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Berry Notes

Prepared by the University of Massachusetts Fruit Team

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Massachusetts Berry Notes Underwriters:

NOURSE Growers of the Finest Small Fruit Plants

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IN THIS ISSUE:

MESSAGE FROM THE EDITOR:

2008 New England Small Fruit Pest Management Guide now available – This guide has been extensively updated and is now available for purchase for $12 plus $4 shipping and handling. Orders can be placed by contacting John Howell at howell@umext.umass.edu or by mailing a check made out to the New England Vegetable and Berry Growers Association to:

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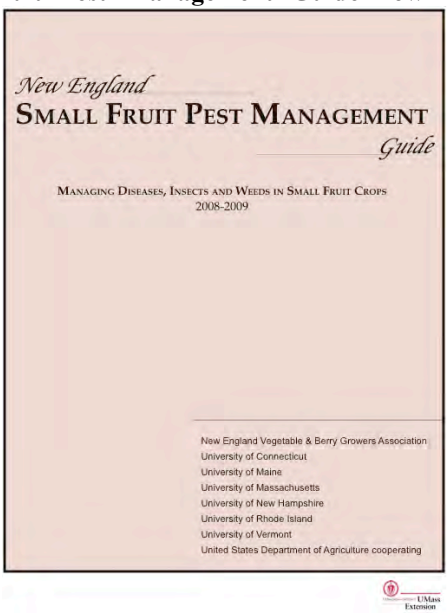


Online purchases will soon be available via the UMass Fruit Team website at www.umass.edu/fruitadvisor. The new guide covers Strawberries, Highbush Blueberries, Brambles, Currants & Gooseberries, and Grapes. Some production information is provided but the main focus is on insect, disease and weed management. Organic options are included for all crops.

TRAC Record Keeping Software available online - In 2008 this valuable software is available online at the following website http://www.nysipm.cornell.edu/trac/downloads/. We strongly encourage all berry growers to try this software for their operations. **For more information contact**: Juliet E. Carroll, Ph. D., Fruit IPM Coordinator, Cornell University at 315-787-2430

Integrated Weed Management Options in Strawberry Production

Chris Benedict and Robin Bellinder, Cornell University

Weed management for perennial strawberries is essential for long-term productivity. Particularly, management during the planting year is especially important to maximize stand establishment and minimize weed pressure in years to come. Reducing weed populations can also reduce disease and insect pressure and drastically lower hand-weeding costs. Different studies have evaluated chemical, mechanical and biological control measures separately. Whereas, commercial growers integrate these tools into a program.

Strawberry plots with interseeded dwarf fescue (200 lb/A) in fall 2006 prior to straw cover. Photo courtesy C. Benedict, Cornell.

A project was initiated in the spring of 2006 to evaluate the efficacy of 7 different management options. The varieties 'Jewel' and 'Earliglow' were utilized for the study and plots were monitored for weed control, crop injury, and strawberry yield. Treatments compared cultivation (in-between row), banded herbicides, and interseeding fescue grass in various combinations.

Banded herbicides, which decreased herbicide use 50%, in combination with cultivation and the broadcast herbicide combined with fescue treatments, had the greatest reduction of total weeds when compared to other treatments. By midseason (July), the broadcast herbicide treatment combined with fescue treatments reduced weed populations more than the broadcast without fescue. This reduced both in-row and between-row and total weeds and weed dry weights for the season. These reductions can be attributed to competition from the fescue. Fescue suppressed between-row weeds as well as between-row cultivation. Some treatments, i.e. banded herbicide + cultivation, had fewer numbers of weeds, but those that escaped tended to be larger. Subsequently, there was no difference between in-row weed dry weights.

Horticultural data suggests that cultivation tools do not have a negative impact on plant development and establishment. Fescue treatments reduced the number of established (rooted) runners by both varieties; although were only significantly lower than the hand-weeded treatment. This reduction can be attributed to the method by which the fescue was managed (weed-whacking) and could be overcome by an alternative management method.

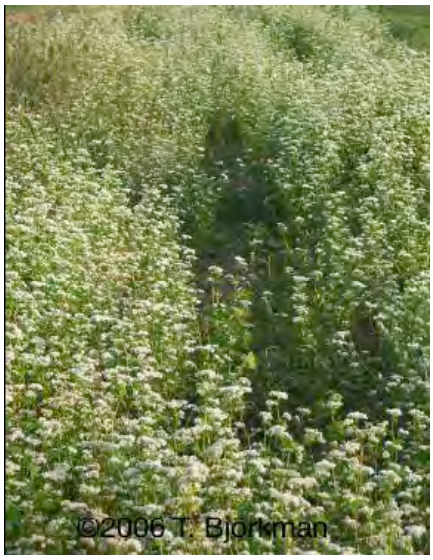
Harvest data outlined different varietal responses to treatments. 'Earliglow' plots containing fescue, regardless of other activities, significantly reduced total yield as compared to a standard broadcast herbicide. In 'Jewel' when herbicides were broadcast in addition to fescue, yields were not significantly reduced as compared to standard broadcast treatment. Yield reductions in fescue plots can be attributed to management practices in 2006 which injured plants. In 'Earliglow' in-row and between-row cultivation resulted in overall higher yields similar to the broadcast program, whereas in 'Jewel' cultivation resulted in overall higher yields. When herbicides were banded in conjunction with cultivation, yields were equivalent to the standard broadcast herbicide.

