spring is the **currant borer**. A relative of the raspberry crown borer, the adult moth has clear wings, blue-black body with yellow markings resembling a wasp. The adult emerges in the spring, mates and begins laying brownish eggs on the bark of canes. After hatching, larvae burrow into canes and begin feeding within the pith. No insecticides are labeled for currant borer although removal of weak canes in the spring and fall will help keep populations down. Other pests that might be observed attacking currants and gooseberries in the spring to early summer include the **currant stem girdler** (lays an egg in shoot tips and then girdles stem below) and **gooseberry fruitworm** (larvae feed inside young fruit, sometimes weaving portions of stems together with silk).

(Editor's note: See NYBN Vol. 3 No. 4 for pictures of the pests described above)

SPRAYING STRAWBERRIES

Dr Andrew Landers, *Cornell University, NYSAES, Barton Lab., Geneva, NY 14456*
(http://www.nysaes.cornell.edu/ent/faculty/landers/pestapp)

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

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

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

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

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

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

Fine classification for contact fungicides and insecticides

Medium classification for herbicides

Coarse classification for pre-emergent sprays

Growers may find these spray classifications in the latest nozzle catalogues and should cross-reference the selected nozzle type, based upon flow rate, with the spray classification. Growers have to consider good coverage and penetration into the canopy, so traditional fine sprays may not penetrate, so the traditional compromise takes place, a medium spray quality should be chosen. On no account should large droplets or coarse spray quality be used, as the droplets run-off the target. Large droplets can also be created from worn or damaged nozzles, remember to change nozzle tips when their output is greater than 10% of the manufacturers recommended flow rate.

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

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

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

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

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

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

015 nozzles seem to be too small and increase the risk of drift (drift will be measured next year) and lower the capacity (rows per hour). 02 and 03 nozzles seemed therefore to be more suited. They did not use cone nozzles in this study, only

flat fan nozzles. Top angle 65 and 80 degrees should be used to maintain good penetration into the plant (but a good overlap has to be ensured). Best results were at 75 psi with the nozzles 4-8inches above the target.

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

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

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

References:

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

BUCKWHEAT FOR STRAWBERRY WEED CONTROL

Thomas Björkman, Associate Professor, Department of Horticultural Sciences, NYSAES Cornell University

Buckwheat a traditional tool for weed control, but knowledge of how to use it effectively is being lost as the practitioners leave farming. Current published guidance is overly general, missing important details needed to incorporate it effectively into farming systems. This project will allow more farmers to use buckwheat effectively by identifying the situations where is works best and providing specific information on the exact procedures for success.

One of the promising situations for use of buckwheat cover cropping is as a pre-plant weed control strategy for strawberries. Weed control remains a major issue for strawberry growers, so there is a significant need for more tools. Furthermore, pre-plant practices are already recognized by strawberry growers as critical to a successful weed management program after plant establishment. Thus, strawberry growers already have the foresight needed to use buckwheat cover crops well.

The SARE Buckwheat cover crop project combines expertise in production and physiology of buckwheat (Thomas Björkman) with expertise in weed sciences (Robin Bellinder). We have had input from farmers who have used buckwheat successfully in their strawberry operations. Foremost among these is project participant Cliff Hatch, of Gill, MA. He has a particularly intense program of sowing buckwheat immediately after tilling in berries after the last year's harvest, then raising two successive buckwheat crops the following year.

To make sure that the project truly answers strawberry growers' important questions, we are currently calling strawberry growers to determine what those questions are. We don't have answers yet, we just need to know we get the right ones.

There are bound to be many strawberry growers who have learned to use buckwheat. We are hoping to find them, and to learn the art. Their techniques can be recorded, and made a lasting legacy that will be of value to strawberry growers for years to come.

If you are using buckwheat in your strawberry weed control program, your knowledge and expertise is important to us. Please let us learn from you by contacting Dr. Thomas Björkman by telephone (315-787-2218) or email (tnb1@cornell.edu)

We will do research trials as necessary to get answers that are not already known by someone in the Northeast. The results from these trials should be available in about two years.

