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SHORTS:

2017 Mass Aggie Workshop Series now posted – The 2017 line-up is set. This popular hands-on workshop series kicks off in February with '*Pruning Grapes – a hands-on workshop'* and wraps up in April with '*Edible Landscaping with Fruit'* Along the way you can learn about '*Pruning Blueberries'*, '*Apple Tree Grafting'*, '*Pruning Raspberries & other Bramble Fruit'*, and '*Home Orchard Pest Management'*, among other topics. Check out the Mass Aggie registration site and see what you might like to learn more about.

USDA's National Agricultural Statistics Service (NASS) Preparing the Mail List for the 2017 Census of Agriculture – New Farmers Encouraged to Respond – Your help is needed to make the 2017 Census of Agriculture as accurate as possible. A major challenge is having a list of farms that is as complete as possible, especially with so many new farmers. If you have never received a Census of Agriculture or survey questionnaire from NASS then NASS may not have you on their farm list. Please take a couple minutes and provide NASS your contact information at www.agcounts.usda.gov/cgi-bin/counts/. If you have previously received a Census of Agriculture or survey questionnaire from NASS then you will receive a 2017 Census of Agriculture questionnaire in late 2017/early 2018. Your cooperation is appreciated. For questions, please contact Gary R. Keough, 603-227-3129, Gary_Keough@nass.usda.gov.

Spotted Wing Drosophila (SWD) management webinars – recordings of these informative webinars can be found at:
Making the Most of Your Insecticide Toolbox to Manage SWD:
https://www.youtube.com/watch?v=nV4Yb6_DiHw&feature=youtu.be
and
Management of Spotted Wing Drosophila using Organic Strategies:
http://articles.extension.org/pages/74034/management-of-spotted-wing-drosophila-using-organic-strategies

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.

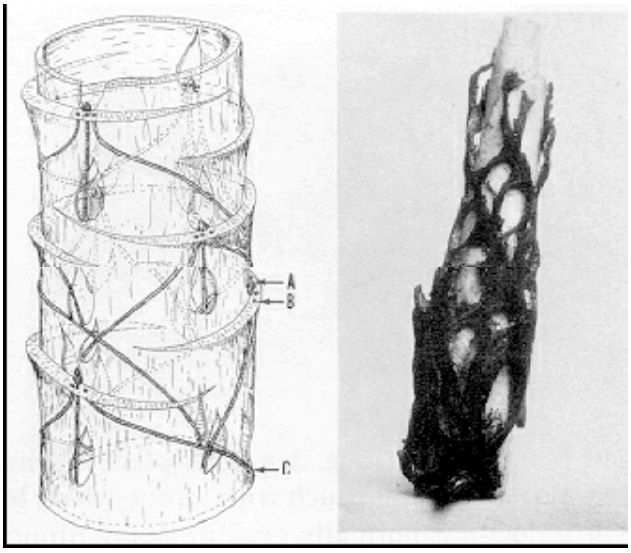


***Figure 1**. Morphology of the strawberry crown. (from G.M. Darrow,The Strawberry: History, Breeding and Physiology; http://www.nal.usda.gov/pgdic/Strawberry/darpubs.htm)*

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.

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.

This will help purge the s oil 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. (*Reprin*

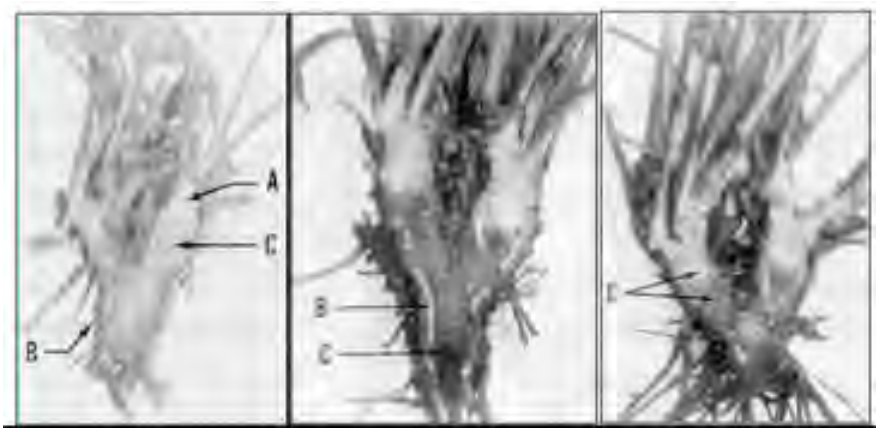


***Fig 3. Cold injury to strawberry crowns**. Uninjured crowns would have white centers at A. 1. The most serious injury occurs when the cambium that carries sap and food is killed. Slight recovery is shown by new cambium in I and 3 at B. Plant 2 would not have recovered. The darkening of the centers 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)*

Winter Injury in Brambles

Rich Marini and Kathy Demchak, Penn State University

Although the earth is warming as a whole as a result of climate change, the weather is also becoming more variable resulting in early-winter cold snaps, winter thaws followed by extreme cold events, and early spring bloom followed by frosts.

Cold-injured primary blackberry bud (left) and uninjured secondary bud (right). ***Photo credit****: Fumi Takeda, USDA-ARS-AFRS*

The net result of these types of weather events is cold injury to many perennial crops. During the fall of 2015, after a brief cool-down, temperatures fluctuated considerably. Unusually warm temperatures occurred in December in PA mainly because a bend in the jet stream allowed warm air from the South to spill into the Northeast.

Winter injury in brambles (raspberries and black berries) is often expressed as dieback of the terminal ends of the canes or dead buds in spring. There is little we can do to influence temperature, other than select good planting sites or grow plants in protected environments such as high tunnels. If we understand how plants are influenced by temperature, we may be able to develop cultural practices that maximize their cold resistance, and also adjust pruning practices to retain the maximum number of buds that will be fruitful.

Winter Injury Terminology

Before going any further it is important that we understand the terminology concerning winter injury. The terms "winter hardy" and "cold hardy" refer to the ability of a plant to tolerate cold temperatures. However, it is important to realize that the cold hardiness of plants will differ during the winter and the relative cold hardiness of different varieties may depend on environmental conditions. The best example I can think of to illustrate this is to consider the peach rootstock 'Siberian C'. This rootstock survives winter temperatures of -20^{0}F in Ontario, New York and Michigan, but it is killed by temperatures above zero in South Carolina and Georgia.