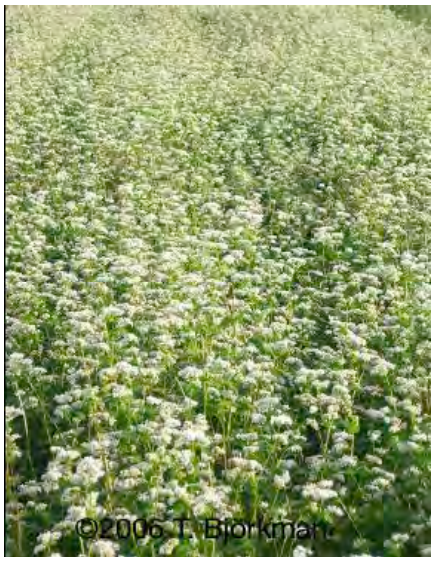
(***Source**: New York Berry News, Vol. 7, No. 3 March 2008. Reprinted with permission from: Proceedings of the 2008 Empire State Fruit and Vegetable Expo: Growing for the Health of NY,February 12-14, 2008, Syracuse, N,Y pg. 104*.)

Want to Spend Less Time Weeding Strawberries?
Use the Power of Buckwheat to get Ahead of the Weeds

Thomas Björkman, Cornell University

You can get more out of a strawberry bed by using a cover crop well in the year before planting. A properly managed buckwheat cover crop can reduce how much weeding is required and improve tilth to keep the roots more productive. Buckwheat is well known for its ability to mellow the soil, buckwheat is also good at reducing the annual weed seed bank and weakening perennial weeds The effective plan starts with a field that is open in the spring, uses a double crop of buckwheat followed by a winter-killed grain. That may seem like a lot of work, it can pay back many times over during the life of the strawberry bed.





Preparing the ground for rapid cover crop growth is important. If the field is too hard or dry at planting, the stand will be poor. A stand like the one on the left will not be effective for reducing weeds. It should look like the one on the right.

The following planting schedule requires the full season to be completed.

1. Till the ground in mid-spring when soil conditions allow the ground to work up easily.

2. Plant in late May or early June. Prepare a good seedbed so the soil is loosened several inches deep and not lumpy. Drill 50 lb/ac, 1 inch deep or less. Broadcasting is possible, but to avoid gaps it must be done with great care to spread evenly using 70 lb/ac. Use shallow incorporation, such as with a drag or chain, to give the buckwheat a faster start than the weeds. Good ground cover is a must for weed suppression.

3. Mow after 45 - 50 days, after immature seed have begun to form.

4. Replant as before, or if the soil is moist and there is time, allow second crop to grow from volunteers. If the soil is dry, irrigate about 1" a few days before planting

5. Mow the second crop within a week of flowering. Plant a winter cover crop (annual ryegrass, oats) in late August or early September.

6. Till in spring and plant a new strawberry crop.

The keys to success with a buckwheat cover crop is to have it start growing quickly, have no gaps in the stand, and to kill it on time. The procedure described here favors all those things.

The winter cover crop is important for maintaining the tilth that buckwheat contributes and for smothering late summer and fall weeds. Grasses do a good job, and there are two that will grow well in the fall and have mostly killed residue in the spring for easy strawberry establishment. These are oats and annual ryegrass. If you need nitrogen, there is another choice.. Medium red clover can be broadcast with the second buckwheat planting. It will grow after the buckwheat is mowed in the fall and provide both winter cover and nitrogen. If it was too dry for the clover to take, plant a conventional grain winter cover.

Perennial weeds are weakened by this buckwheat regime that combines timely cultivation with smother cropping. There is quite a bit of variation in control among the perennial weed based on the limited information we have. Quackgrass is substantially set back for a lot of users. Canada thistle is weakened but not killed. *Oxalis* (yellow woodsorrel) and field bindweed don't grow a lot in the buckwheat but come back the next year from deep roots.

Volunteer buckwheat is likely to appear in the spring. The recommended schedule keeps the volunteer seed to a minimum, but some additional control will be needed. For most strawberry growers, the buckwheat volunteers are killed at planting and with the first cultivation or herbicide application. It's not difficult to control them at this stage. In

fact growers have said that they saw the seedlings but did nothing extra to control them and never had them come back. However, if the early cultivation is missed and buckwheat plants set seed in the new strawberry planting, they may keep appearing over the next year or two. Thus timely control works and does not require anything beyond normal weed control in the first season. However, if volunteer buckwheat isn't controlled then, it can become an annoyance.