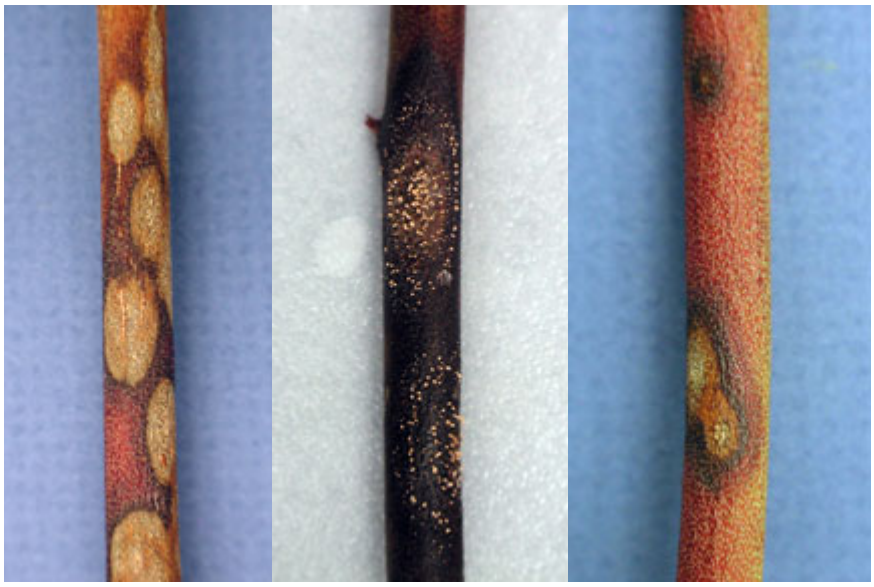
Next year, we hope to have gathered much of the wisdom that is available from the grower. At that time, growers with an interest can obtain buckwheat seed and the provisional answers to their questions.

If you are new to buckwheat cover cropping, and would consider trying it in 2006, before 2007 strawberry plantings, please get in touch.

CANE ANTHRACNOSE FOUND IN SOME BLUEBERRY FIELDS

Annemiek Schilder, Assistant Professor, Department of Botany and Plant Pathology, Michigan State University

This spring, it is not just Phomopsis that is infecting blueberries. One might also see unusual lesions on green blueberry canes that are dark brown to black with lighter brown centers, circular or oval and fairly sharply delineated. Lesions vary in size, from the several millimeters to 3 cm in length. In contrast, Phomopsis lesions tend to be more elongated, often girdle the entire stem and are flattened with more diffuse margins. The lesions may also be mistaken for Fusicoccum canker, but they can occur on any area of the cane and are not necessarily centered on a leaf scar. So far, the lesions have only been observed in a few Jersey fields, but may be present in other varieties as well. What is most striking are the pinkish masses of Colletotrichum spores occurring in concentric circles on the surface of these lesions. Spore masses can be seen on canes in the field now, but if you are not sure, keep the pieces on a moist paper towel in plastic container for a day or two. Anthracnose lesions will produce pink spore masses, whereas Phomopsis will produce creamy white spore blobs in a random pattern. Both can start to look like curly strings if the humidity is just right, but Phomopsis spores have more of a tendency to do so. Anthracnose lesions are initially superficial, only killing the bark, but are assumed to develop further to girdle and kill larger portions of canes.



Anthracnose lesions on BB cane | **Collectotrichum sporulating on BB cane** | **Young anthracnose lesions on BB cane**

The occurrence of anthracnose cane lesions is rare, though it has been reported before by researchers in Japan and was observed in Ontario last year. It may be related to the unusually rainy weather that we had during the 2004 season, which may have provided sufficient wetness to allow infection of young green canes at a time that spores were abundant, e.g. during fruit ripening and harvest season. It is not clear when the infections actually took place. While studies have not been done specifically to determine the best methods to control cane anthracnose, they are likely to be similar to those that would be employed for Phomopsis: pruning out diseased and dead canes, applying lime sulfur as a delayed dormant spray, and fungicides on a regular basis through the season. Since the fungus is sporulating already, it would be prudent to apply protectants, such as Bravo, Captan, or Ziram at this time. Make sure to focus sprays at the base of the bush and provide good coverage. The goal is to protect young and emerging green canes from infection. During and after bloom, strobilurins are should be effective as well.

