

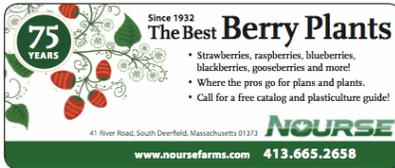
Berry Notes

Prepared by the University of Massachusetts Fruit Team

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UP Front FYI:

NRCS MAKES HIGH TUNNEL PROGRAM MORE FLEXIBLE

The Interim Conservation Practice Standard (798) 'Seasonal High Tunnels System for Crops' was piloted in 2010 to offer a technology to extend the growing season in many areas of the United States to successfully produce vegetable and other specialty crops. The interim standard has been used for about 9 months now. Many producers have requested to add fans, heaters, and roll-up sides as features that would improve function and efficiency. As a result, the Interim Conservation Practice Standard (798) has been revised to relax the restrictions on electrical, heating, and mechanical ventilation systems. This revision is applicable to previous facilities planned and installed. The new practice definition for (798) reads: "A seasonal polyethylene-covered structure that is used to cover crops to extend the growing season in an environmentally safe manner." This will provide the opportunity for those producers who want to add the additional electrical, heaters, double layer poly greenhouse covering, and ventilation systems to do so at their own expense.

The criteria for the interim standard remain unchanged. If the addition of electrical or mechanical equipment adds to the structural requirements of the structure, it is up to the producer to fund the higher-cost structure. The seasonal high tunnel system must still be a manufactured kit, as stated in the criteria.

High Tunnels are offered in the Agricultural Management Assistance Program and the Environmental Quality Incentives Program for fiscal year 2011. **The deadline to apply for the second round of EQIP and the initial round of AMA is January 14, 2011.** For more information contact your local NRCS office or go to: <http://www.vt.nrcs.usda.gov/>

STRAWBERRY

Winter Mulch for Strawberries

Sonia Schloemann, UMass Extension

An important fall job in commercial strawberry production is mulching. Strawberries are commonly grown in cold climates, such as the northern US and Canada, but the strawberry plant itself is actually quite vulnerable to cold injury. Research has shown that, without mulch, strawberry crowns can suffer damage at temperatures below 12°F and unprotected strawberry plants can suffer desiccation damage from drying winter winds. A protective mulch can protect strawberries from cold by providing insulation, and from desiccation by providing a barrier against drying winds. Mulches will also protect plants from injury caused by soil heaving, which results from freezing/ thawing cycles during the winter. So, a key to consistent quality strawberry production in cold climates is in protecting the plants from severe temperatures or temperature swings through the practice of mulching.

Production systems can also affect the need for mulching. Plants on raised beds, for example, are more vulnerable to cold and desiccation injury than plants in level plantings, especially in locations that are exposed to strong winter winds. Annual production systems, such as fall planted plasticulture, may utilize less hardy or disease susceptible cultivars. As we will see, mulching practices must adapt to these new systems.

When should the strawberry grower plan to apply mulch? Research suggests that a good timing guide is to apply mulch after three consecutive days with a soil temperature of 40°F or below. This soil temperature usually occurs after multiple frosts, and when the plants have slowed growth in response to cooler temperatures. It is best to apply mulch before the soil freezes solid. In New England mulches are applied in late November.



or Sudan grass work well. Straws coarser than Sudan grass are not recommended. Straw should be clean, free from weed seed, and contains a minimum of grain seed. Strawberry growers can produce their own straw, often cutting the straw before the grain seed is viable. Store straw for mulching in a dry area. Occasionally, grain seedlings can become a weed problem the following spring; an application of sethoxydim will give good control.



How much mulch should be applied? A traditional, level matted row planting will require 2.5 to 3 tons of straw per acre for a 2 to 3 inch deep mulch, or about 300 small bales of average weight. Raised bed plantings and sites with strong wind may require twice this amount for adequate coverage.



How is the mulch applied? Smaller plantings may be mulched by hand by shaking out the bales of straw over the row. Larger plantings often use bale choppers to break up the straw bales and distribute the straw over the bed. Choppers are available for both small bales and large round bales.