More information about buckwheat as a summer cover crop is available at:

www.nysaes.cornell.edu/hort/faculty/bjorkman/covercrops/

(***Source**: New York Berry News, Vol. 7, No. 3 March 2008)*

RASPBERRY

Spring Bramble Chores

Gina Fernandz, NC State and Marvin Pritts Cornell University

Chores and timing may be somewhat different in your 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 onsider 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.

(**Source**: THE BRAMBLE Newsletter of the North American Bramble Growers' Association, SPRING 2007)

Blueberry Disease Fast Fact Sheet; Mummy berry

Dena Fiacchino, Cathy Heidenreich, and Wolfram Koeller, Cornell University

Figure 1.

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.

(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

Figure 2.

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

Figure 4.

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* [or *2008 New England Small Fruit Pest Management Guide*]. Apply all pesticides according to label rates and instructions.

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(***Source**: New York Berry News, Vol. 5, No. 2, March 31, 2006*)

Cankerworm and/or Winter Moth in Blueberries

Bob Childs and Deborah Swanson, UMass Extension

(adapted for blueberries by Sonia Schloemann, UMass Extension)

In recent years, many blueberry growers in eastern, and especially southeastern Massachusetts, have reported serious damage from early season feeding of a small green caterpillar originally thought to be green canker worm. Last year, we determined that this caterpillar is more likely the larval stage of an insect called Winter Moth and the potential for serious damage to blueberries and other host plants is high.

Photographer: Louis-Michel Nageleisen, Département de la Santé des Foréts - France

Winter Moth is a new pest in Massachusetts. Prior to its introduction, both spring and fall cankerworms were not uncommon in our area. However, the level of damage from Cankerworms was typically less severe and occurred less frequently compared to the damage we are now finding from Winter Moth. Cankerworms, both fall and spring, are native insect pests.

Cankerworm populations will appear in an area and exist in damaging numbers for several years before going into decline due to natural controls. Then they may not reappear in that area for one or more decades. The winter moth, however, is an introduced insect pest and as such does not have sufficient natural controls yet to cause the populations to decline. Here is what we know about Winter Moth, its life cycle, damage and how to control it.

Winter Moth (*Operophtera brumata* (L.))

Origin: Winter moth is an insect pest that was introduced to North America from Europe. Its introduction has been known for years in various regions of eastern Canada, including: Nova Scotia, Prince Edward Island, and parts of New Brunswick. It has also been a pest in the northwestern region, namely Vancouver, British Columbia.

Winter Moth was introduced into the United States and has warranted control measures in Washington and Oregon. This pest is now in Massachusetts in, at least, the southeastern region and parts of Cape Cod. It is the first known occurrence of it in outbreak proportions in New England. It is also, currently, a problem in the United Kingdom (England and Scotland).

Injury and Host Plants: Many different deciduous plants are susceptible. These include: oaks, maples, basswood, white elm, crabapples, apple, **blueberry**, and certain spruces such as Sitka spruce (Scotland). Young larvae or caterpillars, resembling inchworms, tunnel into and feed

inside buds, especially on fruit trees (apple, **blueberry**, cherry, and crabapple) in the early spring before bud break.

These caterpillars move from bud to bud as they feed. Delayed bud opening due to cool weather conditions can lead to bud death as the caterpillars have longer time to feed. Older larvae feed in the expanding leaf clusters and are capable of creating defoliation in high populations.

Research in Canada has shown that four consecutive years of partial defoliation of deciduous hosts can lead to branch mortality while complete defoliation in each of those years leads to tree mortality. In certain regions of Nova Scotia, this pest is responsible for a 40% red oak mortality in forested stands.

Life Cycle: Moths, or the adult stage, of the winter moth emerge from the soil usually in late November and can be active into January. The adults are strongly attracted to light and can often be found flying around outside lamps or holiday lights. The male moths are 4 cm , light brown to tan in color and have four wings that are fringed with small elongate scales that give the hind margins a hairy or fringed appearance. The female is gray, wingless and, therefore, cannot fly. She emits a sex pheromone or scent that often attracts clouds of male moths.

Females are usually found at the base of trees but can be found almost anywhere. After mating, the female deposits an egg cluster on tree trunks and branches, in bark crevices, under bark scales, under loose lichen, or elsewhere. The adult moths then die and the eggs over-winter. Eggs hatch when temperatures average around 55°F. It is believed that egg hatch in Massachusetts occurs when 20 – 50 Growing Degree Days (base 50) have accumulated. This means that this usually occurs in the spring, before bud break of most of its host plants. Newly hatched larvae often crawl up tree trunks and produce a long 8 silken strand of silk which makes them air buoyant. This larval dispersal method is known as “ballooning”. In certain situations, winter moth caterpillars can arrive in areas where they have not expected to be a problem, given topography and wind patterns. Larvae are pale green caterpillars with a white longitudinal stripe running down each side of the body. Winter moth larvae are loopers or inchworms and have just 2 pairs of prolegs. At maturity, these caterpillars will be approximately one inch long. They will feed voraciously until mid- June, whereupon they migrate to the soil for pupation. They will stay in the soil in the pupa stage until they emerge in late November as adult moths.

