

Berry Notes

Prepared by the University of Massachusetts Fruit Team

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Editors Note:

Focus on pruning. This issue of Berry Notes focuses on pruning of berry crops. This is an important practice that should be carried out thoroughly every year. Doing a good job with pruning leads to healthy, balanced and productive plants.

Freeze Damage Assessment: A concern each winter in our region is whether or not perennial plants have suffered winter injury, either from severe cold or from drastically fluctuating temperatures. Knowing how to assess winter injury is an important skill and can guide some pruning decisions. This issue of Berry notes contains some information on what the critical temperatures are in some of our berry crops and how to go about determining if damage has occurred. More information on this topic will be in the March issue of Berry Notes.

The 2010-2011 New England Small Fruit Pest Management Guides will be available for purchase through the New England Vegetable & Berry Grower's Association and State Extension offices by early April. It contains updated label information and pest management recommendations for Strawberries, Blueberries, Raspberries, Currants & Gooseberries, and Grapes. Pricing information has not yet been finalized but will be announced soon via this newsletter and on the UMass Extension Fruitadvisor website at www.umass.edu/fruitadvisor.

Check out the UMass Extension Mass Aggie Seminar Series at: <http://www.umass.edu/fruitadvisor/massaggie/index.html>



IN THIS ISSUE:

Editors Note

STRAWBERRY

- ❖ Managing Root Feeding Insects of Strawberries
- ❖ Winter Freeze Injury to Strawberry Crowns

BRAMBLES

- ❖ Pruning Summer- and Fall-Bearing Raspberries
- ❖ Pruning Black, Red and Purple Raspberries and Blackberries

BLUEBERRIES

- ❖ Blueberry Pruning Brush-up - No Pun Intended!

GRAPES

- ❖ Balance Pruning Grapevines

RIBES

- ❖ Practical Ecology and Management of White Pine Blister Rust in Currants

GENERAL INFORMATION

- ❖ Organic Berry Production Guides now Available
- ❖ Expand Your Fall Market with Berry Crops

UPCOMING MEETINGS

Managing Root Feeding Insects of Strawberries*Richard Cowles, Connecticut Agricultural Experiment Station*

Several species of insects feed on the roots of strawberry plants. Among these are three principal groups: root weevils, white grubs, and the strawberry rootworm. White grubs are larvae of scarab beetles (Japanese beetle, oriental beetle, European chafer, and Asiatic garden beetle); along with strawberry rootworm, these larvae have six legs. White grubs are relatively easily managed with an application of imidacloprid (Admire) at the time of renovation, and immediately incorporated with irrigation. Root weevil larvae are distinctive in being legless. Four species of root weevils can be found in damaging numbers: black vine weevil (BVW), strawberry root weevil, rough strawberry root weevil, and the leaf weevil. The leaf weevil adults are a beautiful metallic green, are sexually reproducing, and are capable of flight. The first 3 species mentioned are very closely related to each other (all are *Otiorhynchus* spp.) and have similar life cycles. They consist entirely of females, which after feeding extensively for about a month, lay eggs in the soil. The eggs hatch into larvae, which feed exclusively on the roots of plants and complete 5 molts before pupating. Late instar larvae and pupae overwinter, then transform into adults about the time that strawberries are ripening. Black vine weevil (1/2 inch long) is about twice the size of the other species and consequently can cause much more damage on a per-grub basis. Because root weevils are much more difficult to manage in strawberries than white grubs, their management is emphasized here.

Monitoring methods

To assess whether you have root weevil problems, take a sample of 100 leaves from across each field. The best time to do this is immediately following harvest, when weevils have had the longest time to feed on the leaves, but before mowing the leaves for renovation. Count the number of leaves with characteristic notches along their edges of the leaves. If more than 50% of the leaves are notched, then you probably should consider spray(s) to control the weevils. In our surveys of strawberry fields in Connecticut, only 1 field out of 48 did not have any evidence of root weevil activity, but only 12 had sufficient populations to be concerned about economic losses from weevil activity. Leaves with holes may signify activity of Asiatic garden beetle (one of the white grub species).

Another sampling method is to walk through the field at night with a flashlight mid-way through harvest. You can then directly observe which species of weevils are present (presence of notched leaves doesn't tell you *which* species is feeding), and whether Asiatic garden beetles are abundant. The presence of only the smaller weevil species indicates that a spray of bifenthrin may be needed, as

these are more difficult to kill with nematodes. An alternative to nighttime observation is to trap weevils in a pitfall trap. Use a thin film of motor oil to coat the top inch of the inside surface of a plastic 18 fluid ounce drinking cup. Set this cup into the soil near injured strawberry plants, so that the top of the cup is flush with the soil surface. Weevils can't fly, so when they stumble into the pitfall trap they cannot climb back out. Predatory ground beetles are also caught, so you can also monitor how active these beneficial predators are in your field.

Check parts of strawberry fields that change color in the fall earlier than the rest of the field – this is an indication of poor root function. Of course, any disorder that causes loss of root function, such as root rot, lesion nematodes, or feeding by white grub or strawberry rootworm will also cause plants to turn red. Dig up the plants to observe whether larvae have been feeding on the roots and check to see what species are present. Finding larvae with legs signifies that an insecticide (Admire) application to target white grubs is justified during the next year.

Control strategies

Foliar sprays to kill adults. Adult weevils must feed extensively at night for about four weeks before being able to lay eggs. This period for BVW coincides with the time that there are strawberry fruits present in the field. Evidence of their feeding can be found as irregular notches along the edges of leaves. This distinguishes root weevil foliar feeding from most other insect pests, which usually chew holes through the leaves. Root weevils have become very difficult to kill with insecticides, probably due to the evolution of insecticide resistance. Furthermore, these foliar sprays can have unintended effects on beneficial insects and mites, making management of root weevils and spider mites more difficult after spraying.

The most effective adulticide currently appears to be bifenthrin, a pyrethroid. Applying bifenthrin virtually eliminates predatory mites; so effective mite control has to be implemented before applying bifenthrin. Be aware that weevils can recover from bifenthrin poisoning if they land in a protected location. Adult weevils may appear to be “dead” for 5-6 days, but may only be knocked out.

A management program entirely dependent on foliar sprays to control adult root weevils is risky. If the weevils are insecticide-resistant, or if they recover following poisoning, then they can still reproduce. If the sprays also eliminate their predators from the field, the root weevils can then reproduce to even larger numbers. Bifenthrin appears especially effective against the smaller root weevils (strawberry root weevil and rough strawberry root

weevil). Growers in some locations have continued to suffer losses from black vine weevil even after applying bifenthrin against adults.

Biological control to suppress larval populations. Biological control of root weevil larvae with insect pathogenic nematodes (EPNs) can be an effective component in an integrated management program where soils are relatively sandy. Heavy clay soils will interfere with insect pathogenic nematodes. Of the several species tested, *Steinernema carpocapsae*, *S. feltiae*, *Heterorhabditis bacteriophora*, *H. marelatus*, and *H. megidis* all have the ability to keep root weevil populations low. The species *Steinernema kraussei*, marketed as Nemasys L, is said to be active against black vine weevil larvae under colder soil temperatures. Most nematodes require minimal soil temperatures of 55 F to find and infect hosts (and for their bacteria to reproduce), while *S. kraussei* is claimed to infect larvae at 40 F. The normal use rates for nematodes are 3 billion per acre for Steinernematids and 1 billion per acre for Heterorhabditids. If you have the ability to band the nematodes directly over the row, you can immediately realize a savings of about 50% of the cost of the application, because you'll reduce the area treated to only the planted rows. Expect to pay ~\$250 per acre for nematodes, but don't expect immediate results. From my experiments, nematodes have worked very well when applied in early May. This has allowed nematodes to have one infection cycle in the spring, leading to sufficient populations of beneficial nematodes in the soil to virtually eliminate the next (fall) generation of black vine weevil larvae. It is unknown whether EPN applications are economically justified where root weevil numbers are already low. They may only work well in causing additional cycles of infection where there is a critically high population density of larvae available to infect.

To use insect pathogenic nematodes, find a commercial source through the web site <http://www.oardc.ohiostate.edu/nematodes/biologyecology.htm>. Much lower application rates may also be effective because nematodes continue to propagate in repeated infection cycles. When you apply nematodes, be sure to take fine screens out of your sprayer, and do not use a sprayer with a piston pump. Irrigate the field before and after nematode application, and avoid application in sunny conditions (the nematodes are very sensitive to UV light). Nematodes can effectively be applied in early May or in late August. Nematodes work especially well against black vine weevil, particularly when there are high populations of larvae. Control is poorer for the smaller root weevil species.