So a variety that is winter hardy in one region or during a particular winter may not be very hardy in a different situation. This is why it is so difficult to evaluate cold hardiness of plants. Many years are needed to evaluate plants under varying field conditions. Therefore, pomologists have relied on controlled freezing experiments to evaluate hardiness by exposing plants or parts of plants to a range of temperatures in freezers and then recording the amount of injury sustained by the plant either by rating tissue browning or evaluating growth in the greenhouse.

This is not to be confused with cold-injury related to the chilling requirement being met too early in the season, as is the case when cultivars that are better-adapted for southern conditions (certain low-chill varieties of blackberries or blueberries) begin to come out of dormancy too early in late winter or early spring and then are subsequently injured by cold temperatures.

Acclimation and De-acclimation

"Cold acclimation" is the process by which plants develop cold hardiness. Raspberries cease growing in late summer and blackberries continue to grow into the fall. In mid-summer raspberries shoots are killed at about 18°F. During the fall, the leaves sense the shortening days and this induces the first stage of cold acclimation and by Mid-October the plants can withstand about 10°F. The second stage of acclimation is induced by temperatures just above or below freezing. As a result of a mild frost, the cold hardiness of woody plants can increase by 6 to 10 degrees within 24 hours. By early November raspberries can withstand about 1°F and by early December they can survive -10°F to -35°F depending on the variety.

Early in the acclimation process the plants enter a period of dormancy called "rest". There is quite a bit of confusion and different terms concerning dormancy and different stages of dormancy, but for this discussion I will assume that there are two stages of dormancy. When plants are in rest they will not grow even if they are place in environmental conditions that are ideal for growth (long days and warm temperatures). Plants remain in rest until they have been exposed to adequate chilling.

The ideal chilling temperature is about 47°F; temperatures above 65°F and below 32°F do not contribute to chilling. The chilling requirement for most brambles is usually between 800 and 1,000 hours. A study in New Jersey in cooperation with Cornell University showed that holding potted summer-bearing red raspberries at 40°F for 40 days

was adequate to satisfy chilling for greenhouse production. In Pennsylvania, the chilling requirement for brambles is usually satisfied by early January. After the chilling requirement is satisfied the plants will de-acclimate in response to warm temperatures and they will also lose some cold hardiness. If exposed to lower temperatures gradually, the plants will partially re-acclimate and regain most, but not all of their cold hardiness. This is why fluctuating winter temperatures can be so harmful.

In Poland, Pocholak (1978) determined the T50 (temperature at which 50% of the canes were killed) throughout the winter for the hardy variety 'Latham' and the less hardy variety 'Malling Promise'. He reported that in October 'Malling Promise' had a T50 of about 10°F, in January the T50 was about -31°F and in February the T50 was only -11°F. For 'Latham' the T50 was also 10°F in October and -20°F in January, but -20F in February. So 'Malling Promise' and 'Latham' were equally hardy during the fall and mid-winter, but 'Malling Promise' was more susceptible to cold following a winter warm period because it was more responsive warm mid-winter temperatures and de-acclimated more than 'Latham'.

Craig and Aalders (1966) compared 6 red raspberry varieties in Nova Scotia and reported that bud survival for 'Viking' and 'Trent' during the winter of 1963-64 was 9% and 71%, respectively and they speculated that 'Viking' was affected more by the mid-winter fluctuating temperatures. Hummer et al. (1995) evaluated maximum cold hardiness of more than 120 varieties and selections of brambles at the USDA-ARS Germplasm Repository in Corvallis, Oregon.

The plant material was first preconditioned at 31°F for 4 weeks, so the tissue should have been at its maximum hardiness. Buds and sections of the canes were then frozen at a range of temperatures from 0 to -40°F to estimate the T50. Although within each group, varieties differed in their cold hardiness, summer-bearing red raspberries and purple raspberries were most hardy, followed by black raspberries, then fall-bearing red raspberries, whereas blackberries were least cold hardy. In general the T50 of canes was 2 to 16°F lower than for buds and the bud base, where it attaches to the cane, was less hardy than the buds.

Warmund and George (1990) evaluated the hardiness of primary and secondary buds of bramble varieties from the Arkansas and Minnesota breeding programs as well as plant growing in Missouri and Illinois. In Arkansas, 'Darrow' was the hardiest blackberry and 'Wells Beauty' was least hardy. In Minnesota, 'Canby' was hardier than 'Latham' and 'Titan' red raspberry. In general the more fruitful primary buds were less cold tolerant than the secondary buds, which are less fruitful.

General Conclusions

Brambles develop hardiness rapidly during November and buds will lose hardiness during warm periods in January and February.

During December and until there is a warm period in January most varieties are quite hardy and will survive temperatures typical in Pennsylvania; most varieties will survive at least -25°F.

Winter injury usually occurs during mid-winter when several warm days are followed by a cold snap.

There is a range of cold hardiness between and within each type of bramble. Summer-bearing red raspberries are hardier than fall-bearing varieties and black berries are least hardy.

Researchers have developed several methods for assessing winter injury that occurs in the field and growers can probably use these methods to evaluate the extent of winter injury before they start pruning in early spring. Some researchers cut canes at the base and placed them in water in warm conditions. They changed the water every other day to eliminate bacteria in the water. Before the chilling requirement is satisfied, it took 15 to 50 days for buds to start growing. By early January buds begin to grow in 10 to 15 days. Buds that begin to develop into shoots will likely produce fruit and the buds that don't grow have been killed. So a grower can estimate the percentage of buds that have been lost to winter injury. However, if growers attempt to grow the shoots too early, before their chilling requirement is satisfied, the canes will not break bud for period of weeks, and the conclusion might be erroneously reached that the canes are dead.

Some buds can be cut lengthwise (tip to base) as they swell, and examined for blackened centers surrounded by green tissue (an indication that the flower buds were killed), or for tissue that is completely dead. Magnification, as with a 16x hand lens or greater, will be required. This is most easily done as the buds are beginning to swell.