Editor's Note: For NY fungicide options to control anthracnose check the 2005 Pest Management Guidelines for Small Fruit. So far, there have been no reports of anthracnose cane lesions in NY. If you find lesions like these in your blueberry planting- please let us know!)

(Reprinted from: Michigan State University, Fruit Crop Advisory Team Alert, Vol 20 No 3, April 26, 2005.

OPTIMIZING POLLINATION OF FRUIT CROPS WITH BEES

Rufus Isaacs and Zachary Huang, Department of Entomology, and Amy Iezzoni, Department of Horticulture, Michigan State University

Pollination is a critical phase of the production cycle for most specialty crops, and in Michigan alone the total annual value of fruit and vegetable crops dependent on bee pollination is about $300 million. Bees are the most important delivery vehicle for pollen, and their activity ensures that the flower stigma receives sufficient pollen for fertilization to occur. Well-pollinated crops ripen earlier, produce larger and more even fruit, and improve grower profit. Investment in pollinators is essential for reaching the potential of many fruit crops. To reach this potential, growers need to know how to optimize pollination of their particular crop(s) and varieties being grown.

Table 1 provides the recommended densities of honeybee hives for optimal yields in some common Michigan fruit crops. These numbers come from a series of studies over the years and are averages. Growers using densities lower than these numbers risk their yields and quality, unless the native pollinator community is abundant and healthy.

Use the "early" strategy for tree fruit crops

For tree fruit crops, it is advantageous to have bees working the flowers as soon as they open. This provides multiple benefits. It improves the odds that fertilization will occur before the ovules start to lose vigor (this can happen in only three days on some crops), flowers are more likely to receive the multiple visits needed to deposit enough pollen, and in many crops the first flowers that open set the best fruit. An additional benefit is that having bees in place in orchards at the time of first bloom makes it most likely that all the 'king bloom" flowers that produce the best fruit will be pollinated. Also, if the weather turns bad, some fruit will be produced.

Use the "late" strategy for small fruit crops

Generally, flowers of small fruit crops are less attractive to honeybees than some other flowers due to the shape and the relatively low "reward" from the flowers, so a different strategy is required than you might use for apples that need bees early. The crop should be starting to bloom before bringing bees in, so that bees stay on the crop to forage, and don't move elsewhere. If brought in too early, bees will learn to forage on other patches of flowering plants and when the crop blooms, they may not be attracted back to the crop. So, moving bees into fields after 5 percent bloom but before 25 percent of full bloom is recommended. For blueberries, having 4 to 8 honeybees per blueberry plant in the warmest part of the day during bloom is sufficient to achieve good pollination. The "late" strategy is especially important for cranberries, which is not very attractive to bees. Luckily, cranberry flowers will stay open for a while if not pollinated, proving opportunities for pollination when the weather is good. In cranberries, it is better to wait until 10 percent bloom in order to maximize the yield. If too many flowers start turning rosy, pollination was too low and the number of honeybee hives should be increased next year.

Honeybee prices and hive strength

Expect to pay anywhere from $50 to $80 per hive for spring fruit pollination. There is a range here because if renting only 10 hives, there may be a higher price than if renting 500 hives. Colonies might be also of different strengths, and it is important to get strong hives that will work the flowers well. A strong hive should contain more than six to eight full frames of bees. The pollination agreement with the beekeeper can contain language about the expected hive strength.

Hive placement

If possible, place the colonies in sheltered locations so their entrances face the early morning sun. This will encourage earlier bee activity as the hive warms in the morning. Pallets of hives or individual hives should be spread out around the field to maximize the spread of floral visitation by bees, with a maximum of 300 yards between colonies.