Cultural control

Importance of healthy roots. Researchers elsewhere have determined that strawberry plants can support

approximately 2 larvae per plant without showing any signs of injury. How many larvae a plant can support is determined by the health of the root system. When strawberry plants are growing vigorously and have extensive root systems, root weevil feeding amounts to insignificant grazing. However, when the root systems are poor, perhaps due to root rot or feeding by other insects, then any feeding by black vine weevil can cause the plant to collapse. This is especially true when root weevil larvae are starving for roots, whereupon they resort to feeding on the strawberry crowns, which destroys plant vigor. Planting cultivars tolerant to black root rot and black vine weevil should help to reduce problems associated with these pests.

Exclusion barriers. Fields eventually need to be plowed under and hopefully rotated to an intervening crop before being replanted to strawberries. I have observed that weevils displaced from plowed fields will readily walk through to infest an entire adjacent planting of strawberries, and can cause large outbreaks of weevils. This is especially damaging when the nearby planting is a newly planted strawberry field. One way to avoid this problem is to leave some rows of strawberries completely surrounding the perimeter of a field being plowed under. Weevil adults then are left with a place to feed and lay their eggs, and these last rows can be tilled in September after all the egg laying has ended. I feel that this trap row concept could prevent many of the disasters I have observed in relatively young strawberry plantings. These trap rows could be used in conjunction with an exclusion barrier, which should be more effective than either method used by itself.

Inexpensive plastic film can be used as an exclusion barrier (<http://www.fruit.cornell.edu/Berries/strawpdf/strawberryrootweevilexclusion.pdf>); spray the top with horticultural oil to further reduce the number of weevils able to cross the barrier.

Summary

Strawberry growers can manage white grubs with imidacloprid. This insecticide should be expected to provide other benefits through reduction of plant stress (through a plant growth regulator effect), and reduced populations of tarnished plant bug, spittle bugs, and whiteflies. However, it is only partially effective against Asiatic garden beetle and is ineffective against root weevils. Root weevils can be managed by preventing infestations of new plantings with exclusion barriers, planting tolerant varieties, using a foliar spray of bifenthrin at the end of harvest, and/or applications of insect pathogenic nematodes: none of these approaches are effective for managing white grubs. Therefore, different tools need to be used to manage these two groups of root-feeding grubs. (*Source: New York Berry News, Vol. 9, No. 1, Feb 2010*)

Winter Freeze Injury to Strawberry Crowns

Sonia Schloemann, UMass Extension

Strawberries are susceptible to winter injury in two primary ways. The first is damage to roots from the heaving of soil that can result from cycles of freezing and thawing in the spring. This heaving action can snap roots and lead to problems with root infections in the wounded tissue. The other way in which strawberries can suffer damage in the winter is from freezing of crown tissue.

The strawberry crown is actually a compressed stem structure with layers of vascular tissue that forms a cylinder with vascular tissue running spirally in two directions. (See Fig. 1.) Inside this lignified or woody vascular tissue is a fleshy pith that can easily be injured and turned brown by the formation of ice crystals at low temperatures. The critical temperatures will vary with the variety of strawberry.

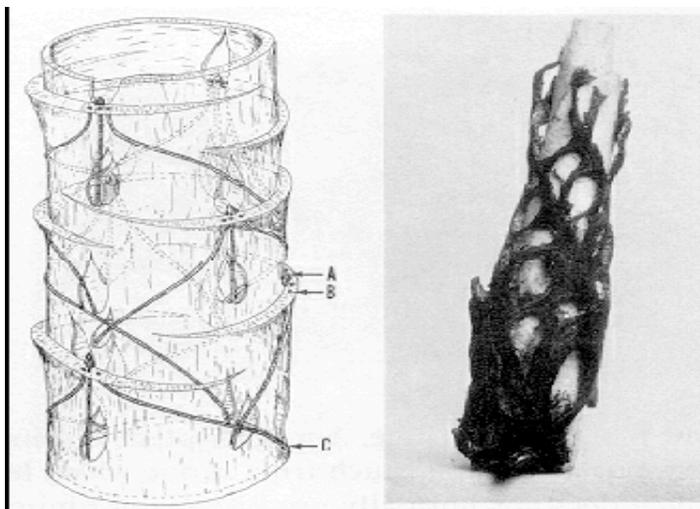


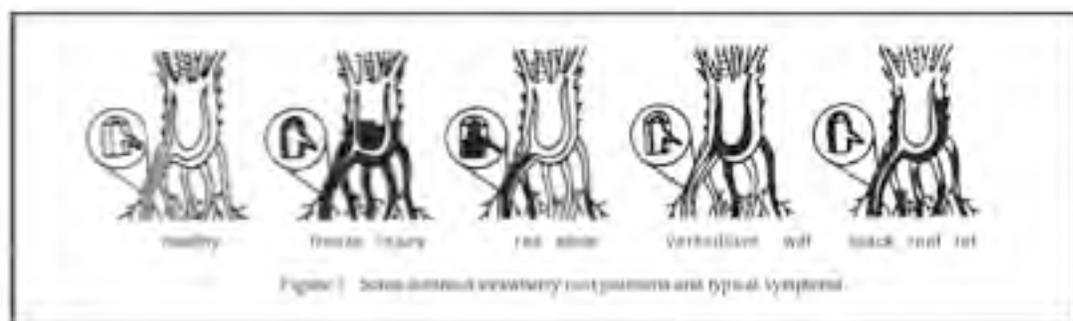
Figure 1. Morphology of the strawberry crown. (from G.M. Darrow, *The Strawberry: History, Breeding and Physiology*; <http://www.nal.usda.gov/pgdic/Strawberry/darpubs.htm>)

Freezing injury is easily seen by cutting the crowns length wise and looking for damaged tissue. (Be aware that if left exposed to air for a while, this tissue will oxidize and turn brown like an apple when it is cut open.). Uninjured pith at the center is a creamy white when first cut. With slight injury to the crown, but not measurable in its effect on the plant, browning of the lower part of the pith occurs.

Moderate injury, seen as a deeper browning, will result in noticeable damage to the plant (i.e., general weakening, slow growth, fewer blossoms and reduced yield). Lethal injury, where vascular tissue has been killed, will exhibit deep browning and blackening of the outer cambium and result in plant death.

If you suspect winter damage in your strawberry field, go out and cut some crowns a week or two after the ground has thawed. If a high percentage of crowns show severe injury, it may be necessary to plow the

field down and enter into a rotation cycle for a few years.



Most of our Northern varieties can withstand crown temperatures of between 10 to 14°F. This is why mulching for winter protection is so important for this crop. At these temperatures, not only is the pith damaged, predisposing the tissue to infection by various pathogens, but the vascular function of the outer layer of cambium tissue can prevent normal transport of water and nutrients in the plant.

This will help purge the soil of high levels of pathogens that may build up on the decaying strawberry crowns. Low levels of damage can be nursed through to better health by judicious irrigation, fertilization and other practices to keep plant stress low. See figures 2 and 3 below for help determining if your plants have winter injury or some other type of crown/root damage. (Reprinted from *Mass Berry Notes*, February 15, 2006 Vol. 18, No. 2)

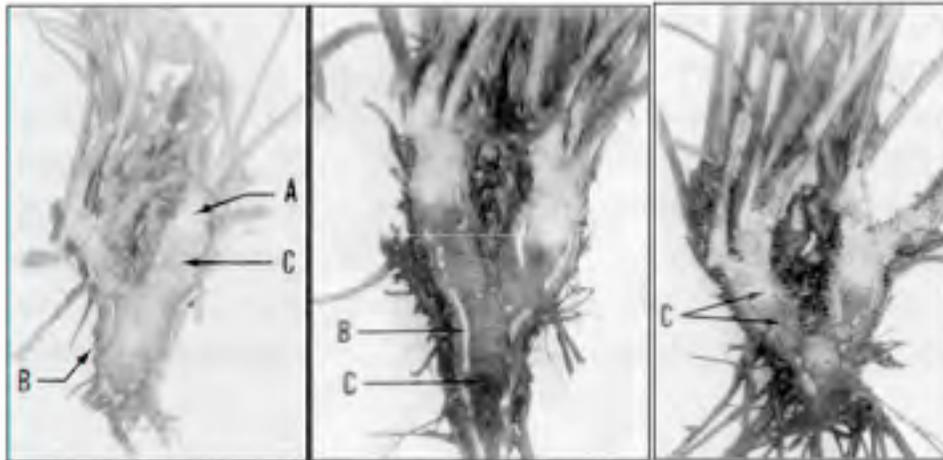


Fig 3. Cold injury to strawberry crowns. Uninjured crowns would have white centers at A. 1. The most serious injury occurs when the cambium that carries sap and food is killed. Slight recovery is shown by new cambium in 1 and 3 at B. Plant 2 would not have recovered. The darkening of the centers of the crowns (C) is caused by the formation of frost crystals that break through the cell walls and oxidation follows, as in the browning of sliced apples. (from G.M. Darrow, *The Strawberry: History, Breeding and Physiology*; <http://www.nal.usda.gov/pgdic/Strawberry/darpubs.htm>)

RASPBERRY

Pruning Summer- and Fall-Bearing Raspberries

Marvin Pritts, Cornell University

Plant growth can be manipulated by growers to achieve long-term increases in production of quality fruit. Pruning affects plant growth rate, fruit quantity and size, soluble solids (sugars), disease susceptibility, ease of harvest, and spraying efficiency. Brambles respond significantly to pruning, but these practices are usually the most expensive and time-consuming part of an operation. Growers must use care when choosing pruning strategies. The following discussion presents different types of pruning methods for primocane fruiting and floricanes that best promote high yields of high quality fruit.