The warm temperatures in December would not necessarily have resulted in more winter injury, so growers should not be overly concerned about the warm conditions. Temperatures dropped gradually enough after the warm period that plants probably acclimated before the colder weather in January. Most injury is thought to occur later in the winter and early spring when the plants are less dormant, and thus cold-injured more easily (at higher low temperatures). Growers may want to delay pruning as long as possible, preferably after testing some canes as recommended in steps 5 and 6 above, and possibly leave a few more canes than usual until a judgement can be made as to how much winter injury occurred. The extra canes can be removed later. (***Source**: Vegetable and Small Fruit Gazette, January 13, 2016*)

Pruning Brambles

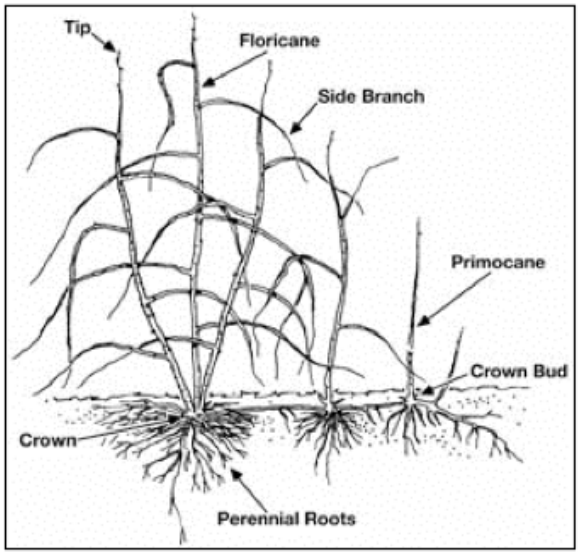
Sonia Schloemann, UMass Extension

Introduction

Once established, raspberry plants require regular attention to keep them healthy and producing well. Weed and pest management are important aspect of maintaining a productive raspberry patch. Annual pruning is also a key activity for keeping raspberries productive.

Why is pruning important?

Brambles are plants with a biennial growth habit. This means that canes are produced in one year (called primocanes), overwinter, and then flower and fruit in the second year (then called floricanes). After floricanes fruit, they are no longer needed by the plant and will die back. Removal of these spent floricanes is the first step in pruning brambles.



What are the steps to successfully prune raspberries?

Understanding of the goals of pruning will help guide how you prune your raspberries. The primary goal of is to generate optimal fruit production.

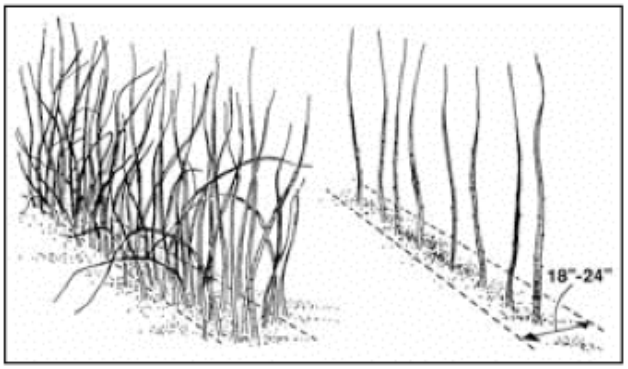
Raspberries produce fruit on floricanes (except fall-bearing types) so removing 'spent' floricanes after harvest and correctly managing primocanes results in productive plants. Secondly, you want to create good conditions for fruit production and ripening. An open growth habit for raspberry rows allows for good air circulation and drying conditions which helps reduce the incidence of fruit rots. This also allows for sunlight penetration into the fruiting zone and promotes ripening and heightens flavor.

Types of Brambles:

Summer bearing types, including red, black, purple, yellow raspberries and blackberries all fruit on 2nd year canes.

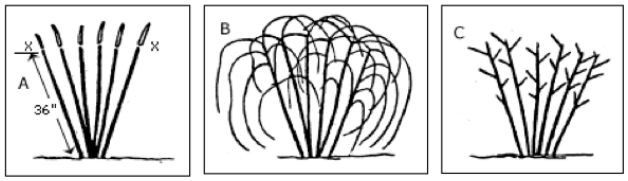
Steps in pruning summer bearing raspberries:

1) remove spent floricanes (fall – winter)
2) thin remaining primocanes to 6-8" apart, weed out spindly or broken canes, keep healthy robust canes (March)
3) re-establish 12-18" row width (March or later)
4) top remaining canes to 5" above top trellis wire (48 – 60")



Steps in pruning blackberries:

1) tip primocanes in summer (A) to promote growth of laterals (B); leave at least 6" above top trellis wire (summer)
2) remove spent floricanes (fall – winter)
3) thin remaining canes to 5-10 canes per plant; remove spindly/damaged canes first (March)
4) head back laterals (C) to 6-8" (March)
5) adjust overall height of canes to 6" above top trellis wire (March)



Steps in pruning fall bearing raspberries:

1) mow all canes to 2 – 3" from the ground.

What are the tools used for pruning?

Hand tools such as loppers and hand pruners can be used for pruning raspberries. All tools should be sharp and clean at the outset. Select the appropriate tool to remove wood as cleanly as possible to avoid unnecessary injury to the plant. Leather gardening gloves are also recommended to prevent thorns from injuring or irritating bare hands.

Summary
Learning to master the art and science of pruning raspberries takes time and practice. Contact your University Extension Educator for updated information on pruning. Make sure your raspberries are pruned each year to keep them healthy and to maximize fruit production and increase the overall fruit quality.

Illustrations from PennState Small Scale Fruit Production Guide used by permission.

BLUEBERRY

Pruning Blueberries

Sonia Schloemann, UMass Extension

Why is pruning important?
Blueberry bushes that have not been pruned on an annual basis become overgrown in both height and branch density and as a result are less productive (Figure 1). Proper pruning of blueberries is key to maintain plant size, shape, and fruit production (Figure 2).