Feeding: In certain years, winter moth eggs may hatch in March. After ballooning, the larvae will tunnel into buds, especially the flower buds of fruits (apple, blueberry, cherries, and flowering trees). They will feed on both fruit and foliar buds but fruit buds are preferred. Once a bud has been devoured from within, the caterpillar will migrate to other buds and repeat the process. Once leaf buds open, the small caterpillars can be found within the tight clusters of new leaves during the day. During cool springs, if weather hinders leaf expansion, the winter moth caterpillar can cause high levels of injury to these leaves. Winter moth caterpillars often leave these clusters to become free feeders at night. They may also "drop" or "balloon" to plants that are located beneath infested trees. These caterpillars may then feed on a whole host of herbaceous perennials, roses etc. that are near or beneath these trees. Winter moth caterpillars are often found in association with both the fall and spring cankerworms, which look and have similar feeding patterns to the winter moth caterpillar.

What can be done?

•- **Scout**: Orchardists need to be particularly aware of the winter moth. The potential exists for both apple and blueberry crops to be heavily damaged. By the time one realizes that the flower buds have been consumed, it will be too late for action. Therefore, favored host plants in susceptible areas should be monitored carefully. Bark crevices should be inspected for egg clusters. By late winter, winter moth eggs will be reddish-orange in color. Upon hatching, winter moth caterpillars climb high into the host plant and produce a long strand of silk to make themselves air buoyant. They will be carried by the wind to a new host plant. This process of dispersal is called “ballooning”.

•- A **dormant oil spray** to the blueberry bushes may be helpful in killing the overwintering eggs before they hatch. However, some egg clusters are under bark flaps and loose lichen and may be protected from oil sprays. Eggs may also be in other locations on or off the host plant. Caterpillars may also invade host plants by ballooning onto them after treatment has been applied.

•- ***Bacillus thuringiensis*** (B.t. (kurstaki), a bacterium specific to caterpillars of butterflies and moths, works very well on the younger larvae of both winter moth and cankerworms while they are free feeders.

• **Spinosad** products (SpinTor® and Entrust®), both of which are labeled on blueberries are a biorational compound that works well against both of these species.

• **Insecticidal soap** may be effective against the younger caterpillars but only when they are exposed on the host plant.

• **Chemical insecticides.** Few compounds, are labeled for this pest although many are being tested and may receive supplemental labels in the future.

Confirm® insecticide is labeled for loopers, spanworms and other lepidopterous pests in blueberry and should be effective. Imidan® may also be effective. Consult your local supplier and always read, understand and follow all label directions for pesticide products.

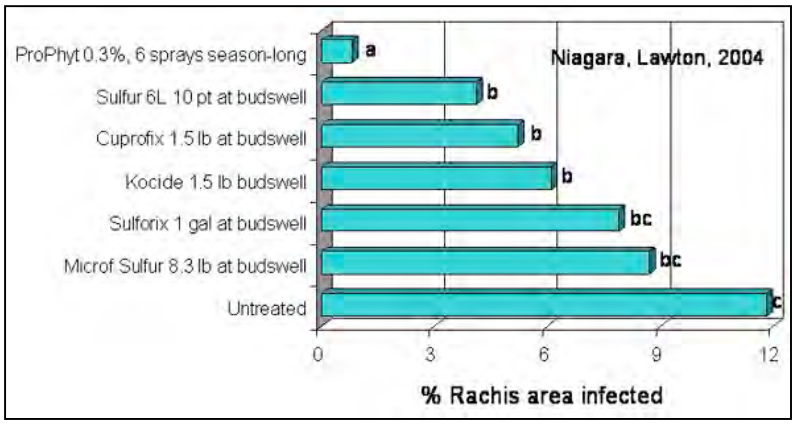
• **Plants heavily defoliated** by winter moth caterpillars will be severely stressed. Blueberry bushes must put out a second flush of growth in order to survive. **Water is critical to the bushes at that time.** Supplemental watering of bushes will be necessary if a drought or little rainfall occurs naturally. (***Source**: Reprinted from Mass Berry Notes, Vol. 17, No. 2, Feb 2005*)

GRAPE

Reducing Disease Pressure in Grapes with Dormant Fungicide Applications

Annemiek Schilder, Michigan State University

Dormant applications of crop protection chemicals are typically applied in the fall or spring when no green tissue is present on plants. The purpose of dormant sprays is to eradicate pathogens and insects that are overwintering on the plant. Lime sulfur (a mixture of calcium polysulfides formed by boiling slaked lime with sulfur) has long been used as a dormant spray in tree fruit and brambles. Copper formulations are also used, particularly for control of bacterial diseases. These products kill mainly through direct contact, so applications must be applied with maximum coverage. Lime sulfur, while effective, is smelly, corrosive to farm equipment, and can be phytotoxic to green tissues. While lime sulfur used to be relatively inexpensive, the price has gone up significantly in recent years and can be as high as $100 per acre if applied at higher rates.