Primocane-Fruiting (fall-bearing) Raspberries

Primocane-fruiting raspberries produce fruit at the top of first-year canes in late summer. If allowed to overwinter, these same canes will produce fruit again in early summer of the second year. However, the quality of this early summer fruit is inferior to both the late summer primocane crop and summer crops of floricanes-fruiting types. Also, harvesting the early summer second-year crop is difficult because of interference from new primocanes. Likewise, harvesting the late summer primocane crop is difficult because the primocanes are thinner and taller when the second-year canes are allowed to grow, too. Most growers sacrifice the early summer second-year crop in favor of a smaller, but higher quality late summer primocane crop. The smaller yield of a single late

summer primocane crop is offset by the ease of management.

To prune primocane-fruiting raspberries for a single late season crop, the canes need only be cut to the ground in early spring. New canes will grow each year and fruit in late summer, the canes will be cut early the following spring, and the cycle continues. It is important to cut old canes as close to the ground as possible so that buds will break from below the soil surface. If canes are not cut low enough, fruiting laterals may form on any remaining cane portion. These fruiting laterals are not healthy; they are entry sites for insects and disease pathogens. Also, any fruits that form will most likely rot, attracting pathogens and creating a source of inoculum (disease-conducting material) for the late summer crop. All canes that are cut from the planting should be removed from the area and destroyed. In warm climates, the primocane crop can be delayed by mowing the young primocanes a second time when they are approximately 1 foot tall. Pinching the primocanes (removing the growing tip) in July to stimulate growth of laterals will also delay fruiting. This is sometimes done to delay harvest until after the intense heat of July.

The timing of cane cutting is also important. Carbohydrates move from plant leaves into the crown in autumn, and from the crown to the buds in early spring. If canes are cut before all the carbohydrates reach the crown in autumn, the new canes may not be as vigorous the following year. Canes can also be cut too late, after carbohydrates have moved into the

buds. From December through February, most carbohydrates are in the crown, so this is the ideal time to cut canes.

Yield of primocane-fruiting types is influenced mainly by (1) the number of canes per unit area and (2) the number of berries per lateral. Growers can influence the number of canes produced by plants. Since large numbers of canes do not seem to decrease fruit size in the fall crop of primocane-fruiting raspberries, growers should try to produce as many canes per area as possible. This can be done by planting narrow rows and more rows per acre. Row widths of 12-18 inches are considered ideal for harvesting. The distance between rows should be wide enough to allow available equipment to pass. The other factor influencing yield, the number of berries per lateral, generally depends on the particular cultivar being grown. The grower has little control except to choose productive cultivars.

Floricanes-Fruiting (summer-bearing) Raspberries and Blackberries

Floricanes-fruiting brambles produce fruit only from buds on second-year canes. Unlike primocane-fruiting raspberries, these canes must remain intact throughout the winter and following growing season, until the completion of harvest. Also, during second-year flowering and fruiting on floricanes, new first-year primocanes are growing. These primocanes interfere with spraying and harvesting, shade the leaves and laterals of floricanes, and compete for water since they share a single root system. This interference must be minimized to obtain a high yield of fruit each year. Five general methods of pruning floricanes-fruiting brambles are described below. Each method will produce different results in the growth of primocanes and floricanes of floricanes-fruiting crops. Also, with the following methods, row widths should be maintained at no greater than 18 inches.

Conventional: No Mowing or Suppression of Primocanes

This training system is traditionally used by bramble growers in the Northeast. Primocanes emerge and are permitted to grow throughout the season. The following year, they become floricanes, flowering and fruiting as new primocanes. Immediately after fruiting, however, the floricanes are cut at ground level and destroyed. Some carbohydrates are lost by cutting canes in summer.

However, this loss is offset by the advantages of reduced disease inoculum and a reduction in dormant season pruning. In early spring, all remaining canes are topped (headed back) to a convenient height for picking, since little vegetative growth occurs in the second season. Canes are thinned to a desired number, usually 3-4 canes per square foot. When thinning, the

most vigorous canes should be selected to produce the next crop - - those with good height, a large diameter, and no visible symptoms of disease, insect damage, or winter injury.

Alternate Year Mowing

Primocane interference among floricanes is reduced by alternately mowing half of the planting to the ground each year during the dormant season. In the spring after mowing, primocanes will emerge and grow without interference from fruiting canes. The following year, the floricanes will flower and fruit. Although primocanes will also grow in the fruiting year, all canes will be cut to the ground during the next dormant season. Advantages of this method are that no detailed cane thinning or pruning is required, and spray material costs are reduced approximately 50%. Disadvantages include a reduction in fruit quality, berry size, and yield of approximately 30% for most cultivars, since only half the planting is fruiting in any one year.

Mowing with Primocane Suppression

The reduction in yield caused by alternate year mowing can be recovered over the short-term by removing all primocanes from the plant row during the fruiting year. The elimination of primocanes after they begin growth is called "suppression." After the first few flushes of growth are removed, primocanes eventually will be allowed to grow. A system that involves mowing in one year, followed by primocane suppression in the second year, is truly biennial - - primocanes grow without interference from floricanes, and floricanes grow without interference from primocanes.

Removing primocanes, however, is not easy. Dinitrophenol products can no longer be used, so growers must find other ways to remove primocanes until new products are developed. Some growers have reported success with Gramoxone, Scythe and Goal. The advantages of this method are the ease of pruning when done in early spring, and a reduction in spray materials cost. Disadvantages are a reduction in yield over the long-term, since only half the planting is fruiting in any one year, and the cost of primocane suppression (labor, materials).

Primocane Suppression without Mowing

The highest long-term yields and largest berry sizes have resulted from a combination of selective floricanes thinning and suppression of primocanes in late. If primocanes are suppressed when 6-8 inches tall, shading on the lower portions of floricanes is reduced. Harvesting is easier because smaller primocanes cause less interference.

Primocane suppression has also been reported to increase hardiness. Since there is less shading and fewer demands for water, fruit size and productivity of lower laterals are increased. Primocanes of vigorous cultivars can still grow to a sufficient height for adequate fruiting the following year.

Primocanes should not be suppressed until the planting is at least three years old. Primocanes contribute large amounts

of carbohydrates to the bramble plant, and repeated suppression will reduce carbohydrate levels. Therefore, suppression should be skipped every third or fourth year to allow the planting to recover from the general reduction in vigor. Weak hills or sections of rows should not be suppressed at all. There are conditions under which suppression of primocanes is not recommended. If a fruit crop load is particularly heavy, primocane growth may decrease naturally as developing fruit demands all the plant resources. Also, if primocanes are suppressed in regions with short growing seasons, they may be too short at the end of the growing season. Suppression is not recommended under the above conditions, or whenever the plant is stressed, such as from a lack of moisture or a nutritional imbalance.

Advantages of primocane suppression are: (1) increases in fruit size and quality, (2) increases in production, and (3) reduced cane numbers. Disadvantages are: (1) longterm reductions in stand vigor and (2) expenses involved with primocane suppression or elimination.