What are the steps to successfully prune a blueberry bush?
Understanding of the goals of pruning will help guide how you prune your blueberries. The primary goal of is to generate fruit production. Blueberries product fruit on 'young' wood so removing 'old' wood and continuously generating 'young' wood results in productive bushes. Secondly, you want to create good conditions for fruit production and ripening. An open growth habit for bushes allows for good air circulation and drying conditions which helps reduce the incidence of fruit rots. Also, an open habit allows for sunlight penetration into the fruiting zone and promotes ripening and heightens flavor.

Are individual blueberry varieties pruned differently?
There may be slight variations in how certain varieties are pruned. Each variety may produce a different number of new canes each year; however, the overall plant structure is generally the same. Most high-bush blueberry varieties will respond similarly in terms of vegetative growth, fruit production, and quality of fruit following general pruning.

Can young blueberries be pruned the same as older, mature bushes?
Young bushes generally require less pruning to remove undesirable growth. Mature bushes normally require more selective cuts to maintain a desired shape, plant structure, and productive fruiting wood. The key to pruning young plants is to focus on setting up the overall plant structure that will make the bush fruitful for several years. Bushes that are seven years old and older will need to have a few mature canes removed to maintain a balance between older canes that are becoming less productive and young canes that are not quite into full production.

How to approach a blueberry bush when pruning:
1) Visually size-up the blueberry bush from all sides and imagine what the plant should look like when pruning is completed.
2) First remove all diseased and broken canes or ones growing too low to the ground.
3) Next, canes that are eight years old or older should be removed.
4) Remove all but the 2-4 most robust new canes produced the previous year.
5) Ultimately, the bush should be:

***Figure 1**. Blueberry bush before pruning.*

a) narrow at base,
b) open in the center, and
c) have a balance of multi-age canes throughout the bush.

How should older, overgrown blueberry bushes be pruned?
Blueberry bushes should be rejuvenated to improve fruit production and maintain proper shape. This may require that several old canes be removed and the bushes be pruned to fit the desired shape. Rejuvenating bushes can be quite a challenge if there has been no annual pruning done for several years. The first approach would be to remove any diseased or broken branches. Secondly, depending on the overall number, the oldest two or three canes should be removed to open up the plant structure. As with any blueberry bush, the center of the plant should be open to sunlight and air movement. The base of the bush (at the top of the root crown) should be tighter than the middle to upper portion of the bush. All branches that are touching and crossing should be removed. Sometimes,

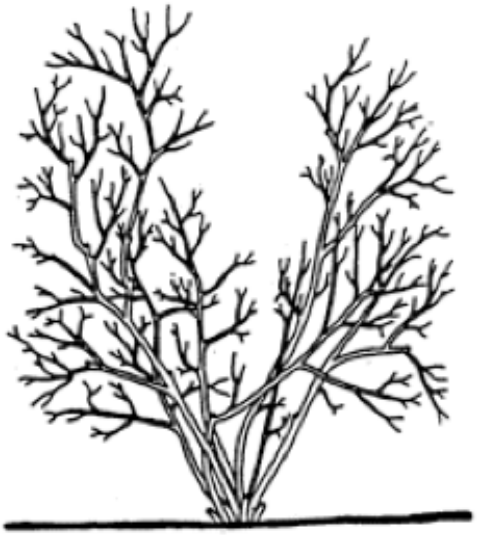


***Figure 2**. Blueberry bush after pruning.*

the best approach is to cut down the entire bush and allow it to regrow from the roots. This will eliminate any fruit production for a couple of years, but results in a rejuvenated and productive bush thereafter.

What are the tools used for pruning?

Hand tools such as loppers, hand pruners, and handsaws can be used for pruning blueberries. All tools should be sharp and clean at the outset. Select the appropriate tool to remove wood as cleanly as possible to avoid unnecessary injury to the plant. Hand pruners can be used to effectively remove one- year-old wood. If the wood is two or three years old, it is suggested that a lopper or saw be used to cut through the heavier wood. Occasionally wood is too thick or positioned in such a way that it is difficult to cut cleanly with loppers or handsaws. In such a case, a cordless reciprocating saw is an excellent tool.

Summary

Learning to master the art and science of pruning blueberries takes time and practice. Contact your University Extension Educator for updated information on pruning. Make sure your blueberries are pruned each year to maintain the size and shape of the bushes to maximize fruit production and increase the overall fruit quality.

Illustrations from PennState Small Scale Fruit Production Guide used by permission.

Revitalize Blueberries With Renovation

Mark Longstroth, Michigan State Univ. Extension

Blueberries have a distinct growth habit. Each spring new shoots emerge from the crown at the base of the plant. These shoots grow quickly the first couple years when they are young. They then start to bear fruit. In the fall, flower buds for next year form at the tips of this year's growth. Last year's shoots fruit at the tips and branch below. Every year the new shoots fruit and branch again. In a few years, you have an old, gray cane with many short branches. These small shoots have one or two flower buds and a few leaf buds on each shoot. The fruit and leaves on these older, less vigorous canes are smaller and the cane gets weaker and weaker each year. These older canes produce a lot of flowers at the ends of all the small branches, but do not produce a lot of new growth. Eventually the cane dies.

The trick for blueberry growers is to know when to remove these older canes. I feel that blueberry stems are most productive when they are three to six years old and should be removed in the seventh or eighth year if not before. A good balance for a blueberry bush is to have 20 percent of the canes as one- to two-year-old shoots, 60 percent as three- to six-year-old canes and 20 percent as canes older than six years old slated for removal.

Many vigorous shoots sprouted from the crowns when these 40-year-old Jersey bushes were cut back in late March. Photo was taken in mid-June. All photos: Mark Longstroth, MSU Extension

This 30-year old Bluecrop bush shows many older, weaker canes and no new growth from the crown. Bushes like this are an excellent candidate for renovation.

A lot of growers are reluctant to prune and remove fruiting canes that will fruit next year. Over time the bush has more older canes and fewer newer shoots. The older canes often die during the winter, and experienced growers will say, "We should have pruned harder," and new growers will ask, "Why did all those canes die?" What is needed is a drastic removal of old canes to force the bush to grow new shoots and replace the old, weak, aging canes. I also often speak to people who have bought or inherited an old blueberry farm or planting. They have the same question, "How can I revitalize the blueberries?"