Other managed pollinators

Growers are becoming more interested in bumblebees, which can now be purchased commercially from a supplier based in Michigan. These have the advantage of visiting more flowers per minute than honeybees and being active in the cooler damp conditions we often experience in Michigan. For some crops, such as blueberry, they also provide the buzz pollination required to maximize release of pollen from the flower. While the cost per bee is higher, each bumblebee is

much more efficient than each honeybee. Increased interest in native bees has also lead to the commercial development of blue orchard bees (species of *Osmia*) for pollination, and this is growing slowly but steadily as growers learn more about how to manage them.

Native pollinators

Many other helpful insects are active in fruit crops during bloom, working flowers and providing free pollination services. Native bees (such as the mason bees, sweat bees and bumblebees) can be seen moving among flowers during spring, and their activity generally remains high when weather conditions turn too cold or wet for honeybees. These native bees may be insufficient to provide the complete pollination required for good yields, however, and until we learn more about them they should not be relied on to stand alone as your sole pollination source. By providing the right nesting habitats, and food for the bees after your crop has flowered, you can enhance the local populations of native bees around your crop. This is a long-term process and you'll need several years of experimenting before these bees can become a reliable part of your pollination planning.

Pest management during pollination

Avoid use of insecticides when flower buds are open to prevent killing pollinators. Some products are bee safe, but the label should be followed carefully if using them during bloom. Beehives should be removed immediately after pollination if post-bloom pesticide applications are planned. By monitoring for pest problems carefully during bloom, growers can help minimize the need for pest control. If an insecticide application is necessary during bloom, compounds that are least toxic to bees should be used and applied when bees are not foraging, with careful observation of the pollinator-restrictions on the label.

Plan ahead how to optimize pollination

We cannot control the weather, but planning ahead will help maximize the chance of pollinators working flowers during some part of bloom. A diverse combination of pollinators is expected to provide the best insurance against low fruit set from a cool spring. Honeybees will remain the dominant pollinator of fruit crops, and with bumblebees and blue orchard bees now available commercially, a combination approach is more possible than in the past.

Bee management for Balaton® tart cherry

Over the past few years, fruit set in Balaton has been disappointing in years with cold weather during bloom. Apparently normal-looking flowers simply failed to set fruit. We strongly suspect that this poor fruit set is due to ovule senescence prior to fertilization. Therefore, to improve fruit set in Balaton, we recommend the following strategies:

1) Increase early pollen availability, and
2) Improve pollen transfer.

Honeybees should be placed in the orchard in ample time for the bees to visit the first open flowers as the first flowers may have the best potential to set fruit. In addition, we recommend a minimum of two honeybee hives per acre since under cool conditions, Balaton fruit set may be improved with Montmorency or sweet cherry pollen.

Table 1. Recommended density of honeybee hives (per acre) for common Michigan fruit crops

Crop	Hive density	Notes
Apple and pear	1-3	Use more hives for higher density plants
Sweet cherry	2	
Tart cherry	0.5-1	Use sweet cherry rates for cv. Balaton®
Plum, peach	1	
Blueberry	3	Cultivars vary in their dependence on pollination
Cranberry	3	
Raspberry, strawberry	1	
Grape	0	Grape is wind pollinated

(Reprinted from: Michigan State University, Fruit Crop Advisory Team Alert, Vol. 20 No. 3, April 26, 2005. Pictures courtesy of C. Heidenreich)

STRAWBERRY DISEASE FAST FACTS

Cathy Heidenreich, Department of Plant Pathology, NYSAES Cornell University, Geneva

Most growers are aware of potential disease problems in their fruit plantings, based on prior disease history and current/projected weather conditions. However, a brief review is always beneficial. Links are provided if you want more details.