In grapes we have done several years of trials with dormant fungicide applications, including less expensive alternatives, such as sulfur and copper products. Below a graph showing the efficacy of a single dormant spray at budswell against Phomopsis rachis infection in Niagara grapes at harvest. The following products were tested: Microfine Sulfur (powdered sulfur), Sulfur 6L (liquid sulfur), Kocide 2000 (copper hydroxide), and Cuprofix (basic copper sulfate). No other fungicides were applied during the season. ProPhyt applied on a seasonal schedule was included for comparison. We also found that dormant applications of sulfur and copper reduced black rot infection of fruit, and that dormant copper reduced downy mildew infection. In general, dormant sprays significantly reduce disease pressure of a range of diseases. The effects of dormant sprays on powdery mildew infection will be investigated in 2005.

It is important to note that Concord is sulfur sensitive. While we have not seen any phytotoxicity in previous trials, we have not specifically tested whether a dormant application of sulfur or copper can hurt the newly emerging green tissues through redistribution of the product. So as a safeguard, we do not recommend sulfur compounds at this time on Concord, even as a dormant spray. Niagara is not sulfur sensitive. Both cultivars are considered slightly sensitive to copper. At this time, Cuprofix is considered a good option for broad-spectrum disease control and is specifically labeled for dormant application. The label rate is a bit higher (2.5-6 lbs) than what we tested.

Dormant sprays should not be used as a stand-alone measure of controlling diseases. However, in 2004, we tested a reduced spray program in Niagara grapes (a dormant application of Sulfur 6L, an immediate pre-bloom mancozeb spray, and one postbloom Abound spray). This program provided control of Phomopsis that was equivalent to a full-season spray program. This suggests that when a dormant spray is included, seasonal sprays may be reduced. The amount and timing of possible fungicide reductions will be further investigated during the 2005 season.

General

Dealing with Deer Concers in Berry Crops

Paul D. Curtis, Cornell University

Deer may feed upon a wide variety of natural plants and agricultural crops. Although deer feeding injury may occur at any time of the year, it is usually more severe to berry crops during the late winter and early spring months. Deer may also damage plants such as strawberries early in the season after protective mulch is removed. An adult deer can consume 6 to 8 pounds of plant material each day. This may include anywhere from 0.5 to 1.5 bushels of twigs or plants. It is no wonder a few deer can devastate a berry planting in just a few weeks.

When damage form deer feeding is light, and restricted to just a few weeks early in the growing season, repellents may be the best approach. However, remember that no repellent is 100% effective. If the damage to the plants is moderate to heavy, and deer are feeding in the field for more than a few weeks, repellents may prove inadequate protection. Excluding deer from the crop with fencing or netting may be the most effective method for preventing damage, and some fence designs are more effective than others.

Repellents

The most effective commercial repellents include putrescent egg solids as the active ingredient. However, only a few products (e.g. Deer Off) are registered for direct application to food crops. Most deer repellents are registered for applications to ornamentals or fruit trees during the dormant season. Check pesticide labels and regulations to make certain the products are registered as deer repellents for food crops. There are several deer repellents available that contain "low-risk" active ingredients, and these products are exempt from EPA registration. Most of these repellents have not been adequately tested for efficacy under a variety of field conditions.

Preventing deer browsing requires repeated repellent applications every 4 to 6 weeks while plants are susceptible. This schedule may be very difficult for growers to maintain due to cold weather and spring snow or rain. Repellents may only be effective if the area being damaged is small, damage is light to moderate, and 1 or 2 applications will do the job.

If the fruit planting is small (an acre or less), some growers have had success combining rope fencing with repellents. You can string visible white cotton rope around the planting on wooden or metal stakes about 30 inches above ground level. Tie 2- inche wide strips of cotton cloth around the rope fence every 3 to 4 ft. Spray the cloth strips with an egg-based deer repellent (e.g. Deer-Away or Big Game repellent). Deer repellents registered for ornamentals can be used because application is on cloth strips, not the fruit crop.

Some fruit growers have had success repelling deer from plantings using invisible fencing and trained dogs. This technique can be costly effective and significantly reduce browsing damage. Dogs are usually run in pairs in areas from 5 to 15 acres. However, dogs within invisible fencing systems act as "repellents", and low levels of deer damage must still be tolerable for growers. Also, landowners must be willing to maintain daily dog care. For low growing crops such as strawberries, dogs may not be suitable because of the potential for trampling damage to the crop.