The labor involved in pruning out most of the canes on a large planting of blueberries is daunting and everyone asks, "Isn't there a cheaper, quicker way?" Yes, there is. Cut off all the canes and grow a whole new crop of canes. Many people then ask, "Won't that kill the plant?" No, blueberries are bushes, not trees. Their natural habit is to grow new shoots from the crown every year. If you cut off the top, the crown will send up new shoots as it is programmed to do so. Increasing fertilizers will result in some more growth and perhaps some new shoots from the crown, but the older canes remain and they are not going to be revived by more fertilizer.

Renovation involves mowing or grinding off the plant in the spring. The blueberry bush responds by growing many new shoots. Dozens of new shoots emerge and grow quickly from a dense clump of new shoots. The problem is that you may have too many new shoots. Here are pictures from a Michigan blueberry field that was renovated several years ago.

Blueberry crowns soon after they were ground down to a height of several inches.

Blueberry shoot growth from the crowns in early spring.

One season's growth renovated plants on left and unrenovated plants to the right, 40 year-old 'Jersey' blueberries. Photo taken in September.

Renovation should be done as early in the spring as possible. Don't wait for growth to start in the spring. The later you do the cutting, the less time is availble for the plant to change gears and get a good start on annual growth. You are not finished after removing the bush canopy because they will produce many more new canes during the next year or two than are needed. Several years of increased pruning is needed to the abundant new shoots. Generally, I recommend growers remove two-thirds of the new shoots the first year and then about half the new shoots the second.

An alternative to cutting the whole bush down is to remove one-third or half the canes one year and then the rest over the next year or two. This approach may allow for some fruit harvest during the process, but often the canes that are left are weak and not very productive. This approach requires more pruning time than cutting all canes at once.

Advantages of renovation:

- Renovation of existing fields allows growers to quickly develop a new crop of fruitful shoots.
- Quicker and cheaper than replanting.
- Growers lose only a few years of production.

Unfortunately, renovation is not a cure all for old blueberry fields. Renovation can work well if a healthy planting has been neglected. It can be especially useful if newer plantings are out of balance with many older canes and few new shoots. It is not a panacea for older plantings. Renovation is likely to expose hidden problems in the field.

After renovating older fields, growers may discover virus diseases they did not know were in the field. This is because grinding the crowns can spread isolated viruses throughout the planting. The vigorous new growth of infected plants will often show virus leaf symptoms in the first season after the stumps are ground off. Plants that were infected during renovation will not show symptoms immediately. Generally, it takes several years for virus symptoms to appear after infection. Since many older plantings already have viruses in the plantings, Michigan State University Extension does not recommended renovation for these plantings. The only treatment for virus-infected plants is to remove and destroy the plant. If viruses are suspected in the field, infected plants should be identified and removed before renovation.

Renovation is only a short-term stimulus for some fields. These older, problematic fields on good sites are probably the best candidates for replanting.

Shoot growth from renovated crowns. Photo take in January before pruning.

Spring growth the following season. Note that most of the canes that grew the previous season have been removed and more new shoots are growing from the crown.

Close-up of renovated plants. Note that plants were cut back to a half-dozen shoots. Last year's shoots are blooming and putting out new shoots.

Balance Pruning Grapes

Joe Fiola, University of Maryland

I. Critical Step in Maintaining/Adjusting Vine Balance

A major theme of viticulture is that for a vine to consistently produce high quality fruit it must be "in balance." That means that the amount of vegetative growth (shoots and leaves) is just right to properly ripen the reproductive growth (fruit load). Too little fruit may lead to an over-vigorous vine, shaded fruit and lower quality. Too much fruit may decrease vigor to a point where there is not enough photosynthetic area to properly ripen the crop leading to under-ripe fruit and reduced quality.

The first step in achieving proper vine balance is choosing the proper training system for that variety on that site. The next step to annually adjust and maintain that balance is through dormant pruning. Mature grapevines require annual pruning to remain productive and manageable. An average grapevine will have 200 to 1000 buds on mature canes capable of producing fruit. If all of the buds were retained it would result in the over-cropping scenario described above.

To avoid this situation, researchers have developed a method of pruning to balance the fruit productivity and vegetative growth that will give maximum yields without reducing vine vigor or wood maturity. This procedure is appropriately referred to as "Balanced Pruning," as the amount of pruning is based on the vigor of the vine.

Weighing grape prunings in the field. ***Photo****: S. Schloemann.*

Here are some of the specifics of proper balanced pruning:

- The way to quantify vigor is through vine size, which is determined by the weight of one-year-old cane pruning.
- To balance prune a grapevine and estimate the vine size, roughly prune the vine, leaving enough extra buds to provide a margin of error.
- Then weigh the one-year-old cane prunings (small spring scale) that you just cut off and apply the weight to the pruning formula to determine the number of buds to retain per vine.
  - *For Concord vines, the pruning formula is 30+10, which means leave 30 buds for the first pound of prunings plus 10 buds for each additional pound. A vine with three pounds of prunings would require a total of 50 buds, 30 for the first pound plus 10 for each additional pound.*
  - *Here are some other variety examples and their 'typical" bud count formula. Remember, each variety will behave differently in different environments, so these are meant to be suggestions and used as a starting point and adapted for the vigor of your site.*
- To final prune that vine, continue to prune the spurs or canes until you have remaining the number of buds you calculated from the pruning weight formula for that vine.
- Remember we are ultimately looking for 3-5 shoots per linear foot of row during the growing season, depending on the cluster size of the specific variety. Future Timely Viticulture issues will address timing and other critical issues.

II. Timing

Pruning a vine causes it to deacclimate similarly to a warm spell, so do not prune (especially very sensitive varieties) when you know you will experience very serious cold shortly afterwards.

The best thing to do is to try to delay pruning as long as practically possible. If you could accomplish all of your pruning in the last two weeks of March that would probably be best, although that is typically not enough time for most commercial vineyards.

Delayed pruning also allows for better estimation of winter injury to buds so that adjustments in bud number can be made.

If you cordon prune it is sometimes best to "rough prune," maybe down to 12-16 inch spurs initially and then down to your final 2-3 bud spurs.