How and when is the mulch removed? In the spring, when plants begin to show growth under the winter mulch (new green tissue), the mulch should be raked off the rows to allow sunlight to penetrate and reach the foliage. Delaying removal will delay plant growth and flowering and may reduce yield. Mulch can be raked off by hand with ordinary yard rakes in smaller plantings. In larger plantings, various mechanical tools are available ranging from modified hay rakes and tedders to equipment specifically designed for the purpose.



Floating row covers as mulch. These covers are composed of a plastic such as polypropylene, spunbonded into a fabric that is permeable to light, air, and water. Research and growers' experiences demonstrate that these covers are useful for winter protection of strawberry plantings. While floating row covers are available in several weights, only the heavier weights are recommended for winter protection. At present a widely available weight recommended for winter strawberry protection is 1.25 oz/yd² (42 g/m²). A variety of fabric widths are available, with common

widths ranging from 15 feet to 60 feet. This material currently costs about 4 cents per square foot. With proper care, this heavier fabric should last 3-4 seasons. Floating row covers are widely used to protect annual plasticulture plantings.

Row covers are best applied on still days. Be sure to line up sufficient labor to place the row cover. If possible, use wider widths for more efficient application. The row cover edges must be anchored, as must areas where two covers overlap. A variety of methods are used to anchor the edges. Edges may be anchored with posts, rocks, or tube

sand. The edges may also be covered with soil.

Once the mulch is in place, the job is not done for the winter. Monitor the planting frequently. If straw has blown off areas, replace at once. Watch the edges of row covers, and adjust anchors if needed. Repair any rips or holes as soon as possible.

Any reference to equipment or product brand names does not constitute endorsement over like products or equipment.

Day Neutral Strawberry Production at Fraisebec in Quebec

Laura McDermott, Cornell Cooperative Extension

In the Capital District region of NY, many strawberry growers have been experimenting with growing strawberries on plastic mulch. These trials have included June bearers grown in perennial systems on traditional black or white coated plastic mulch, or on biodegradable mulch. Day-neutral varieties have taken the main stage as our retail markets are very receptive to local strawberries throughout the season. Not all attempts at producing strawberries on plastic have been successful. We struggle with fertility issues that may affect quality, and the best choice of varieties and production systems remains a question. This summer the North American Strawberry Growers (NASGA) summer tour focused primarily on large

Quebec farms that were growing strawberries on plastic, which was a real motivator to attend.

As a first time attendee, I was impressed with the entire event which was well attended by growers from across the U.S., Canada and even the Dominican Republic! The tours were well organized and we were treated to lovely catered lunches with live musicians, but most importantly, the tours were chock full of helpful information.



Day neutral strawberry beds prepared for planting at Fraisebec, Quebec, Canada

Our first farm stop was at FraiseBec Inc. in Sainte-Anne-des-Plaines, the largest strawberry grower in Canada. FraiseBec was started by Yvon

Charbonneau 32 years ago and is now expertly managed by Simon and Isabelle Charbonneau. This farm grows more than 150A of Day Neutral and June bearing



Trays of plug plants laid out ready for planting

strawberries plus over 22 acres of field and high tunnel fall raspberries. They supply fresh berries to wholesale and retail markets throughout Quebec from June through October.

FraiseBec plants part of the day-neutral strawberry crop in the spring as dormant crowns, and harvests fruit from late July to frost from those plants. In order to encourage earlier spring production, they began saving some of this planting and fruited them the following spring, beginning in June to the frost. Unfortunately those fruit were always smaller.

To keep fruit size up but still capture earliness, they began fall planting plugs. FraiseBec plants 1 million plug transplants each year. These plugs are supplied by Novafruit, a large nursery that we visited later in the tour. The fall planting strategy can be risky because strawberries that are not well established are even more prone to frost injury. To encourage snow accumulation, which they rely on for insulation, they plant hedgerow windbreaks or use fencing. This two-pronged strategy allows them to have a consistent supply of berries for the longest possible season.