Partial Primocane Suppression

Yield and quality may be increased without suppressing all the primocanes in a planting. Removing all but 4 or 5 primocanes per linear foot of row will increase yield and fruit quality in floricanes of some cultivars. For this method, growers select the primocanes in late spring

which will be carried into the following year for fruiting. Rejected primocanes are cut to ground level when 8 inches tall. The raspberry plant uses resources for the current fruiting canes and the remaining primocanes, rather than for many primocanes which would eventually be removed. Primocane regrowth is ignored until the dormant season when these short canes are removed. Advantages of this system are: (1) selected primocanes grow for an entire season instead of the partial season permitted in complete primocane suppression, (2) rejected primocanes are removed when small, succulent, and easy to handle, as opposed to large and thorny, and (3) fruit size and quantity of current season is increased. The major disadvantages are: (1) primocane selection is difficult when leaves are on the plant, and (2) suppression of undesirable canes requires much labor. (Source: *New York Berry News*, Vol. 3, No.2, Feb. 2004)

Pruning Black, Red and Purple Raspberries and Blackberries

Ray R. Rothenberger, University of Missouri – Columbia

Raspberries produce fruit on 2-year-old canes, which die after the crop has matured. The pruning of black and purple raspberries consists of:

1. Tipping the new canes when they reach a height of 18 to 20 inches, thus forming a branched cane that is capable of producing more fruit than an unbranched cane. Branched canes are also more able to support the crop off the ground than unbranched canes.
2. As the buds break in the spring, the branches on the canes should be shortened to 8 to 12 inches (longer if the plant is supported by stakes or a wire trellis).
3. After the crop is

harvested, the old fruiting canes should be removed at the soil line. (The removal of the old canes as soon as the crop is harvested is a good disease control practice since it removes an important source of infection.)

Pruning red raspberries

Red raspberries should be allowed to produce long, unbranched canes rather than branched canes like the black and purple varieties. The new canes are, therefore, unpruned during their first season's growth. At the start of the second season, they are topped to a height that will permit them to support themselves and keep the fruit off the ground. If the plants are supported by stakes or a wire trellis, they can be pruned to permit more fruiting wood. The old canes die after the crop is matured and they should be removed as early as possible in

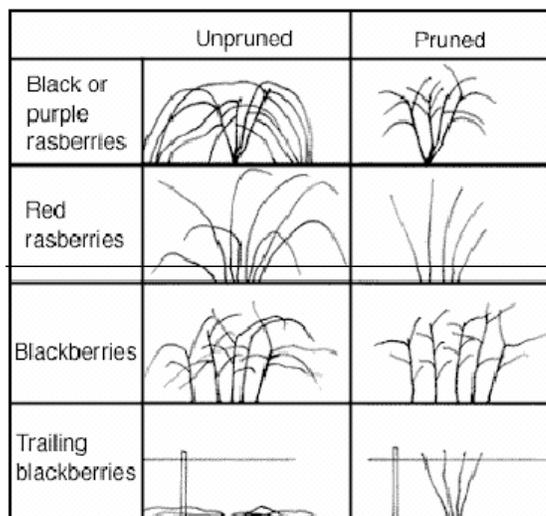


Figure 1. Pruned and unpruned raspberries and blackberries

order to remove sources of disease.

Pruning upright blackberries

Standard American varieties of blackberries are usually able to support themselves without stakes or a trellis. Pruning is similar to that of black and purple raspberries except the canes grow taller. It consists therefore of:

1. Tipping the new canes at a height of 24 to 30 inches to form branched canes.
2. As growth starts, remove all dead and weak canes or branches and head the branches back to a length of 12 to 15 inches or to the degree that the canes can support the expected crop.
3. After the crop is harvested, remove the 2-year-old wood to stimulate the new canes and remove sources of diseases.

Pruning trailing blackberries (Dewberries, Boysenberries, etc.)

Trailing blackberries are not grown extensively in Missouri because of a lack of hardiness and their susceptibility to bramble diseases. Like other brambles, they bear fruit primarily on 2-year-old wood. The one-year wood is usually allowed to grow on the ground where it can be mulched for winter protection. As growth starts in the spring, these canes can be lifted up and tied to a trellis or stakes for fruiting. Weak canes should be removed as well as all dead wood and the stronger canes shortened to fit the trellis or stakes (usually 36 to 40 inches high). After the crop is harvested, the old fruiting wood is removed while the

new wood is permitted to remain on the ground until the next spring (see Figure 1).

Additional suggestions

1. In tipping the new growth of black and purple raspberries and upright blackberries, each cane should have the growing tip pinched out as it reaches the desired height. If several inches of the cane are removed, the side branches are severely stunted.
2. Trailing blackberries and red raspberries should be supported by stakes or a wire trellis to produce maximum crops. The same is true of black and purple raspberries, especially for the first crop (2-year-old plants). These will support themselves fairly satisfactorily after the second year.
3. All brambles in Missouri are subject to several serious plant diseases that are difficult to control. As a result, the plantings are usually short-lived and require frequent replacement.
4. Upright blackberries are frequently affected with a sterility condition in which the plant blossoms normally but produces no fruit. There is no control for this condition and such plantings should be removed.
5. A thorough spray program will assist in producing satisfactory crops of both raspberries and blackberries. (*Source: University of Missouri Ag. publication G6000, <http://muextension.missouri.edu/xplor/agguides/hort/g6000.htm>*)

BLUEBERRY

Blueberry Pruning Brush-up – No Pun Intended!

Cathy Heidenreich, Cornell University

Pruning is one of the few small fruit chores commonly occurring at this time of year. It is also the most “hands-on” task associated with blueberry production, other than harvesting or planting. How to get the most bang for your buck in terms of pruning? Take a minute to review key concepts below before you prune. Fine tune your pruning strategy accordingly to maximize efficiency and minimize cost expenditures both now and later in the season.

Why Prune?

Is pruning just another item on your production schedule to be checked off, or do you really take time to consider what you hope to achieve by pruning? This season, re-focus on the reasons why we prune blueberries. Pruning dollars have direct and indirect

impacts on fruit dollars for the current season, and over the life of the planting. Below are some of the benefits of pruning:

1. Maintains bush productivity and vigor through elimination of older, less productive canes and rejuvenation of new cane growth.
2. Facilitates harvest by developing appropriate growth habit.
3. Increases air circulation, reducing conditions favorable for disease development.
4. Reduces fruit numbers and opens canopy to sunlight, improving sweetness and fruit size.
5. Removes winter-injured, damaged, insect-infested, or diseased plant parts.



Before You Prune

Get your equipment assembled and ready to go. Sharpen all blades. If you are using pruning guns, be sure equipment is fully operational and carry out any routine maintenance that may be needed.

Decide on a pruning schedule, based on your particular planting(s). What variety or planting will you do first? Does this particular variety need special pruning? Pruning stimulates vegetative growth. It follows, then, that weaker bushes will benefit from more pruning than vigorous bushes; they may also require detail pruning as opposed to complete cane removal. Special consideration is needed for varieties with spreading habits. In this case you may be tempted to remove all those canes sprawling into alley ways; care must be taken to leave sufficient canes for fruiting.

Is this a young planting you are pruning for training purposes? Is it an older planting that needs to be rejuvenated? How many canes should be removed from

each plant? Are there insect or disease issues that maybe re-dressed through detail pruning? How will brush from prunings be dealt with?

On to the Main Event

In general, prune to an upright growth habit with an open canopy allowing good light penetration. Do this in four easy steps. First, remove any damaged canes, i.e. winter injury, insect or disease damage, or breaks. Second, remove canes that rub against another cane, to prevent spread of canker diseases. Third, remove older canes and those canes obstructing movement through the alleys. Fourth, remove any short, branched canes within the canopy; fruit on these interior canes generally ripens too late to be harvested. Cut canes to be removed as close to the crown as possible. Avoid leaving stubs which become ideal homes for canker-causing fungi. When branches are removed, make cuts as close as possible to the main cane; avoid leaving short, stubby branches for the same reason.