- This "rough pruning" will inhibit the development of the critical count buds on the spurs you are maintaining compared to cutting directly back to a 2-3 bud spur.
- For early budding varieties (Chardonnay) pruning to final 2-3 bud spur is accomplished only after danger of

late frosts ahs passed.

As much as possible, prioritize your pruning schedule according to the relative susceptibility to winter injury of each variety.

- Prune vines on the best sites first and the worst sites last.
- Prune American varieties first
- Followed by the cold resistant hybrids (Foch, Baco Noir, Seyval)
- Followed by the more cold sensitive hybrids (Vidal, Traminette Chambourcin)
- Save the vinifera for last, doing the least cold sensitive first. (Riesling, Cab Franc)
- And the more sensitive vinifera (Merlot?) for very last.
  - *You may have developed a feel for the "relative" cold sensitivity of the vinifera varieties at your site based on experiences in test winters. Remember, the relative hardiness may change from region to region and vineyard to vineyard.*
- Also early budding varieties (Chardonnay) should be pruned as late a possible to delay bud break and avoid late frosts. Rough prune first as described above, and only make final cuts down to count buds after all danger of frost has passed. (***Source**: Maryland Timely Viticulture, March 2012*)

Crown Gall – A Growing Concern in Vineyards

Bryan Hed, Penn State University

The past two winters have ramped up concerns about crown gall in Pennsylvania and other parts of the Northeast. Wine grape growers are discovering, many for the first time, the horrors of this disease and the extent of the damage it can cause in their vineyards. While there is reason for great concern, I would like to start out by saying that research efforts are generating extensive information on management of this disease, and there are new solutions from research in the pipeline.

Riesling vines that show severe dieback due to winter kill. Photo: Bryan Hed

Crown Gall And Increased Susceptibility To Winter Injury

After the past couple of harsh winters vines have been collapsing in your once "healthy" and productive vineyard. What's going on?

In some cases, brutal winter cold has simply damaged or killed a vine that was not suitable for its site. It is well known that the many varieties of *Vitis vinifera* that vintners prefer are simply less cold hardy than many of the French hybrid varieties. The crown gall bacterium, *Agrobacterium vitis*, can also play a large role by rendering infected vines incapable of properly repairing the cold damage to their trunks. The most obvious symptom of crown gall infection is gall formation at the base of infected vines. These tumor-like growths eventually choke out the vascular connection between roots and canopy, and the vine collapses (Figures 1 and 2).

Figures 1 and 2: *Crown gall on a trunk of French hybrid Chancellor – before and after bark is stripped away. Galls appear in spring as white callous tissue, most often at the base of the trunk, gradually turning green/brown and finally dying and turning into dark brown/black corky tissue.*

How did vines get contaminated with the crown gall bacterium in the first place and why is it now causing problems?

There are many sources of the crown gall bacterium and probably many ways in which vines can acquire it. It is now known that the bacterium exists in populations of wild grapevines and can be found on plant surfaces in the vineyard. The most likely or common source, however, is through contaminated nursery stock. Since the bacterium can live systemically as an endophyte inside vines used for propagation material, cuttings from that material will carry the bacterium as well. The bacterium that causes crown gall can probably live inside vines without ever causing any disease, without causing the growth of tumors at the base of the trunk,

without bringing about the collapse of vine trunks. Cuttings, produced from symptomless, contaminated mother vines, may be contaminated with the bacterium from "day one," but may never develop crown gall. This is probably the case in California and other Mediterranean climates where many of the world's wine grapes are grown.

So why is crown gall such a problem here in the Northeast, and not in California?

The crown gall bacterium shifts from benign coexistence, as an endophyte inside vines, into a tumor-inducing organism when there is damage or injury to grapevine vascular tissue. When injury occurs to the cambium, the bacterium attaches to plant cells at the wound site and literally inserts a copy of a self-replicating DNA strand (called a plasmid) into the plant cells (infection). The plasmid contains genes that code for hormone production that leads to the growth of tumors. These genetically modified grapevine cambium cells begin to grow tumor tissues with poorly organized vascular structure (that is, not capable of adequately conducting resources needed by the vine) at the wound site instead of organized vascular tissues. The injured trunk areas are never properly repaired by functional vascular tissue and as the tumor tissues grow, the trunk becomes more and more non-functional and eventually the vine collapses. And what is the most common cause of widespread grapevine trunk damage in the Northeast? Severe winter cold—which does not occur in most parts of California and similar warm, wine grape production climates.

All Is Not Lost—Tips On Vineyard Renovation

A collapsed vine with healthy roots will throw new shoots from the base of the plant, and these can be used to make new trunks and restore the vine to productive status. Here in the "Great White North" of Erie County, we renovate vines almost every year (Figure 3). Vines "laid low" by crown gall are often capable of being completely restored to productive life. Rather than ripping out your 7 or 10-year-old vineyard and replacing it, it can be more cost-effective to train up new trunks with the potential for a partial crop this year and a full crop in Year 2. An exception to this remedy is when trunks of grafted vines were not hilled with soil in the fall and the base of scions experienced the full force of the severe cold. This can completely kill the scion and leave growers with nothing but the rootstock. In this case, growers may have to start over with new vines, unless there is potential for field grafting of new scion wood. Also, when very young or newly planted vines develop crown gall, it is best to remove the plants, and replace them. The bacterium can be found in roots as well as trunks and can survive for long periods of time (years) in the soil, and it is important to remove all parts of infected plants.