The entire field is fumigated prior to being fitted with raised beds. FraiseBec attempts to prepare all of the beds in the late summer or fall, those for the August planting as well as the May planting which lets them plant as early as possible in the spring. Occasionally the plastic moves or is damaged during the winter, and sometimes fall weather doesn't allow for field fitting but for the most part fall field prep is a time saver.

The day neutral strawberries are grown on 4' wide, 10" high raised beds covered with traditional agricultural black plastic mulch. Two irrigation driplines are placed under the plastic, each between 2 of the rows. The plants, all 'Seascape', were being planted when we were there in mid-August. A hole puncher went through the field in front of a battalion of workers that placed the plants in 4 rows on the beds, 16" between the rows and 8" between the plants within the rows, resulting in 20,000plants/acre. Pre-emergent applications of Chateau and Sinbar were made only in the 2.5' wide alley between the beds to help avoid any potential injury to the transplants, which might be more of a problem in a summer planting.

The first few weeks after transplanting are the most stressful for the newly planted plugs. August daytime temperatures get quite warm, especially on the plastic, so the plants are watered overhead 2x/day for the first week to prevent desiccation and burning. Trickle irrigation requirements are determined by the constant monitoring using tensiometers. Runners are removed weekly until frost, with the goal being to remove all runners. Row covers have been used to encourage fall vegetative growth, hasten spring production and provide a measure of frost protection.

The day-neutral strawberry is a heavy feeder because it is fruiting throughout the season while also growing vegetatively. The rate of nitrogen suggested is variable according to the source that you consult, ranging from 60-

80 lbs of actual N/A for the season to 15# N/A every week! When asked about their nutrient management plan, Isabelle Charbonneau said the farm constantly monitors



Newly planted plug plants, August 2010



Day neutral strawberry field under harvest, August 2010

leaf nutrient levels. When the foliar analysis indicates, the plants are fed through the trickle, rates and types of nutrients are adjusted as required by the foliar analysis.

According to an Ontario Ministry of Agriculture fact sheet on dayneutral production, (<http://www.omafra.gov.on.ca/english/crops/facts/89-099.htm#nutri>), *these berries benefit from a continuous supply of nitrogen and potassium. Additional phosphorus is not necessary provided an adequate supply has been incorporated before planting.*

A large amount of fast-acting nitrogen fertilizer applied at any one time to dayneutrals can soften fruit and cause excessive vegetative growth. There are 3 ways to avoid this yet supply adequate nitrogen during the season. The first is to apply 30 lb/A of nitrogen at monthly intervals throughout the growing season. Be careful not to allow the fertilizer to accumulate on the leaves, especially if they are wet. The second way is to use a slow-release fertilizer at planting. The third option is to apply 5 to 6 lbs/A of nitrogen through the drip irrigation system every week. Calcium nitrate is the preferred source of nitrogen early in the season, but urea can be substituted when temperatures warm.

On soils that are low in potassium, such as sandy soils, supplement the preplant potassium with 10 lb/A of K₂O at monthly intervals or 2 lb/A at weekly intervals through the drip irrigation system during the growing season. Dayneutrals tend to be heavy consumers of boron because of their large commitment to reproduction. Monitor leaves occasionally to ensure that boron levels do not fall below 30 ppm. An application of 2 lb/A of solubor may be required in midsummer if boron levels are too low. The phosphorus/zinc ratio in the leaves should remain below 140, and the zinc level above 20 ppm. Because phosphorus hinders zinc uptake, balanced fertilizers containing phosphorus are not recommended if the soil has been amended properly before planting.

Pest problems are limited primarily to tarnished plant bugs and the occasional lygus bug and of course spider mites, powdery mildew and grey mold. The farm relies on Assail for TPB control and tries to use all other pesticides only if pest levels threaten to become unmanageable. Air assisted sprayers help guarantee good coverage minimizing the number of applications.