Physical Barriers

For areas where damage is heavy, or where spraying of repellents is difficult, physical barriers maybe a better alternative. Electric fences may not work well in all situations, especially if the fences are not maintained, or if the area to be protected is larger than 5 acres. Deer can easily jump an electric fence, and will do so if feeding pressure is high enough. Deer actually prefer to crawl under fences rather than jump over them. A solar-powered electric fence charger should provide 4,000 to 7,000 volts of current to help train the deer to avoid the area. Use only UL-approved fence chargers designed for deer control. Although fencing is the most effective means of keeping deer from ruining your crop, the initial purchase and installation costs are high, and continued maintenance is required.

Adding aluminum tabs to an electric fence with a peanut butter attractant may insure the deer come in contact with the fence with their nose or tongue, and learn to recognize and avoid it. Applying an egg-based repellent to cloth strips tied to an electric fence provides another adverse technique, and may be more effective that the electric fence with peanut butter attractants or an electric fence alone. This is very similar to the rope design mentioned above, and deer associate the bad odor with the electric shock.

Some growers that suffer high deer pressure every year use 8-ft-high, woven wire fencing to protect blueberry plantings. These fence designs provide the ultimate in crop protection, but are also very expensive. Installing such a fence may cost $6 to$8 per linear ft. A good quality gate will also be needed. Installing two 4 x 8-ft metal livestock gates can work well.

It may be possible to cover strawberry rows with plastic netting to prevent deer feeding. Good quality netting can be rolled up after harvest season, and be reused for many years.

However, applying and removing the netting can be labor intensive.

Deer Population Management

IN rural areas where hunting is feasible, growers should encourage local hunters to harvest female deer. The NYS Department of Environmental Conservation offers Deer Management Assistance Program tags to landowners for taking antlerless deer on their property, in addition to the deer management permits big game hunters may apply for in many counties. Taking female deer during the hunting season will lower the overall population and potential for future damage.

In severe situations where the grower is at risk of losing a crop, NYSDEC may issue Nuisance Deer Permits to the landowner. These tags allow the grower, or their designated agent, to take deer outside of the normal hunting season. The permit may allow shooting at night with lights, or other techniques that are not permitted during the regular hunting season for deer. Contact your regional DEC office for more information about these permits.

There is no one solution that will solve every wildlife problem. As for other crop "pests", growers should use an integrated management approach, and use as many techniques as possible to effectively manage deer. If you wish to learn more about different deer control options, visit the web site: http://wildlifecontrol.info .

*(**Source**: New York Berry News, Vol. 7, No. 3 March 2008. Reprinted with permission from: Proceedings of the 2008 Empire State Fruit and Vegetable Expo: Growing for the Health of NY, February 12-14, 2008, Syracuse, N,Y pg.108-109.)*

Effect of Water pH on the Stability of Pesticides

Annemiek Schilder, Michigan State University

Most pesticides are sold in concentrated form and have to be dissolved or suspended in water before they can be applied to crops. This water can come from various sources, such as wells, ponds, rivers, or municipal water supplies. Water naturally varies in the amount of dissolved minerals, organic matter and pH, depending on its source. The pH is a measure of the acidity or alkalinity of water, which refers to the number of hydrogen (H^+) and hydroxyl (OH^-) ions in a solution. The scale for measuring pH runs from zero to 14. The lower the pH, the more acidic the solution, while a higher pH indicates that the solution is more alkaline. Water at pH 7 is neutral, meaning there are an equal number of hydrogen and hydroxyl ions in the solution. Many areas in Michigan have alkaline water with high mineral/iron content. In addition, the pH of water from natural sources can vary throughout the season.

The pH of water can negatively affect the stability of some pesticides. Under alkaline conditions, alkaline hydrolysis occurs which degrades the pesticide to non-toxic (inactive) forms. In general, insecticides (particularly organophosphates and carbamates) are more susceptible to alkaline hydrolysis than are fungicides, herbicides or growth regulators. The end result is less active ingredient applied and poor pesticide performance. The degradation of a pesticide can be measured in terms of its half life. For example, if a product has a half life of one hour, the amount of active ingredient is reduced to 50 percent in one hour, to 25 percent in the next hour, to 12.5 percent in the next hour, etc. Eventually, the pesticide becomes virtually ineffective. The effect of pH on pesticides varies from product to product and is also moderated by buffering solutions contained in the pesticide formulation. Tank-mixing multiple pesticides can modify the pH of the tank-mix.