Figure 3: *Picture from the NE1020 grape variety trial at North East in Erie County, PA. Note the six-year-old Gruner veltliner/101-14 vines (foreground) that were "laid low" by the 2014 Polar Vortex. Although existing canopies are dead or nearly dead, a flush of sucker growth from the scion (protected by hilling during the previous fall) provides the means for trunk renewal. Also note the full canopies of cold hardy French hybrids within the same block. While all cultivars of V. vinifera were killed back to the ground, all hybrids went on to produce partial to full crops in that year.*

All of us would love to be able to train up one original trunk and rely on that single trunk for every vine, every year. Unfortunately for many in the Northeast, that's a pipe dream. Now that you know about crown gall in your vineyard, you can assume that more vines are contaminated than you previously thought. For example, we have a Chambourcin vineyard at the North East lab in which just about every vine is host to the crown gall bacterium. I had no idea this was the case until the winter of 2003-2004, when brutal cold caused nearly every vine trunk to explode with crown gall the following spring (Figures 4 and 5). Apparently, nearly every vine was contaminated with the bacterium and the vineyard collapsed! After discussing my conundrum with Dr. Tom Burr at Cornell University, an expert in crown gall biology/pathology, we spent the 2004 season training up new trunks for every vine, using only shoots that originated from below the galls. From 2005 on, the vineyard was enormously productive for almost ten years. Then came the polar vortex of January 2014, followed by the severe winter cold of February 2015, and with it more devastating bouts with crown gall.

Figure 4 and 5: *Collapsed vine of French hybrid Chambourcin following winter cold damage to the trunk (left) and onset of crown gall at the base of the trunk (right). The entire vineyard eventually collapsed, but was completely restored with new trunks from shoots (suckers) emanating from below galls.*

Improving Your Odds That A Winter Cold Event Will Not Lead To Complete Loss

Growers of *V. vinifera* in Erie County, PA have pretty much resigned themselves to losses from winter cold and crown gall every few years, and they deal with it in a number of ways. The first way is by growing vines on multiple (2 to 3) trunks. The logic follows that if one or two trunks collapse from crown gall there may still be one trunk that produces a crop and provides some income until new trunks can be groomed to replace the galled/damaged ones. Trunks do not need to be replaced as a matter of regular maintenance, but rather when they become injured and/or diseased. The maintenance of more than one trunk can greatly improve your odds that a winter cold event will not lead to complete loss.

Clean Plants for the Future of the Eastern Wine & Grape Industry
This free four-part webinar series from the National Clean Plant Network will cover the process of producing and distributing virus-tested plant material, graft-transmissible diseases and their impact, New York State's new testing and certification program, and New York nurseries' investment in new mother blocks and propagation procedures.

Growers of the hardier French hybrids generally suffer fewer economic down times from winter cold-induced crown gall than growers of *V. vinifera*. We cannot escape bouts of brutally cold winter weather, but we can (and should) plan for the worst and try to wisely match variety with site in order to minimize or eliminate losses to winter trunk damage and crown gall. Simply put, cultivars of *V. vinifera* and cold-sensitive hybrids should be planted only on the best sites in Pennsylvania—sites that ensure good cold air drainage during the worst bouts of winter weather. Where a vineyard is already established, vine management that maximizes vine cold hardiness (balanced timely nutrition, effective disease control, proper balance between growth and yield, good weed and water management) is absolutely essential for minimizing trunk damage and the onset of crown gall after a severe winter cold event.

For grafted vines, hilling soil around the graft union in late fall will protect the base of the scion and may ensure that scion bud wood will survive to throw shoots for replacement trunks the following spring. During the following spring, hilled soil should be removed from around the graft to prevent rooting of the scion, which would otherwise defeat the purpose of the rootstock. Although an added expense, this practice is commonplace in many wine growing regions of the Northeast. Farther south and especially in the mid-Atlantic region, many growers have been avoiding this management practice because it represents a substantial added expense, can contribute to erosion on steep sites, and can increase the odds that vines may become mechanically damaged.

Unfortunately, severe cold during the past two winters caused heavy damage to the less favorable variety/site combinations even in parts of southern PA and the mid-Atlantic. Where grafts were not protected, the supply of scion buds that would have provided for new trunks was killed. In such cases, all but the rootstock dies and the vine must be replaced—a much more expensive operation than trunk renewal. So in these more southerly regions, the decision to hill or not, may be less clear. In southern PA, proper variety matched to the site along with multiple trunk maintenance may be sufficient for sustainability. However, on poorer sites that suffer more frequently from a severe winter cold event, annual hilling of grafts may be necessary or a grower may need to rethink his/her established variety/site combination.

As in all matters of farming, growers must weigh the expense of a practice against the magnitude of the consequences for not doing so as well as the odds that he or she will get hit with another severe cold event. The prudent integration of these management practices will help to guarantee that farms can remain sustainable and profitable in the Northeast.

Research In The Pipeline

Once contaminated, there is no practical way to rid a vine of the crown gall bacterium. The best long term solution rests with the production of crown gall-free planting stock so that growers can at least start with a clean vine/clean vineyard. To that end, through funding from the National Clean Plant Network, Dr. Tom Burr's grape research program and others are devoted to the generation of mother vines free of crown gall that can

be used to start clean sources of grapevine nursery material.

The emphasis in this effort is the development, and ongoing refinement, of extremely sensitive tests used to detect the presence of the pathogen, in order to determine whether a vine that might be used for propagation is "clean" or contaminated. Clean vine material can then be confidently used to establish grapevine mother blocks that will serve as the foundation of nursery propagation stocks. In turn, the mother blocks and nursery stocks can be continuously monitored for the presence of the bacterium using these same tests. The latest research has indicated that plants free of the crown gall pathogen can be generated but they will need to be assayed periodically to ensure they remain clean.

Remember, however, that the crown gall pathogen, once introduced into a vineyard through contaminated plants, can live in the soil for many years. Therefore, the availability of crown gall free planting stock is not going to end our encounters with this pathogen. Clean planting stock will reduce or help to eliminate the incidence of crown gall in new plantings, but the pathogen will likely always remain present and northeastern growers will still have to manage their vineyards with a view toward minimizing the incidence of crown gall. (***Source**: Penn State Tree Fruit Production News, Jan. 21, 2016*)

GENERAL INFO

Pruning Elderberries

Patrick Byers, University of Missouri Extension and Andrew Thomas, University of Missouri Southwest Center

The American elderberry (*Sambucus canadensis*) is a medium to large multiple-stemmed shrub or small tree. During our initial investigations into elderberry culture in the Missouri Elderberry Development Program, we noted that elderberries in a wild undisturbed state produced flower cymes of varying sizes on shoots of different ages. The bloom season was often extended over several weeks, with a corresponding fruit harvest season of 3-4 weeks. We were excited to note, however, that disturbed plants, such as those regularly cut back by mowers, often produced a crop of large cymes on the new shoots that grew the following season after the mowing.