Harvest usually begins in early June. Pickers visit plants every 2 days while they are bearing. This intensive schedule requires a huge amount of labor, provided by 150 local workers and 150 foreign workers. Worker productivity is measured by using a bar code system that requires each picker to swipe their corresponding code as they drop off their flats. FraiseBec expects 2-3 lbs of fruit per plant or 25000 lbs/acre during the 5 month harvest window.

Without being told, a casual observer knows that FraiseBec is a leader not only in the production of berries, but also in marketing. They have beautifully designed billboards everywhere and have recently invested in television advertisements and have trademarked their logo. These efforts are in response to California berries that are undercutting their prices. They are committed to creating demand for their local, high-quality product. FraiseBec sells to supermarkets in the province of Quebec and in other Canadian provinces. They are an important vendor at the wholesale Marché Central (Central Market) in Montreal.

The commitment to high quality berry production was the unifying thread that ran through the entire Quebec tour. Dayneutral strawberries are a VERY important part of that commitment. Despite our very different market structure, NY growers might be able to expand our local strawberry markets by utilizing some of our northern neighbors' expertise.

For more information about growing strawberries on plastic mulch, please visit the following websites:

<http://noursefarms.com/CommercialGrowers/Plasticulture.aspx>

www.smallfruits.org/SmallFruitsRegGuide/Guides/2005culturalguidepart1bs1.pdf

www.agrireseau.qc.ca/petitsfruits/documents/quebec-poling.pdf

Additionally, Dr. Barclay Poling of NC State University is holding an intensive workshop on Monday, November 8th as part of the SE Strawberry Expo being held in Virginia Beach. This workshop is entitled **Strawberry Plasticulture for Northern Growers and Higher Elevations**. For registration information see <http://www.ncstrawberry.org/ExpoPage.cfm>

Editor's note: To view more highlights of the 2010 NASGA summer tour go to:

www.nasga.org/summertour/summer-tour-2010-highlights.htm

(Source: New York Berry News, Vol. 9, No. 9, Oct. 2010)

Observations on Day Neutral Strawberry Varieties

Pam Fisher, Berry Crop Specialist, Ontario Ministry for Agriculture and Rural Affairs

Five day-neutral strawberry varieties were set out at four grower sites this summer. Here are some background notes and preliminary observations made by OMAFRA summer students. Thanks to the Ontario Berry Growers Association for funding these and other variety trials through the Farm Innovation Program in 2010. Thanks also to OMAFRA students Kara Pate and Patrick Clendinning and to the growers who hosted these trials.

Seascape

Seascape is a cross between the cultivars Selva and Douglas, and was developed by the University of California 1991. Seascape is the standard variety for Ontario and is widely grown due to its high yields. Fruit is firm, medium to long conic in shape, bright red in colour and good quality. Fruit are flavourful with an intense, sometimes unpleasant aroma in summer. Seascape produces high yields in August and early September. It is susceptible to two-spotted spider mite and extremely susceptible to powdery mildew, which causes small, seedy fruit as well red blotching on the foliage. Ripe fruit is easily damaged by rain. In Ontario, Seascape is the most winter hardy of these day neutral varieties.

Albion

Albion is a cross between Diamante and a numbered advanced selection from California. Albion produces orange-red firm tasty fruit, with lower yields than Seascape. Fruit is conical in shape and ripens from the tip towards the top. The fruit has excellent quality and excellent flavour. It is less winter hardy and fruits later in the season than Seascape. Although the patent information for Albion suggests it is apparently resistant to phytophthora crown rot, anthracnose crown rot, and verticillium wilt, we have seen all of these diseases on Albion in Ontario. When treated properly Albion has a resistance to two-spotted spider mites. Albion is becoming a favourite in Ontario due to its excellent flavour and quality.

Monterey

Monterey is a cross between Albion and a numbered advanced selection from California. Monterey is similar to Albion in some respects. The fruit itself is very sweet and slightly larger than Albion. However, it is easier to damage because the skin is softer. Monterey has good disease resistance qualities, although it is susceptible to powdery mildew. It has a similar production period as Albion with slightly stronger flowering. The plant is very vigorous so it requires slightly more space than Albion.