The accompanying table (below) shows the half life of a number of pesticide products as well as the optimum pH (where known). As you can see from the table, most pesticides are most stable when the spray solution is at a pH of about five. As many water sources are more alkaline than this, it may be necessary to adjust the pH of the spray solution. Do not attempt to acidify solutions containing copper-based fungicides, since copper becomes more soluble at a lower pH and may become phytotoxic to crops. In addition, phosphorous acid and other acid-based fungicides should not be acidified since they already have a low pH and lowering it could cause phytotoxicity. On the other hand, acidifying carbonate salt fungicides, such as Armicarb, may render them ineffective.

Table to accompany *Effect of water pH on the stability of pesticides* by Annemiek Schilder, MSU Plant Pathology. (March 18, 2008)

Product	Active ingredient	Optimum pH	Half Life / Time until 50% Hydrolysis**
Insecticides/Miticides			
Admire	Imidacloprid	7.5	Greater than 31 days at pH 5 - 9
Agri-Mek	Avermectin		Stable at pH 5 - 9
Ambush	Permethrin	7	Stable at pH 6 - 8
Apollo	clofentezine		pH 7 = 34 hrs; pH 9.2 = 4.8 hrs
Assail	acetamiprid	5 - 6	Unstable at pH below 4 and above 7
Avaunt	indoxacarb		Stable for 3 days at pH 5 – 10
Carzol	formetanate hydrochloride	5	Not stable in alkaline water; use within 4 hrs of mixing.
Cygon/Lagon	dimethoate	5	pH 4 = 20 hrs; pH 6 = 12 hrs; pH 9 = 48 min
Cynbush	cypermethrin		pH 9 = 39 hours
Diazinon	phosphorothioate	7	pH 5 = 2 wks; pH 7 = 10 wks; pH 8 = 3 wks; pH 9 = 29 days
Dipel/Foray	b. thuringiensis	6	Unstable at pH above 8
Dylox	trichlorfon		pH 6 = 3.7 days; pH 7 = 6.5 hrs; pH 8 = 63 min
Endosulfan	endosulfan		70% loss after 7 days at pH 7.3 – 8
Furadan	carbofuran		pH 6 = 8 days; pH 9 = 78 hrs
Guthion	azinphos-methyl		pH 5 = 17 days; pH 7 = 10 days; pH 9 = 12 hrs
Imidan	phosmet	5	pH 5 = 7 days; pH 7 < 12 hrs; pH 8 = 4 hrs
Kelthane	dicofol	5.5	pH 5 = 20 days; pH 7 = 5 days; pH 9 = 1hr
Lannate	methomyl		Stable at pH below 7
Lorsban	chlorpyrifos		pH 5 = 63 days; pH 7 = 35 days; pH 8 = 1.5 days
Malathion	dimethyl dithiophosphate	5	pH 6 = 8 days; pH 7 = 3 days; pH 8 = 19 hrs; pH 9 = 5 hrs
Matador	lambda-cyhalothrin	6.5	Stable at pH 5 - 9
Mavrik	tau-fluvalinate		pH 6 = 30 days; pH 9 = 1 - 2 days
Mitac	amitraz	5	pH 5 = 35 hrs; pH 7 = 15 hrs; pH 9 = 1.5 hrs
Omite	propargite		Effectiveness reduced at pH above 7
Orthene	acephate		pH 5 = 55 days; pH 7 = 17 days; pH 9 = 3 days
Pounce	permethrin	6	pH 5.7 to 7.7 is optimal
Pyramite	pyridaben		Stable at pH 4 – 9
Sevin XLR	carbaryl	7	pH 6 = 100 days; pH 7 = 24 days; pH 8 = 2.5 days; pH 9 = 1 day
SpinTor	spinosad	6	Stable at pH 5 – 7; pH 9 = 200 days
Thiodan	endosulfan	6.5	70% loss after 7 days at pH 7.3 to 8
Zolone	phosalone	6	Stable at pH 5 – 7; pH 9 = 9 days
Fungicides			
Aliette	fosetyl-al	6	Stable at pH 4.0 to 8.0
Benlate	benomyl		pH 5 = 80 hrs; pH 6 = 7 hrs; pH 7 = 1 hr; pH 9 = 45 min
Bravo	chlorothalonil	7	Stable over a wide range of pH values
Captan	captan	5	pH 5 = 32 hrs; pH 7 = 8 hrs; pH 8 = 10 min
Dithane	mancozeb	6	pH 5 = 20 days; pH 7 = 17 hrs; pH 9 = 34 hrs
Nova	myclobutanil		Not affected by pH
Ridomil	mefenoxam		pH 5 – 9 = more than 4 weeks
Rovral	iprodione		Chemical breakdown could take place at high pH
Orbit	propiconazole		Stable at pH 5 – 9
Herbicides			
Banvel	dicamba		Stable at pH 5 - 6
Fusilade	fluazifop-p		pH 4.5 = 455 days; pH 7 = 147 days; pH 9 = 17 days
Ignite	glufosinate-ammonium	5.5	
Gramoxone	paraquat		Not stable at pH above 7
Poast	sethoxydim	7	Stable at pH 4.0 to 10
Princep	simazine		pH 4.5 = 20 days; pH 5 = 96 days; pH 9 = 24 days
Prowl	pendimethalin		Stable over a wide range of pH values
Roundup	glyphosate	5 - 6	
Touchdown	glyphosate	5 - 6	
Treflan	trifluralin		Very stable over a wide range of pH values
Weedar	2,4-d		Stable at pH 4.5 to 7

**The half-life is the period of time it takes for one half of the amount of pesticide in the water to degrade. Other factors than the pH can affect the rate of hydrolysis, including temperature, solubility, concentration, type of agitation, humidity, and other pesticides and adjuvants in the mixture.