Elderberries are for the most part harvested by hand, and we were interested in developing cultural management strategies that could make this tedious (and expensive) part of growing elderberries more efficient. For example, could we develop a pruning strategy that resulted in larger flower (and fruit) cymes, a concentrated ripening period, and a presentation of fruit cymes that made harvest easier? We were also interested in developing pruning methods that streamlined pruning that without sacrificing yield or fruit quality.

We designed a pruning trial to evaluate 4 pruning methods: annual removal of the plants to the ground; removal of the plants to the ground every 2 years; touch up pruning that maintained older shoots; and unpruned plants. We included three elderberry cultivars or selections in the trial, planted in a replicated fashion with 6 replications, and established the research plantings at 2 sites in Missouri. The plantings were established in 2000, and the study was conducted for 7 years.

As might be expected, many interactions among the research variables were noted in the study, and in particular it was difficult to make general statements regarding yield and pruning method. However, cyme number and size were more clearly and consistently affected by pruning treatments than were yields, and manipulation of cyme number and size appears practical and achievable with pruning. Annual pruning generally resulted in the production of fewer, larger cymes across both locations and all three cultivars. This same response was evident on plants that were pruned to the ground bi-annually; during the year of pruning, fewer larger cymes were produced, with cyme number increasing and cyme size decreasing the subsequent year. These results suggest that cyme number and size are directly affected and can be precisely manipulated by pruning. Indeed, this aspect of elderberry pruning management may be more important than yield effects. In most cases, producers would prefer harvesting fewer, larger cymes rather than more numerous, smaller cymes in terms of harvest efficiency and post-harvest handling.

Fruit ripening date was, in many cases, significantly affected by the pruning treatments in this study. The predominant trend was that pruning plants to the ground delayed fruit ripening by several days, and also tended to reduce the number of harvests, focusing the harvest window into a narrower timeframe. Furthermore,

because all growth on such plants is new shoots, uniformity of flowering, fruiting, and ripening is achieved. For producers, this system of pruning management would likely increase harvest and post-harvest efficiency, and any potentially lower overall yields might be considered a reasonable trade-off for the greatly simplified pruning and harvest.

We feel that annual pruning of elderberry plant to the ground may be a sound approach for many, though not all American elderberry cultivars. Observations in other studies indicate that not all elderberries selections or cultivars reliably produce fruit on new shoots. We also have noted that European elderberry (*Sambucus nigra*) often does not produce blossoms and fruit on first year shoots.

Reference:

Thomas, A.L., Byers, P.L., & Ellersieck, M.R. (2009). Productivity and characteristics of American Elderberry in response to various pruning methods. *Hortscience, 44*(3), 671-677.

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/)

UPCOMING MEETINGS:

February 3, 10, 17, 2017 – *Growing Table Grapes for Profit* – Webinar Series, all webinars start at 11:00 am. Free. To register, go to: http://enych.cce.cornell.edu/event.php?id=646.

February 4, 2017 - *New England Vegetable & Berry Growers Association 594th Meeting*. 9:00am – 4:00pm. Hudson-Concord Lodge of Elks, Hudson MA. $20 members, $40 non-members (includes lunch). For more information go to: http://nevbga.org.

February 16, 2017 – *Hudson Valley Commercial Fruit Growers' School* – Grape session (8:30 – noon), Berry session 1:00-4:15). Each session $35 pre-registered, $50 at the door. Discount available for combined registration. For more information go to: http://enych.cce.cornell.edu/event.php?id=475.

February 16, 2017 – *Fruit Workshop I: Pest & Diseases of Small Fruit*. 8:30-12:30. Litchfield Co. Extension Center, Torrington CT. $10-$20. For more information go to: http://plant.lab.uconn.edu/workshops/.

February 23, 2016 – *Fruit Workshop I: Pest & Diseases of Small Fruit*. 8:30-12:30. Middlesex Co. Extension Center, Haddam, CT. $10-$20. For more information go to: http://plant.lab.uconn.edu/workshops/.

February 23, 2017 – *Effective Vineyard Spraying*. 8:30-3:15. $15. Hudson Valley Lab. 3357 US Highway 9W, Highland NY. For more information and to register, go to: http://enych.cce.cornell.edu/event.php?id=662

February 26, 2017 – *SEMAP Agriculture and Food Conference*. Bristol County Agricultural High School, 135 Center St. Dighton MA. For more information see: http://semaponline.org/programs/ag-food-conference/.

March 6, 2017 – *Organic Strawberry Grower School*. 8:00am - 4:00pm, Lake Morey Resort, 1 Clubhouse Road, Fairlee, VT 05045. For more information, go to: http://www.uvm.edu/vtvegandberry/meetings/OrganicStrawberryGrowersSchool2017.pdf.

March 7-9, 2017 – *Harvest New England Agricultural Marketing Conference & Trade Show*. Sturbridge Host Hotel, Sturbridge MA. For more information go to: http://www.harvestnewengland.org/events/.

March 9, 2017 – *2017 Northeastern NY and VT Grape School*. 8:30-5:00 Holiday Inn Lake George, 2223 Canada St. , Lake George, NY. AM: Viticulture Presentations, PM: Wine Faults Workshop. Registration information forthcoming.

March 9, 2017 – *Creating and Improving Pollinator Habitat on Your Farm*. Jones Auditorium, Connecticut Ag. Experiment Station, 123 Huntington St., New Haven, CT 06511. $40 includes lunch. Contact Tracy Zarrillo: Tracy.Zarrillo@ct.gov or 203-974-8473. Cash or check, please (can't take credit cards). Pesticide recertification credit requested.

March 9, 2017 – *9TH Annual Berry Production & Marketing Conference*. 8:00 – 3:30. Gateway Dining Hall, Virginia State University, Petersburg, VA. $20. For program and registration information, visit www.ext.vsu.edu or click here.

March 9, 2017 – *Fruit Workshop I: Pest & Diseases of Small Fruit*. 8:30-12:30. Windham Co. Extension Center, Brooklyn, CT. $10-$20. For more information go to: http://plant.lab.uconn.edu/workshops/.