Winter hardiness has not been tested in Ontario so far.



Monterey strawberries in early September.

Portola

Portola is a cross between two advanced selections from California. The fruit are produced on long petioles, are orange-red color and very shiny, almost plastic looking. The berries are the same to larger in size compared to Albion. Portola has a vigorous plant and may require lower plant density than Albion. The cultivar is slightly resistant to powdery mildew, but it is susceptible to leaf blight and botrytis fruit rot. We have observed consistently earlier and greater yields from Portola compared to other day-neutral varieties for first year pickings. However, Portola is not as flavourful nor as sweet as Albion, and had the poorest flavour of all 5 varieties tested. It had a lower percentage of marketable berries, mostly due to botrytis and fruit rots. Winter hardiness has not been tested in Ontario, but testing is in progress.

San Andreas

San Andreas is a cross between Albion and a numbered advanced selection. San Andreas was very late to come into production in our 2010 trial plantings, although reports from other regions indicate it has a similar production period to Albion. In our trials, yield was very low until early September. Fruit was very attractive, large, very firm, bright red and attractive. It has a lighter color than Albion and a fairly sweet taste. Plants were noticeably healthier and had less leaf disease than the other varieties in the trial. The plant is resistant to powdery mildew and leaf blight. However, it is reported to be susceptible to botrytis and viral infections. Winter hardiness has not been tested in Ontario.

Making a decision - Each year I review variety recommendations with a committee of researchers, growers, and plant propagators. Presently, Seascape and Albion are recommended for limited or regional planting in Ontario. For the most up-to-date variety recommendations, see "Recommended Berry Varieties for Ontario". (*Source: Ontario Berry Grower. Vol. 6, Nov 2010*)

Raspberry Crown Borer

Pam Fisher and Maryam Sultan, Ontario Ministry of Food and Rural Affairs,

The raspberry crown borer is a clearwing moth, similar in appearance to a yellow jacket wasp. It measures approximately 25mm in length and has a wingspan of about 30mm. The adult can be seen basking on raspberry foliage during the day (Figure 1).



Fig 1: Raspberry crown borer adult on raspberry leaf measuring about 25mm in length

Crown borer larvae are white with a light brown head. They possess three pairs of very small true legs and four pairs of prolegs (Figure 2). They range in size from a few mm to 30mm when fully grown. They are found in the raspberry crown where they feed and tunnel into crown tissue. As they feed, they deposit reddish brown, granular frass behind them. Their burrowing severely damages the crown and eventually affects above-ground tissue. The canes become weak and spindly and fruiting canes often collapse while the fruit is still immature. Foliage may wilt and die on affected canes. Eventually, primocanes become so few in number that the planting dies out.



Fig 2. Raspberry crown borer larva from the side showing its 3 sets of true legs close to the light brown head. Only 2 or 4 pairs of prolegs are shown.

Damage from this pest can often go unnoticed for some time. Symptoms are sometimes confused with winter injury, or Phytophthora root rot. To diagnose the problem accurately, use a spade to dig up crowns of weak plants. Shake away the soil and examine the crown for reddish-brown frass and tunnels. Use hand-pruners to cut the crowns carefully to look for crown borer larvae in and around the damaged area (Figure 3). In late fall and early spring, tug on affected canes. If crown borer is the culprit, the affected cane will usually break off at the base, revealing larvae and frass below.



Fig 3. Raspberry crown borer larvae tunnelling into crown tissue. The arrow points at frass associated with larval feeding.

Biology

The raspberry crown borer has a two-year life cycle. In late July, August and September females lay single, reddish-brown eggs on the underside of young leaves. The adult is active for about one week. Females can lay around 140 eggs in this time.

The larvae emerge about one to two months after egg-laying and migrate down to the base of the cane. Each larva overwinters in a hibernaculum below the soil surface. In the spring, they begin boring tunnels and cavities into the crown tissue. The larvae also feed on and girdle roots and other canes belonging to the same crown. They spend their second winter within the roots of the plant. During July of the second summer, pupation occurs inside the crown and mature adult crown borers emerge between late July and September.