Check the pH of the water used for spraying pesticides frequently throughout the season. If you know that your water has a pH of 7.5 or greater, consider lowering the pH, especially if you are applying a pesticide that is sensitive to high pH. The fastest way to determine the pH l evel of water is to test it with a pH meter or test paper. Paper test strips are the least expensive; however, they can be unreliable and can vary by as much as two pH points. A pH meter will provide the most reliable and consistent readings. Meters are available commercially for $50 to $400.

Adjust the water pH by using a commercially available acidifying/buffering agent before adding the pesticide. Buffering agents, such as Buffercide, Buffer-X, Unifilm B, and LI 700 Acidiphactant, will stabilize a spray solution at a predetermined pH and keep it at that level. Read and closely follow the directions on the label of the buffering agent and make sure that the solution is stirred well before taking a pH measurement. While a pH of five may be optimal, a pH of six is usually satisfactory for many pesticides, especially if they will be sprayed out immediately after mixing. Some buffering agents such as pHase5 or PHT indicate five will have a color indicator when the correct pH is achieved. Growers can add this product into the water until it reaches the color that indicates a given pH. For example, five = pink or red; six = orange; etc. Granulated food grade citric acid may be the most convenient and inexpensive acidifying material and is available in 50-pound bags from suppliers that handle food grade chemicals. Two ounces per 100 gallons has been shown to reduce the pH of tap water from 8.3 to 5.4.

When tank mixing multiple pesticides or foliar fertilizers, check the pH after the products have been thoroughly mixed and adjust the pH as needed. Not all pesticides react the same to the pH of the spray water solution and some products should not be used with buffering agents. Always read pesticide labels for any precautions with respect to pH and potential product incompatibility issues. Apply pesticides soon after mixing and avoid leaving pesticide tank mixes in the spray tank overnight. (***Source**: Michigan Fruit Crop Advisory Team Alert, Vol. 23, No. 1, March 18, 2008*)

Upcoming Meetings:

March 18, 2008. **Cornell Soils Workshop: Soil Health & Dynamic Nitrogen Modeling**. Conference Room 102, Mann Library, Cornell Campus, Ithaca, NY. For more information contact Larissa Smith, lls14@cornell.edu or Bob Schindelbeck at rrs3@cornell.edu or see http://nysipm.cornell.edu/press_rel/soil_health_dynamic.pdf.

March 25, 2008. **Berry Pest Management Workshop**, Jordan Hall NYAES, Geneva NY (or via satellite broadcast at additional locations). 8:30am to 4:30pm. Cost $25 includes lunch and proceedings. For more information contact Laura McDermott at 518-746-2562 or lgm4@cornell.edu.

April 15, 2008, **UMass Fruit Team Twilight Meeting**, Cider Hill Farm, Amesbury, MA (http://www.ciderhill.com/)
5:30 PM Farm tour including update on phenology and current pest status.
6:30 PM Speaking program will include updates of current cultural and integrated pest management practices.
Pesticide-license recertification credit (2 hours) will be offered at all meetings. You must be there on time to receive pesticide credits. ***$20/person registration fee. (Except NH meeting.) Light refreshments will be served.***

April 16,2008, **UMass/UNH Fruit Team Twilight Meeting,** Alyson's Orchard, Walpole, NH (www.alysonsorchard.com/)
5:30 PM Farm tour including update on phenology and current pest status.
6:30 PM Speaking program will include updates of current cultural and integrated pest management practices.
Pesticide-license recertification credit (2 hours) will be offered at all meetings. You must be there on time to receive pesticide credits.

April 17, 2008, **UMass Fruit Team Twilight Meeting,** Steere Orchard 150 Austin Ave. Greenville, RI (401-949-1456)
5:30 PM Farm tour including update on phenology and current pest status.
6:30 PM Speaking program will include updates of current cultural and integrated pest management practices.
Pesticide-license recertification credit (2 hours) will be offered at all meetings. You must be there on time to receive pesticide credits. ***$20/person registration fee. (Except NH meeting.) Light refreshments will be served.***

For more info on the Fruit Team Meetings, go to http://www.umass.edu/fruitadvisor/meetinginfo/april08twilight.pdf .

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