FOLIAR DISEASES: LEAF SPOT, LEAF SCORCH, LEAF BLIGHT

What: fungal diseases causing leaf spots on strawberry.
Spot: *Mycosphaerella fragariae*, **Scorch**: *Diplocarpon earlianum*, **Blight**: *Phomopsis obscurans*

When: These diseases may occur sporadically during the growing season, when disease conditions are favorable for infection.
Spot: Spot symptoms are most commonly seen in mid to late spring, just prior to harvest.
Scorch: Symptoms appear on leaves of initial spring re-growth. The disease may intensify from late spring to mid-fall.
Blight: Infections typically occur early in the season, but often remain latent until warmer weather. Symptoms most often appear at renovation or late summer to early fall. Note Blight does not readily infect fruit caps.

Where:
All 3 diseases typically appear first as small purple spots (lesions) on leaves. They are easier to distinguish as lesions age. These fungi may also infect leaf stems, stolons, flower parts, fruit, and fruit caps.
Spot: Leaf spots typically have a light brown to gray to whitish center bordered by a thin reddish purple margin. Fruit infections occur around seeds- a condition known as "Black-seed".
Scorch: large purple to reddish to yellow patches dotted with purple lesions. Note the centers of these lesions do not become white, brown, or gray, as with Leaf spot or Leaf blight. As the disease progresses the leaves brown, wither and curl, becoming "scorched" in appearance.
Blight: Large, nearly circular spots with wide reddish purple margins and brown centers. Lesions from the leaf margin may also be V-shaped. Phomopsis soft rot of fruit has recently been reported from various locations in the US.

How:
Conidia of all 3 pathogens are spread primarily by splashing water-rain, dew, and irrigation. Infection periods for these fungi are favored by 12+ hrs leaf wetness, temperatures between 15-25 ^{o}C. Scorch is favored by slightly cooler temperatures than Spot or Blight.

What to do:
Plant in light, well-drained soil with good air circulation and exposure.
Choose disease resistant cultivars suitable for your location (Appendix of Strawberry Cultivar Disease Resistance).
Plant only disease free plants purchased from reliable nurseries.
Apply nitrogen fertilizers only at renovation to reduce succulent new leaf tissue that is more susceptible.
Carefully space runner plants in matted-row culture and control weeds in all plantings to improve air circulation and reduce drying time for leaves.
Remove older or infected leaves before setting runners in new plantings.
Removing and burning/burying all debris at renovation (after harvest) helps to reduce overwintering inoculum of leaf pathogens.
If leaf diseases are a problem in the planting, follow a fungicide spray schedule recommended for control of leaf diseases and fruit rots to aid in control.
Thoroughly cover all above ground plant parts with spray, especially undersides of leaves.

Fore more information: 2005 Pest Management Guidelines for Berry Crops, NYBN Vol. 3, No. 4, NYBN Vol. 2, No. 5, NYBN Vol. 1, No. 4,

Leaf Spot

Leaf Scorch

Leaf Blight

STRAWBERRY DISEASE FAST FACTS (continued)

GRAY MOLD

What: a fungal fruit rot, caused by *Botrytis cinerea*

When: The fungus overwinters primarily as microscopic fungal threads (mycelium) in infected or dead leaf tissue. It also overwinters in straw mulch as small, black, thick-walled fungal structures (sclerotia), mummified fruit, and weeds. Conidia are the principal inoculum source for fruit infections. These spores are dispersed by wind, splashing rain, and irrigation water. Infections occur whenever weather conditions are favorable from early bloom through the green fruit stage.

Where: Symptoms appear on blossoms, and green, white, and pink stage fruit. Infected petals and pedicels brown; entire blossoms and fruiting structures may die. Fruit infections typically occur at the calyx end of the fruit. Tissues turn light to medium brown. The rot progresses more rapidly as harvest approaches. Infected fruit are typically covered with a gray mass of mycelium and powdery masses of grey conidia. Young leaves and petioles may also be infected but visible infections do not develop until after leaves begin to senesce.

How: Infections are favored by extended periods of high relative humidity or surface wetness during flowering, and temperatures between 15 and 25 ^{o}C.

What to do:

Close mowing combined with **removal** of cut foliage at renovation can suppress gray mold incidence by 50% the following year.