Management and Control

Researchers are working on the development of a pheromone lure to attract adult insects but these are not yet available.

Field sanitation, clean pruning and habitat management will help to reduce pressure from this pest. Remove

nearby wild brambles to reduce the likelihood of infestations. Prune out and destroy old canes each spring, cutting them as close to the ground as possible, to destroy larvae overwintering at the base of the cane. Keep grass mowed short and weeds under control to reduce the shelter they provide to adults during the egg-laying period.

Several insecticides are registered for control of raspberry crown borer. [New England: **Brigade 2EC**: This product provides excellent control of raspberry crown borer. Spray in early spring, to control young larvae before they tunnel into the crown. Apply in a high volume of water per hectare as a drench to crowns and base of plants.

Apply when new primocanes are less than 10 cm above ground. Because this pest has a 2-year life cycle, two applications, one year apart, are necessary for control.]

Altacor: This product was registered in August 2010 through the minor use registration program and will require more careful timing for control. It is effective on early instar larvae, which must ingest the product to be affected. The product must be present on foliage and eggs, to control hatching larvae in mid-late summer. We need more field experience with this product in order to develop the best strategy for raspberry crown borer control. (*Source: Ontario Berry Grower. Vol. 6, November 2010*)

BLUEBERRY

Blueberry Crown Gall

Jay W. Pscheidt, Oregon State University

Cause: *Rhizobium radiobacter* (formerly *Agrobacterium tumefaciens*), a bacterium that survives in soil and infects plants through wounds. The disease is a sporadic problem in propagation beds, young plantings, and a few established fields. Some cultivars seem more susceptible than others.



Symptoms: Gallings occur on branches, at the bases of canes, and on major roots. Young galls are cream to light brown; mature galls are dark brown to black and are rough and hard. An unusual symptom of crown gall is small galls erupting contiguously along the length of aerial branches. Galls may be in strips or may completely encircle the branch. Tissue underneath the galled area is green but necrotic between galls. This symptom does not extend to underground portions of the plant.

Cultural control:

- Purchase clean stock, and inspect new plants before planting. Discard any diseased plants.

- Do not plant in previously infested fields, or rotate infested field to grasses or vegetables for 2 to 3 years before replanting blueberry.

- Preplant soil solarization has been effective for cherry nursery stock in western Oregon and may have some value for home or organic production. Place clear plastic on rototilled ground, which has been irrigated to near field capacity, from mid-July to mid-September. More effective on sandy loam soil.

- Remove and destroy diseased tissue.

- Prune bushes only during dry weather and frequently disinfect pruning equipment.

Chemical control: Gallex (ready to use) painted on very young galls to reduce further development. Galls may return the following year or, if treated late, may continue to develop. Tissue surrounding the gall may be injured, especially on younger plants. Prepare the surface by removing soil from around the galled area, and allow the area to dry before application. **Not registered in Idaho.** 12-hr reentry.

Biological control: Cuttings or plant roots may be dipped in a suspension of an antagonistic bacterium before planting. To be effective it must be applied a few hours after wounding.

Galltrol-A. Not registered in Idaho. 12-hr reentry.

References:

Caruso, F.L. and D.C. Ramsdell. 1995. Compendium of Blueberry and Cranberry Diseases. St. Paul, MN: APS Press.

(*Source: Oregon State Online Guide to Plant Disease Control; <http://plant-disease.ippc.orst.edu/>*)

GRAPE

Grape Crown Gall

Jay W. Pscheidt, Oregon State University

Cause: *Rhizobium vitis* (formerly *Agrobacterium vitis*), a bacterium that attacks only grape and chrysanthemum. The bacterium survive for years in old galls, infected vines, and infected plant debris in the soil. It can enter the plant through wounds and often is already present in vascular tissues of symptomless grapevines. Although plants are systemically infected, with or without symptoms, the bacteria are rarely found in the green shoot tips of vines. Winter damage that causes wounds can trigger the infection process. After the bacterium enters a wound, a small piece of its DNA is transferred into the plant's DNA. The foreign DNA transforms normal plant cells in the wounded area into tumor cells. Once transformed, tumor cells proliferate automatically and produce unique substances that the bacteria can utilize readily. The result is a gall, a disorganized mass of hyperplastic and hypertrophic tissue. Crown gall is a greater problem on grafted vines than own rooted vines as the graft union can result in active gall growth even without winter freezes or mechanical damage. Grape production can drop by 40% on affected vines.