Plant Stage	Pruning suggestions
1-2 year old plantings	Little pruning required. Promote vegetative growth by rubbing off flower buds in March or April. Alternatively prune off shoot tips where flower buds are located.
3 year old plantings	If more than 2 new canes were produced previous year, leave the 2 healthiest new canes; remove the remaining new canes.
3-8 year old plantings	Continue light pruning, leaving the 2-3 best new canes from previous season, until plants reach full size. Eight year old plants should have 10-20 canes of various ages.
> 8 year old plantings	Annual removal of 8 year old canes. In general, 20% of older wood (1 out of every 6 canes) may be removed without reducing yield. Berry numbers may be lower but fruit will be larger in compensation.
Plantings needing rejuvenation	<p>Strategy 1: Remove old, unproductive canes, leaving 2 or 3 older canes and all younger canes. IN successive years, remove up to 20% older wood until new cane growth occurs. Keep 2-3 new canes and continue to remove 20% oldest canes.</p> <p>Strategy 2: Cut all canes to ground level (delays harvest 3 years). Thin new canes to most vigorous 6-10 canes.</p> <p>Strategy 3: Summer hedge immediately after harvest; selectively remove dormant canes.</p>

Pruning to reduce disease and insect pressure One of the benefits of pruning referred to above is reducing disease and insect pressure. Disease pressure reduction in blueberries is a one-two punch, when it comes to pruning. Two of the most common blueberry canker diseases,

Fusicoccum (Figure 1) and Phomopsis (Figure 2), overwinter in cankered wood. These fungi are also particularly adept at colonizing dead wood, particularly pruning stubs. Removal of cankered canes and avoiding cane or branch stubs during pruning will reduce the number of new

infections occurring during the season. Prune out and burn diseased canes and branches, taking care to remove all infected (brown) tissue below the cankers. Cultural practices (maintaining plant health, minimizing winter injury and early spring frost damage) and pruning out dead wood are



Figure 6. Fusicoccum cankers on cane.



Figure 7. Phomopsis canker, sometimes mistaken for winter injury. Inset: Close-up of fungal spore-producing structures on cane surface.

more important in controlling canker diseases that sprays, so now is your chance! Canker disease severity and spread may be further minimized if new cankers are pruned out as they appear during the growing season.

Pruning further reduces disease development by maintaining an appropriate growth habit and opening the canopy. Cane, leaf, and fruit surfaces dry more

A report of another, less common blueberry disease also surfaced this past season, blueberry crown gall (Figures 3 and 4). This disease is a sporadic problem and is not frequently seen in New York plantings. It is caused by the bacterium, *Agrobacterium tumefaciens*, and may occur in propagation beds and young plantings. It is sometimes found in older plantings as well. If you happen to have this disease in your planting, take some of these precautions



Figure 3. Bush infected with blueberry crown gall.



Figure 4. Close up of gall on cane. (Pictures courtesy W. Bertram)

quickly when good air circulation occurs throughout the canopy/planting, minimizing conditions favorable for disease development. This is true not only for canker diseases, but other blueberry diseases as well.

during pruning:

- 1) Prune bushes during dry weather,
- 2) Frequently disinfect pruning equipment. A 10% bleach solution or 70% ethyl alcohol (shellac thinner) solution works for this purpose,



Figure 5. Scale insects on blueberry cane.



Figure 6. Scale on young twig. (Pictures courtesy G. Loeb, NYSAES-Cornell)



Figure 7. Older stem gall with emergence holes; younger galls to the left and below. (Picture courtesy K. Cox, Cornell-NYASES)



Figure 8. Insect stem gall with overwintering larvae. (Picture courtesy J. Burth, Oswego County CCE)

and 3) Remove and destroy diseased tissue. Insect pressure may also be reduced through good pruning practices. Scale insect infestations are more frequently found in poorly maintained bushes. Good pruning practices go a long way toward reducing scale insect problems. Keep an eye out for the hard -covered female insects on small twigs and branches while pruning (Figures 5 and 6). If scales are present, schedule a dormant oil spray for early spring during bud swell.

Insect stem galls were particularly prevalent on blueberries during the 2006 growing season and several growers reported problems with this insect pest (Figure 7). The tiny wasps overwinter as larvae in the galls (Figure 8). Adult wasps emerge in early June and lay eggs on twigs, causing new galls. Currently there are no products available for control of this insect.

Your only recourse in this instance is to prune out and burn the galls now to reduce your insect stem galls next season. Watch during mid to late June and July for new galls. Prune out and destroy them as they appear. (See a movie on this pest at <http://www.nysaes.cornell.edu/pp/extension/tfabp/movies.htm> .)

Final considerations

Brush removal is an important part of the pruning process. Several options are available depending on the layout of your plantings and available equipment. One method is to chop brush in place using PTO driven

equipment such as Bush Hog or a flail mower. Another option may be to push brush out of alleyways and burn, chop, or chip it off site.

Is the job done? Not quite. What remains is to take time next fall and winter to evaluate how well your pruning strategies for the 2007 worked, and determine what needs to be done in 2008 to keep those pruning dollars yielding better blueberries, and returns on your investment.

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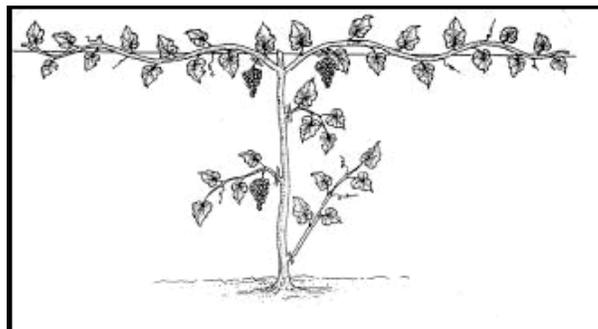
(Source: *New York Berry News*, Vol. 5, No. 11, January 2007)

GRAPE

Balance Pruning Grapevines

Mark Chien, Penn State Cooperative Extension

Pruning is not instinctive. When I look at a rose bush or an apple tree in my yard, I panic. We all know that there is a “right” and a “wrong” way to prune a plant – and most of us are pretty sure we will do it wrong. Pruning your vines is something worth learning how to do correctly. While vines are very forgiving, over time, if pruned incorrectly, their shape can be lost and they will become more disease prone and less productive. Its not rocket science, but does require intelligence, creativity and practice. Every vine is different, and you need to know how to shape and mold each vine to its ideal form. Pruning is the



act and art of making cuts to remove living vine parts. But pruning is also an important cultural practice in the long-term maintenance of your vineyard. Some would argue that it is the single most important part of the annual

vineyard cycle. Its almost impossible to explain how to prune a vine without actually demonstrating how to do it. Therefore, I’ll focus on balanced pruning as a viticultural concept and hope that those who need pruning lessons will attend a workshop.

I would urge every grower to balance prune at least a few vines for every acre of vineyard, if nothing else, just to get an idea of the general vigor of your vines. This information, along with petiole and soil tests, and you own astute observations, can help you plan an effective strategy for managing your vineyard. It will also help you to make critical decisions regarding any future

planting you may do.

The objective of balance pruning is to make the major step towards achieving a balanced vine in the coming growing year. A vine in balance is one whose vegetative

and reproductive functions are in equilibrium. If you can achieve this utopian vine condition – you will likely harvest ripe fruit and have a healthy vine that will age gracefully and survive the winter. A vine’s size is determined by the sum of all its contributing parts – roots, shoots, and permanent wood. As a matter of convenience, only the new growth can be measured, so the number of nodes left after pruning is correlated to the amount of wood that is removed. For an excellent explanation of vine balance please read Stan Howell’s treatise on this subject titled “Grapevine Crop Control” in the Sept/Oct, 2000 issue of Wine East magazine.

Most of us have wrestled with over-vigorous vines. The reasons why these vines often do not produce high quality fruit are well documented. Fortunately, contemporary viticulture technology in the form of rootstocks, divided trellis systems, deficit irrigation and many other practices allow growers to bring vines into balance in awkward sites. Each winter a vine sheds up to 90 percent of its previous year’s wood. The quality and quantity of what remains is of critical concern to both the vine and the grower. The number of buds that a pruner leaves will directly influence crop load and vine vigor in the coming year. – and thus the quality and quantity of fruit, bud fruitfulness, disease incidence and more. To balance prune a vine is to make an attempt to equate the number of nodes retained at pruning with vine capacity, the goal being to maintain a balance between vegetative growth and fruit production. This idea was first proposed by Nelson Shaulis at Cornell in the 1940’s, and has persisted to this day as a key concept in the production of high quality wine and juice grapes.

The idea has since been refined by disciples of Dr. Shaulis, most notably Richard Smart from Australia. Brian Freeman does a good job of describing balanced pruning as a way of quantifying the intuitive process of an experienced pruner. When standing in front of a big vine, it makes sense to leave more buds to allow the growth of that vine to spread out. Conversely, a wimpy vine will have to be pruned “harder”, i.e., to fewer nodes, in order to stimulate the growth of those shoots. In the classic balanced pruning formula, a set of recommendations is given for specific varieties – but these can be adjusted over time for your vines. For example, for Concord the formula is 30 plus 10. That means for the first pound of pruning weight – the measured amount of one-year old wood you remove from your vine – you should leave 30 nodes/ The “plus 10” refers to the number of nodes you should leave for each additional pound of pruning

weights. Numbers are given for many varieties on a 20 + 20 basis. Lider et al recommends 10 + 10 for Chardonnay based on California growing conditions. Because of their relative delicacy, it is suggested that vinifera vines be double pruned – leaving twice the number of necessary nodes on the first pass, and fine tuning once the threat of winter injury and/or frost damage has passed. It’s important that only count be used for pruning decisions.