Avoid nitrogen applications during the cropping season as they can increase gray mold incidence by 60-80%.

Gray mold infection may be accentuated by frost damage. Protect blossoms during periods of freezing temperatures with overhead irrigation.

Fungicide applications starting at bloom followed by 7-10 day intervals when conditions are favorable for disease development. Alternate pesticide chemistries to prevent resistance development.

Avoid overripe or infected fruit during harvest. Handle harvested fruit carefully to minimize injury. Whenever possible, promptly cool harvested fruit to near 0 ^{o}C to suppress fruit respiration and growth of gray mold.

Fore more information:

Check out the 2005 Pest Management Guidelines for Berry Crops, NYBN Vol. 3 No. 5, NYBN Vol. 3, No. 4.

Gray mold mycelium and spores (conidia)

Early stages of infections on green fruit

WEATHER REPORTS OF TEMPERATURES AND PRECIPITATION THROUGHOUT NEW YORK STATE FOR WEEK ENDING SUNDAY 8:00am, May 1st, 2005

	Temperature				Growing Degree Days (*Base 50*)			Precipitation (*inches*)			
	High	***Low***	***Avg***	***DFN[1]***	***Week***	***YTD[2]***	***DFN***	***Week***	***DFN***	***YTD***	***DFN***
Hudson Valley											
Albany	70	33	52	1	22	102	64	0.48	-0.22	2.42	-0.67
Glens Falls	68	34	49	-2	9	45	21	1.24	0.50	4.82	1.73
Poughkeepsie	68	36	51	-2	17	96	43	0.96	0.06	3.82	0.20
Mohawk Valley											
Utica	69	32	47	-4	12	64	29	0.88	0.06	5.31	1.63
Champlain Valley											
Plattsburgh	68	36	50	2	14	45	19	1.70	1.03	4.92	2.03
St. Lawrence Valley											
Canton	67	32	47	-1	8	29	9	0.75	0.05	3.15	0.20
Massena	66	33	47	-2	9	38	14	1.69	1.08	4.58	1.85
Great Lakes											
Buffalo	68	32	45	-6	6	68	32	0.62	-0.08	4.44	1.47
Colden	67	30	43	-5	5	39	18	0.67	-0.17	4.20	0.31
Niagara Falls	69	31	46	-5	7	59	18	0.54	-0.16	4.03	0.78
Rochester	70	31	47	-5	11	58	15	0.41	-0.22	4.14	1.44
Watertown	67	34	47	-2	7	38	15	1.22	0.60	5.23	2.63
Central Lakes											
Dansville	70	31	45	-6	4	52	14	0.31	-0.35	3.50	0.60
Geneva	68	31	46	-5	8	58	25	0.93	0.23	5.45	2.44
Honeoye	69	29	46	-4	10	52	18	0.44	-0.25	4.61	1.57
Ithaca	68	29	46	-3	10	47	21	0.24	-0.46	4.67	1.66
Penn Yan	69	32	47	-3	14	74	41	0.51	-0.19	5.10	2.09
Syracuse	72	32	49	-2	18	88	47	0.87	0.10	5.78	2.34
Warsaw	63	28	41	-6	2	33	17	0.45	-0.32	5.25	1.77
Western Plateau											
Alfred	68	29	44	-5	5	41	21	0.57	-0.13	4.03	0.83
Elmira	70	24	47	-4	14	62	32	0.24	-0.42	3.92	1.14
Franklinville	67	25	41	-6	2	20	9	0.80	0.03	4.47	1.08
Sinclairville	66	30	43	-5	4	41	22	0.79	-0.11	4.02	0.07
Eastern Plateau											
Binghamton	65	30	46	-4	7	71	44	0.50	-0.27	4.39	1.15
Cobleskill	67	32	48	-2	8	38	15	0.65	-0.12	3.85	0.45
Morrisville	68	30	44	-4	5	40	21	0.72	-0.05	5.09	1.89
Norwich	68	31	45	-5	2	38	14	0.58	-0.25	4.43	0.95
Oneonta	72	32	48	2	6	47	28	0.68	-0.21	4.93	1.32
Coastal											
Bridgehampton	64	39	51	2	16	54	29	1.55	0.64	4.96	0.86
New York	67	41	55	-2	37	167	73	1.20	0.29	4.63	0.71