Symptoms: Fleshy galls typically are at the crown and on the first 2 feet of the vine above the soil line. Large galls may develop rapidly and completely girdle young vines in one season. Galled vines generally produce poor shoot growth, and vine portions above the galls may die. Few clusters develop on these shoots and if fruit do form they do not ripen. Galls are rarely seen on roots but the bacterium may cause areas of dark necrotic lesions on the roots.



Cultural control:

- Plant pathogen-free nursery stock. The Northwest Grape Foundation Service in Washington cultures vines to be free of crown gall.
- Remove diseased vines including as much old root material as possible from the vineyard. Sterilize pruning tools between vines with 10% Clorox (bleach, which also will oxidize your pruning equipment) or shellac thinner (70% ethyl alcohol).
- Avoid any injury near the base of the vine.



- Control of soilborne nematodes may help reduce the incidence of plants with galls.
- If the gall is high enough on the trunk, a sucker replacement may be brought up from well below the galled areas in nongrafted plants.
- Soak dormant cuttings in hot water (129°F or 54°C) for 30 min. May help eliminate most of the bacteria (see reference). Primary buds are killed, but secondary buds grow out well. Some cultivars may be more sensitive than others.
- Use green shoot tips to propagate plants.
- Do not graft over to a new cultivar on vines that are exhibiting crown gall.

Chemical control: The efficacy of chemicals such as copper-based compounds, other chemicals and antibiotics is not satisfactory and thus not recommended.

Gallex (ready to use) painted on very young galls to reduce further development. Galls may return the next year or, if treated late, may continue to develop. Tissue surrounding the gall may be injured especially on younger plants. Prepare the surface by removing soil from around the galled area, and allow the area to dry before applying. Not generally recommended for use. **Not registered in Idaho.** 12-hr reentry.

Biological control: *Agrobacterium radiobacter* K84 (Galltrol) is ineffective since it does not prevent infections.

References:

Burr, T.S., Bazzi, C., Sule, S., and Otten, L. 1998. Crown gall of grape. Biology of *Agrobacterium vitis* and the development of disease control strategies. Plant Disease 82:1288-1297.

(Source: Oregon State Online Guide to Plant Disease Control; <http://plant-disease.ippc.orst.edu/>)

GENERAL INFORMATION

What is the Best Way to Put Micronutrients into Plants?

Steve Bogash, Penn State Cooperative Extension

There are several ways to approach micronutrient plant nutrition. The first and best long-term management technique is to have sufficient micronutrients available to plants through their root system. Root micronutrient (and macronutrient as long as we are talking nutrients) uptake is largely based on pH, and having nutrients in available forms and in sufficient amounts so that and single nutrients' availability is not adversely affected by other nutrient concentrations. Secondly, plants also take in nutrients through their leaves. Foliar application can be an excellent method to make up for short term deficiencies. A regular program of timely tissue testing is the only method to spot deficiencies before they affect plant health and yield.