Spurs typically have basal buds that can produce additional, often non-fruitful shoots. Native and vinifera varieties usually don’t produce many adventitious buds, but some hybrid varieties, like Seyval, are notorious for overproducing. Many growers regularly shoot thin extra shoots between budbreak and bloom.

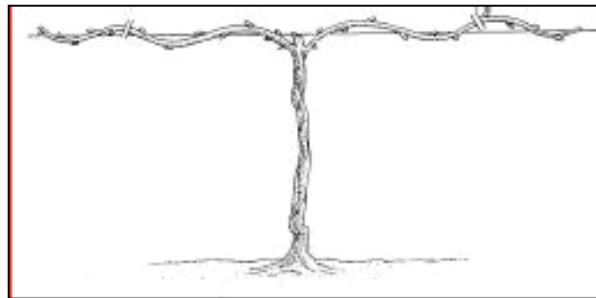
Richard Smart has formulated his own Golden Rules that provide a guide to achieving a balanced vine. Rule #1 recommends 12 – 16 buds per pound of pruning weight. The second rule is to have four to five shoots from count bud positions per foot of canopy. If you have more than this, you need to thin out excess shoots. He notes that these two formulas can be in conflict with each other. The

trick is to figure out how to get the node number in rule 1 into the space allocated in rule 2. In a vigorous vine situation, this often means dividing the canopy or removing vines to increase the linear part of the equation.

You may wonder what good balance pruning will do for you once your linear vine spacing is already established once the trellis is in the ground. Good questions. If you are getting

node numbers far beyond what your trellis can accommodate (approx. 0.4 lbs/ft), it may be time to consider splitting the canopy, if possible – at the least, take measure to devigorate your vines. If the numbers are low, then you should consider ways to invigorate your vines, or perhaps interplanting. Again, the goal is to achieve balance between the vegetative and reproductive needs of the plant.

There are other important indicators of vine capacity you may wish to use to determine your pruning level. Cane weight and length can be instructive. Smart and Coombe estimate a cane weight for a moderately vigorous vine at 0.75 – 1.5 ounce per cane. Average length would be 15 to 20 nodes. I suppose a person could spend the entire winter taking measurements from vines and a) never find the perfect vine and b) never get around to actually pruning the vines. All of these numbers are pertinent and useful guidelines as you gain you own feeling about the capacity of your vines. In the vineyard I managed we had distinctive areas of similar vine size and would measure vines in each zone and prune accordingly. We might balance prune five vines in an acre just to get an idea if



Illustrations from Washington State University; Spokane County website <http://spokanecounty.wsu.edu>

our bud counts were in the ballpark, Please buy a reliable pocket hand scale - you can find one by looking under hanging scales in your favorite search engine (go to fishing scales), a 2 – 3 pound maximum scale is fine, as long as it reads in ounces.

Finally, the inevitable disclaimer. It is impossible to absolutely quantify viticulture into a simple set of numbers and formulas. Your accumulated experience with your vineyard is more valuable than anything you may read here or anywhere else. Use your intuition as a guide. Do not be afraid to experiment with pruning levels, trellis systems, training systems, canopy management techniques and whatever other tools or concepts are available to the modern grape grower that will enable you to produce the best quality wine grapes possible from your vines. That's the challenge, and the fun part of

growing wine. For printed pruning instructions and more details about balanced pruning, please refer to the following excellent reference resources:

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2. **Mid Atlantic Wine Grape Growers Guide.** T. Wolfe and B. Poling. <http://www.ces.ncsu.edu/resources/winegrape/>
3. **Sunlight Into Wine.** 1991. Richard Smart. Winetitles. Adelaide, Australia. ISBN 1875130101
(*Source: PennState Grapevine Newsletter, Winter 2007*)

RIBES

Practical Ecology and Management of White Pine Blister Rust in Currants

Kerik D. Cox and Steven McKay, Cornell University

White Pine Blister Rust in NY

White pine blister rust (WPBR), caused by the fungus *Cronartium ribicola*, is a disease of white pine that greatly impacted the white pine industry in the United States. Like other macrocyclic rust diseases (cedar apple rust, wheat stem rust), WPBR needs two hosts in order to complete its life cycle. The hosts in the life cycle of WPBR are pine and members of the *Ribes* genus (currants, gooseberries, etc.). The most common strategy for eliminating this type of rust disease is to kill off one of the two hosts. In the case of WPBR, it was decided that the Pine industry was more valuable than *Ribes* production and as early as April 1917, *Ribes* quarantine and eradication legislation was beginning to be put into effect. From 1961 to 1967, there was a more extensive *Ribes* eradication effort in the US (2, 6). This effort was quite successful in the eastern United States to the point where it was believed that wild *Ribes* posed little danger to the pine industry (2). Eventually, the federal ban on currant production was removed due to the development of rust resistant pines (1, 3). However, individual states still impose severe regulations or bans on currant production. Despite the availability of new scientific data and management practices to mitigate dangers to the pine industry, no revisions to state restrictions on were made for some time (2). In New York, planting restrictions on currant production were first discussed in 1998 (7, 8) and restrictions were slightly revised recently in 2003. Rust resistant and immune *Ribes* varieties do exist, but are often less horticulturally desirable than highly susceptible black currant varieties



such as Ben Alder (1). Because of these varietal concerns, the New York State Department of Environmental Conservation has established both currant fruiting and currant

quarantine districts (www.dec.state.ny.us/website/reg/s/part192.html) to allow some currant production in New York.

Currants produce extremely high levels of antioxidants and vitamin C (4, 5), and are becoming increasingly popular according to a report from the New York Farm Viability Institute (10) (<http://www.nyfarmviability.org/press-07-26-06.htm>). Previously, the crop profile for currants in

New York State in 2000 (www.ipmcenters.org/cropprofiles/docs/nycurrants.html) listed total bearing acreage for currants as approximately 9 acres (9). Currently, growers such as Greg Quinn of the Currant Company LLC (<http://www.thecurrantcompany.com/>) and Curt Rhodes of R.H. Rhodes and Sons Inc. are reported to have more than 15 acres each planted to black currants (9, 10), and are continually expanding.

Practical Ecology of White Pine Blister Rust

Understanding the life cycle and ecology of WPBR and the two hosts needed for its survival has led to management practices that are effective for controlling the disease. The disease is also controlled to some extent by environmental factors and even gnats that eat the fungus present on *Ribes* leaves.

Environmental Considerations

- Hot temperatures in the summer can actually kill the infections on *Ribes* leaves preventing further spread of the

disease between *Ribes* plants and preventing the development of sporidia which infect pines. White pines have a 20% rate of resistance to WPBR in trees from unselected seed sources. This is increased to as much as 50-75% by selecting seeds from resistant trees. There are no known cases of WPBR overcoming the resistance genes in *Ribes*. Resistance can be lost in pines, however.

- WPBR infections must have cool temperatures in the 60 to 70 oF range and moisture for 2 weeks to produce the telial columns which produce sporidia in the fall which can infect moist pine needles and become established on the trees. In a dry, warm year infection potential is less, and in a moist cool year infection potential is greater, and even possible in the summer.
- Climate zones have been defined where pines live. They are zones 1 (least likely to be infected) to zone 4 (most likely to have conditions for pines to be infected in the Fall). Arborists say that planting of susceptible *Ribes* is least problematic for pines in zones 1 and 4 since in zone 4 they will not become infected, and in zone 1, pines shouldn't be planted due to the high probability that they will become infected from wild *Ribes*.
- Sporidia produced on telial columns on *Ribes* leaves travel from the *Ribes* to pines in Fall normally only travel about 1,000 feet maximum. Pine seedlings are the most at risk, and a border of 1000 feet free from susceptible *Ribes* plants is recommended for nurseries and Christmas trees.
- 99% of infections on pines take place on the lower 9 feet of the trees. Infections that develop at least one foot from the trunk cause death of the branch, but the cankers do not grow back to the trunk.
- Gooseberries seldom have infections that develop spores that can infect pines.

Management Practices to Protect Pines

- Plant a high population of pine seedlings and rust will rogue susceptible trees. Excess trees are thinned out later.
- Plant trees in microclimates less likely to have dew in the Fall. Plant in zones 1 and 4.
- Plant immune *Ribes* varieties and pines from seed selected from resistant trees.
- Plant trees in areas with overstories to avoid free moisture and infections.
- Plant *Ribes* at least 1000 feet from pines.