1. *D*eparture *F*rom *N*ormal
2. *Y*ear *T*o *D*ate: Season accumulations are for April 1st to date

The information contained in these weekly releases are obtained from the New York Agricultural Statistics Service (http://www.nass.usda.gov/ny/), who in turn obtains information from reports from Cornell Cooperative Extension agents, USDA Farm Service Agency, Agricultural Weather Information Service Inc., the National Weather Service and other knowledgeable persons associated with New York agriculture.

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Hudson Valley											
Albany	63	30	48	-7	9	111	39	0.03	-0.69	2.45	-1.36
Glens Falls	63	25	45	-7	5	50	0	0.00	-0.77	4.82	0.96
Poughkeepsie	65	31	49	-7	5	101	8	0.21	-0.77	4.03	-0.57
Mohawk Valley											
Utica	68	27	46	-7	7	71	5	0.08	-0.72	5.39	0.91
Champlain Valley											
Plattsburgh	66	30	46	-6	5	50	-1	0.07	-0.56	4.99	1.47
St. Lawrence Valley											
Canton	68	31	46	-5	4	33	-10	0.04	-0.64	3.19	-0.44
Massena	68	30	46	-6	4	42	-7	0.11	-0.45	4.69	1.40
Great Lakes											
Buffalo	69	33	48	-5	13	81	14	0.05	-0.62	4.49	0.85
Colden	66	28	44	-7	3	42	-2	0.21	-0.60	4.41	-0.29
Niagara Falls	70	31	48	-7	12	71	-4	0.19	-0.49	4.22	0.29
Rochester	66	31	47	-7	7	65	-14	0.02	-0.58	4.16	0.86
Watertown	67	25	44	-7	0	38	-8	0.07	-0.50	5.30	2.13
Central Lakes											
Dansville	69	30	46	-8	6	58	-12	0.08	-0.55	3.58	0.05
Geneva	65	29	46	-7	6	64	0	0.00	-0.65	5.45	1.79
Honeoye	68	28	45	-8	1	53	-12	0.02	-0.61	4.63	0.96
Ithaca	64	28	44	-8	2	49	-2	0.16	-0.54	4.83	1.12
Penn Yan	65	30	46	-7	5	79	15	0.00	-0.65	5.10	1.44
Syracuse	67	30	48	-7	8	96	19	0.03	-0.72	5.81	1.62
Warsaw	63	30	43	-7	3	36	1	0.06	-0.71	5.31	1.06
Western Plateau											
Alfred	65	27	44	-8	0	41	-3	0.21	-0.49	4.24	0.34
Elmira	66	24	44	-10	7	69	10	0.10	-0.58	4.02	0.56
Franklinville	67	23	41	-8	0	20	-6	0.28	-0.49	4.75	0.59
Sinclairville	66	28	44	-6	2	43	5	0.21	-0.64	4.23	-0.57
Eastern Plateau											
Binghamton	62	31	45	-8	3	74	20	0.03	-0.69	4.42	0.46
Cobleskill	64	25	44	-8	2	40	-7	0.05	-0.72	3.90	-0.27
Morrisville	62	21	42	-9	1	41	-1	0.08	-0.69	5.17	1.2
Norwich	66	20	43	-9	0	38	-11	0.07	-0.75	4.50	0.2
Oneonta	68	27	46	-5	6	53	12	0.10	-0.84	5.03	0.48
Coastal											
Bridgehampton	62	34	48	-6	1	55	4	1.06	0.15	6.02	1.01
New York	64	44	53	-5	25	192	42	0.28	-0.63	4.91	0.08

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Check out the NYSAES Tree Fruit and Berry Pathology web site at:
www.nysaes.cornell.edu/pp/extension/tfabp

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