White Pine Blister Rust Management Trials in Geneva

Now that currants are back on the table, is WPBR still an issue? There are a lot of excellent currant and gooseberry varieties, but not all of them are rust immune. Although we didn't mention it above, WPBR is also devastating to the currant host. Planting highly rust susceptible varieties is still not allowed in NY, but even some of the resistant varieties get some WPBR infection. Over the past seven years, the Geneva experiment station has conducted

WPBR management trials on currants and gooseberries across a range of susceptibility to WPBR. Early work focused on conventional pesticide programs and timing while more recent work focused on the management potential of organic and biopesticide programs.

A bulleted results summary of our trials follows Highly rust susceptible currant varieties:

- Can be successfully managed using a 4-5 applications of DMI or QoI fungicides. Unfortunately, the 2ee for Nova 40W (DMI) is still in effect, but the 2ee does not apply to the replacement product Rally 40WSP. Cabrio EG is the remaining registered material for WPBR in currants.
 - Can be managed to low level of infection using a 4-5 application program biopesticides and organic fungicides including materials such as Serenade Max, ProPhyt 4L, and JMS Organic Stylet oil.
- Rust resistant to less susceptible currant and gooseberry varieties:
- Can be rust free using a 4 application program of DMI or QoI fungicides (Nova 40W and Cabrio EG see above).
 - Can be rust free using a 4-5 application program biopesticides and organic fungicides including materials such as Serenade Max, ProPhyt 4L, and JMS Organic Stylet oil.

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(Source: *New York Berry News*, Vol 8., No. 3, March 2009)

Pruning Gooseberries and Currants

B. C. Strik and A.D. Bratsch, Oregon State University

Prune when the plants are dormant in late winter. Red currants and gooseberries fruit in a different way from black currants, so you should prune them differently.

Red currants and gooseberries

These produce most of their fruit on spurs that are located on 2- and 3-year-old wood. Canes (stems arising from the base of the plant) that are 4 or more years old are no longer productive; remove them when you prune. After pruning, a healthy bush should have 9 to 12 main canes--3 to 4 each of 1-, 2-, and 3-year-old canes. Remove all canes older than 3 years and canes that are damaged or diseased. Prune to form an open center and remove canes that are low to the ground.

After planting, a yearly pruning schedule would look like this:

Year 1. At the end of the planting year, remove all but 6 to 8 of the most vigorous canes during the dormant period. Make your pruning cuts as close to the ground as possible.

Year 2. At the end of the second season, leave 4 or 5 new 1-year-old canes, and keep 3 or 4 of the 2-year-old canes.

Year 3. Keep 3 to 4 canes each from 1-, 2-, and 3- year old growth.

Year 4. At the end of the fourth and following years, remove the oldest canes and keep 3 to 4 new 1-year-old canes to replace the older canes you removed.

Black currants

Black currants produce best on 1-year-old wood. Strong 1-year-old shoots and 2- or 3-year-old canes that have an abundance of strong 1-year-old shoots are the most productive.

When you prune, keep a total of 10 to 12 canes per mature bush -about half should be 1-year-old shoots. You can leave a few more shoots if the plant vigor is very high. Remove all shoots that are more than 3 years old. Make your pruning cuts close to the ground.

Because black currants bear most of their fruit on 1-year-old wood, you can prune them to produce on alternate years. In this system, prune plants to the ground during the dormant period. This causes the plant to produce many new shoots; no fruit will be produced the season after pruning. Don't prune the plants in the next dormant period, other than removing diseased wood or weak growth.

The following year, they fruit on the 1-year-old wood. Prune your plants to the ground again the following dormant period, repeating the cycle. In this system you get fruit produced every other year on a particular plant. To get fruit each year, you can have half your plants fruiting in one year and the other half the next.

If you're growing black currants in a hedgerow, it's simplest to follow the alternate-year pruning method. Training to a trellis. Currants and gooseberries can be grown as a fan-shaped bush on a trellis. Plants trained this way look attractive and produce a good crop of well colored fruit. To train to this system, plant rooted cuttings along a trellis with 3 to 5 wires. Space single plants at 3 to 4 feet. Tie side branches to the wires as they develop. To develop a narrow fruiting wall, use the pruning techniques mentioned for the type of currant or gooseberry you're growing. This system requires a lot of labor and patience—only gardeners with a lot of experience should try it! (*Source: Oregon State University Home Horticulture Publication EC 1361, online at <http://extension.oregonstate.edu/catalog/html/ec/ec1361/>*)

GENERAL INFORMATION

Organic Berry Production Guides now Available

Mike Orzolek, Penn State University

The New York State IPM Program announces publication of two new organic berry guides: 2010 Production Guide for Organic Strawberries, and 2010 Production Guide for Organic Blueberries.

Guide topics in the guides include soil health, site selection, cover crops, variety selection, nutrient management and organic IPM. The guides were written and edited by



Juliet Carroll, Marvin Pritts, and Cathy Heidenreich with contributions from Kerik Cox, Greg Loeb, Andrew Landers, Paul Curtis, Michael Helms, Courtney Weber, Laura McDermott, Elizabeth Thomas and Teddy Bucien, and funded in part by the New York State Department of Agriculture and Markets. The free publications are available as a pdf file for reading, printing or downloading.

There are now a dozen organic production guides for fruit and vegetable crops available from the NYS IPM

program. You can find them at: www.nysipm.cornell.edu/organic_guide.

Expand Your Fall Market with Berry Crops

Steven McKay and Cathy Heidenreich, Cornell Cooperative Extension

There are several specialty small fruit crops that may be added to commercial berry operations in order to expand the fall berry market. These include Aronia, and elderberries, hardy kiwifruit, primocane-fruiting blackberries, dayneutral strawberries, and cranberries. Commercial production of these crops is beginning to catch on in NY and you may want to consider adding one or more of these to your small fruit repertoire. They are also an excellent compliment to other fall crops such as apples, pumpkins, squash, and other fall ornamentals. What follows is an overview of these small fruit crops. For more in depth information on commercial production of these and other small fruit crops visit: <http://www.fruit.cornell.edu/berry.html>.

Aronia - Aronia (black chokeberry) is a member of the Rosaceae family, and the cultivars used for fruit production are from the species *Aronia melanocarpa*. 'Viking' and 'Nero' are cultivars that are commonly available in North America; cultivars are self-fertile.

Aronia is adaptable to a wide variety of neutral to slightly acid soils. Less fertile soils are desirable to keep plants smaller in size. It is suggested that plants be placed 0.8-1.0 meters apart and mulched with plastic to prevent weed growth. Plastic can be removed after two to three years as plants sucker and fill in the hedgerow. At five to seven years, selective pruning is done to remove the oldest, thickest branches, and keep the center open. Frost protection is not necessary since plants bloom so late, mid May in New York. Aphids on shoot tips, and leaf-eating beetles are possible pests, but plants are so vigorous that pest damage does not have much of a negative effect. Fire blight is a potential problem, but has not been reported as such.

Aronia is mechanically harvested between August and September. Five to ten tons per hectare can be expected in about five years, once plants have matured. Some yield can be expected in the first years, but plants often have weak branches that fall over in the ground.

Elderberries – Elderberry is a member of the family Caprifoliaceae with 13 species native to North America. Commercially, we are interested in *Sambucus nigra L. ssp. canadensis* (North American, formerly classified as a separate species), and *Sambucus nigra L.* which is native to Europe. The fruit clusters (cymes) of the *S. nigra* cultivars are larger than those of *S. n. canadensis*. In addition, some of the *S. nigra* cultivars have superior growth habits. Elderberries are only partially self-fruitful, and planting of two or more varieties within 60 feet of one another is beneficial. It is assumed that any pair of cultivars will function as mutual pollenizers.

Elderberry prefers a sandy to heavy loam soil with a pH of 5.5-6.5. It is recommended that plants be set out at 0.75 to 1.0 meter spacing, and that every other plant be removed after three to four years. This will improve chances of getting an economic return faster. The 'Samdal' and 'Samyl' cultivars have a nice growth habit where they throw canes from the base every year in good numbers. Six to eight canes are maintained per plant to fruit the following year. Flowering takes place in mid June in New York. In the fall after fruiting, the spent canes are removed, and a rotation is maintained. This way, canes are never left for more than a year, and plants are maintained as a five to seven foot bush. Aphids, leaf wrinkling mites, birds, cane borers, mildew, and botrytis blossom blight can be pest problems. Tomato ringspot virus has been a problem in the past with *S. n. canadensis* cultivars, but is less of a problem with *S. nigra*.

Elderberry is picked by hand in the US, although mechanical harvesting is a possibility. Twenty tons per acre are produced in Denmark, while four to twelve tons per acre are recorded in New York. The *S. nigra* cultivars are higher yielding, especially when grown as hedge-rowed bushes. Fruits are picked as whole cymes and frozen until ready to use. A premium is paid for stem-less frozen berries. Harvest takes place from August through September. Flowers can also be harvested around June 15 and sold fresh, or processed.

Hardy kiwifruit - Another small fruit delicacy ripening in fall is hardy kiwifruit (*Actinidia arguta* or *A. kolmitka*). These emerald green, grape sized fruit are not hairy like their Kiwi cousins and may be eaten whole, skin and all. Hardy to zones 3 and 4, they are a sweet and flavorful addition to a fall fruit or cheese plate. Grape growers may find these vine crops an easy addition to their operations as they are best grown on a trellis system. Both male and female vines must be planted together at a ratio of approximately 1 male for every 10 female plants. Hardy kiwifruit are not for the impatient berry grower as they do not produce fruit until years 4 to 6. Once hardy kiwifruit begin fruiting however, they more than compensate for their delay in maturity. Recorded yields indicate a single plant may produce up to 300 lbs of fruit annually. Hardy kiwifruit maintained in cold storage remains in good condition for 2 to 3 months, further extending the marketing window for these luscious, bite-size beauties. With no significant pest problems, they are also well-suited to organic production.

Day Neutral Strawberries - Day neutral strawberry production is an excellent way of extending your strawberry harvest through midsummer into early fall.

These berries are uniquely different from their traditional June-bearing cousins as they are insensitive to day-length, flowering and fruiting continuously when temperatures are moderate (June through October). Day neutrals are typically planted at a density of 20,000 plants/A. They may be grown in annual or perennial production systems. Annual production is perhaps best accomplished on raised beds with plastic mulch. Another annual production system used by some growers is a hydrostacker system.

Perennial production may also be done on plastic or in more traditional matted row systems. Perennial plantings are typically fruited for only 2 seasons as pest management problems build up rapidly over time. In both systems, flowers are typically removed for the first 6 weeks after planting; runners are removed as they appear for best production. Suggested varieties include 'Seascape', 'Albion', 'Tribute', and 'Tristar'.

Consumer education is needed whether day-neutral production is to be a u-pick operation or they are to be sold retail; consumers do not traditionally expect to pick NYS strawberries after July 4th. Day neutrals enjoy excellent success when grower harvested and sold through farm stands, farmers' markets, grocery chains, restaurants, etc.

Cranberries - Cranberries are another unique berry crop for extending your fall harvest. Soil pH for cranberries should range between 4.0 and 5.0; sulfur should be added to make the adjustment. A planting machine and a weighted roller are used to set unrooted cranberry cuttings at a density of between 1 and 1.5 tons of cuttings to the acre. These cuttings root easily if properly watered; each stem produces up to 200 uprights per square foot. New plantings need to grow three years before they will bear harvestable fruit; full production should be reached in year four. Once established, an acre of wellmanaged cranberries will produce fruit indefinitely, yielding approximately 20,000 lb berries annually. Overhead irrigation is essential both for good growth and frost protection. Pest management concerns are relatively low; pests of concern to date in NY include black-headed fireworms and weeds.

Cranberry acreage in NY is now at approximately 260 acres and includes both bog and upland production. Bog cranberry production is currently centered in Franklin County (60 acres). Heavy clay soils there naturally impede the vertical movement of water, forming an

impermeable base layer for the bog, allowing it to be flooded for harvest and for winter protection. Once a site is leveled, 6 to 8 inches of sand are placed on top of the clay base layer, providing sufficient drainage for proper aeration, root development and prevention of Phytophthora root rot. Bog cranberries may be hand harvested for fresh fruit; bogs are flooded for mechanical harvest for processing (frozen fruit for juices, other value-added products).

Upland cranberries grow best in areas of the state where snow cover provides consistent winter protection for plants. Current upland production (200 acres) centers in Oswego County, NY. Upland cranberries may be hand-harvested (with rakes) for fresh fruit or machine (dry) harvested and shipped to commercial processors for "sweet and drieds" (craisins).

Primocane-fruited blackberries – In contrast to the florican-fruited blackberries, primocane blackberry fruit is borne on canes produced during the current growing season. Newly released primocane varieties include 'Prime Jim' and 'Prime Jan'.

Select sites that have good internal water drainage along with an ample supply of high-quality irrigation water. Well-drained sandy loam soils with a pH of 6.0 to 6.5 are ideal. When starting from tissue culture plants (2 ft in-row spacing, 10 ft between row spacing) do not expect a commercial primocane crop the planting year. Allow plants to grow un-trained and un-manipulated during the planting year using a simple 2-wire trellis system (wire spacing 1 ft, 5.5 ft) to reduce wind breakage and bending over of vigorous canes. Weed management may be done using preemergent herbicides and/or mechanical methods. Row width should be maintained at 18' using cultivation. Soil moisture should be maintained weekly through drip irrigation.

Recent research indicates primocane blackberry berry weight may be increased 33% when primocanes are double tipped (soft-tipped at 20" then subsequent laterals soft-tipped at 20" in length). The same research indicated high tunnel production also increased yield as well as offering a method of season extension (3 weeks) and winter protection for primocane-fruited blackberries. Double-tipping/protected production (tunnel) gave the most favorable response in growth, time of harvest, and yield overall. (*Source: New York Berry News, Vol. 9, No. 1, Feb 2010.*)

UPCOMING MEETINGS:

February 24-26, 2010. *North American Raspberry & Blackberry Conference*, Monterey, California, preceded by preconference tour. More information: <http://www.raspberryblackberry.com/>.

February 26, 2010. *Hudson Valley Fruit Program, Processing Berry Meeting*, Holiday Inn, Kingston, NY. More information: Peggy 518-828-3346.

March 2, 2010. *Massachusetts Farm Wineries and Growers Assoc. Annual Meeting*, Time: 8:00 AM – 4:30 PM,

Hopkinton Country Club, 204 Saddle Hill Road, Hopkinton, MA 01748. For more info contact Kim LaFleur at 781.585.1999 or leesidemini@gmail.com

March 2, 2010. *Berry Production in Northern NY*, Clinton County Cooperative extension, Plattsburg, NY. More information: Amy Ivy, adi2@cornell.edu or call 518-561-7450.

March 3, 2010. *Berry Production Short Courses*, sponsored by the Capital District Vegetable and Small Fruit Program, Voorhesville, NY. More information: Laura McDermott, 518-746-2562 or lgm4@cornell.edu.

March 4, 2010. *3rd annual Small Farms Summit*, Ithaca, NY, and other locations by videoconference. **Central NY** (Ithaca): Violet Stone, vvs7@cornell.edu, or 607-255-9227, **Eastern NY** (Albany County): Tom Gallagher, tjg3@cornell.edu, or 518-765-3500, **Northern NY** (St Lawrence County): Bernadette Logozar, bel7@cornell.edu, or 518-483-7403, **Western NY** (Erie County): Lynn Bliven, lao3@cornell.edu, or 585-268-7644

March 15-16, 2010. *New England Farm Energy Conference*. Radisson Conference Center, Manchester NH. See <http://www.uvm.edu/vtvegandberry/meetings/FarmEnergy3-10.pdf> for more info. QUESTIONS or would like to REGISTER by phone or email, PHONE: (802) 524-6501 EMAIL: heather.darby@uvm.edu

March 19, 2010 - *Specialty Crop Tour*, Young Grower Alliance (YGA), Flinchbaugh's Orchard and Farm Market, York, PA and Weaver's Orchard, Morgantown, PA. Contact Katie Ellis, (717) 334-6271, kag298@psu.edu

March 30, 2010. *2010 Ontario Strawberry School*, Newtonville, Ontario, Canada. More information: email info@ontarioberries.com. By phone: 613-258-4587.

June 22-26, 2011. *10th International Rubus and Ribes Symposium*, Zlatibor, Serbia. For more information contact: Prof. Dr. Mihailo Nikolic, Faculty of Agriculture, University of Belgr, Belgrade, Serbia. Phone: (381)63 801 99 23. Or contact Brankica Tanovic, Pesticide & Environment Research Inst., Belgrade, Serbia. Phone: (381) 11-31-61-773.

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