In general, when we are talking micronutrient deficiency in our region we are considering levels of Copper, Iron, Manganese, Boron, and Zinc. Calcium and Magnesium are primary nutrients, but since they are seldom addressed in articles relating to macronutrients and we use similar techniques to make up for deficiencies in them, their application is included here. Working towards a slightly acidic pH of 6.2-6.8 in the root zone will greatly increase the availability of most of the nutrients needed to grow a good small fruit or vegetable crop (with the notable exception of blueberries). As pH in the soil solution approaches 7.0 and higher, many nutrients become less available. Some soluble fertilizers such as Miller's Nutrichem 9-15-30 contain a blend of micronutrients formulated largely as chelates which are very stable and available to plants along with N, P and K. Dry kelp meal or kelp extracts are good natural sources to bring soil micronutrient levels up. Some, but not all of these products are OMRI listed. Soluble fertilizer blends consisting only of a blend of micronutrients such as Miller's Microplex are another option. Specific nutrient materials such as Helena's Ele-Max Super Zinc and Ele-Max Magnesium FL are very useful in supplementing zinc and magnesium levels. Trace elements fed to livestock and applied as manure to fields will often prevent micronutrient deficiencies.

While agricultural limestone and dolomitic limestone are good sources of Calcium and Magnesium, the often heavy application rates of these materials have the unpleasant side effect of increasing pH, thus decreasing the availability of many other nutrients. Applications of liquid

calcium products, calcium chelate, magnesium oxides and magnesium chelate will increase the availability of these nutrients without adversely impacting soil pH.

Foliar application of nutrients is an excellent method to cure immediate deficiency problems. The single greatest concern in foliar application is in causing phytotoxic reactions, thus damaging leaves or fruit. While you might apply #1-2 / acre of Zinc chelate through drip lines, a foliar application of 3-8 oz of the same material is sufficient. Up to #3/ acre of Boron as Borax can be applied to the soil, yet only 4-8 oz/ acre is the maximum that can be applied foliarly. Growers can utilize tank mixes in applying many micronutrients. However, just as some mixes of fungicides and insecticides can be phytotoxic, multiple micronutrients in a tank mix can have a similar result. Most injury shows up within the first 48 hours. So apply a test solution to a small area, wait 48 hours and assess the situation before making the entire application. Foliar applications are best used to make up for short term deficiencies. Growers will either need to apply them often or combine foliar with fertigation application. The first step in producing a healthy crop is in creating a healthy canopy. Once you've burned the leaves from too much material or a toxic blend, it is very challenging to turn the crop around.

Copper and zinc deficiencies are often not seen when fungicides / bactericides such as Kocide, Phyton 27, Champ, mancozeb, Manzate, Dithane are used as these materials contain either copper or zinc (zinc-based materials are primarily fungicides while copper materials do double duty). In fact, tissue testing often indicates very high to toxic amounts of these materials if the samples are pulled shortly after their application.

Liquid kelp extracts are often applied foliarly to make up for general micronutrient deficiencies in crops grown under organic production rules. Many organic growers that I've spoken with in the Lancaster area are convinced that fermented vermiculture solutions not only supply vital nutrients, but also confer serious disease prevention characteristics. Fertrell Products worked in a side-by-side tomato nutrient study this past season at Penn State's Southeast Research and Extension Center (SREC, also known as the Landisville Research Farm). We are just starting to analyze the results of that study which will be

published over the next few months. An increasing number of new nutrient products are being introduced to serve the organic production market. Be sure to check the most recent OMRI listing and check with your certifier before application as this list is evolving over time.

Of all of the errors that I've made and seen growers make over the years, simple mathematical errors that occur in determining foliarly applied micronutrient rates seem to be the worst. It is very easy to make a simple mistake of one decimal point in calculating rates and burn a crop past the point of no return. A one decimal point mistake can produce a 10x error that will readily create a micronutrient solution that is very toxic to a crop. Foliar application also complicates tissue testing since the laboratory has no way of knowing whether the boron / zinc / copper.... that is showing up in their sample is sitting on the tissue surface or has been taken up by the plant. For field samples, wait to harvest tissue until after a

soaking rain. When pulling greenhouse or high tunnel samples, wait at least one week after nutrient application, carefully wash the leaves or petioles, then, blot dry on paper towels. This simple extra care in sample handling will greatly increase test accuracy.

Both foliar and root applied micronutrients are useful in maintaining plant health, neither method is better than the other. A program of soil or media testing prior to planting followed up with regular, timely tissue testing and subsequent nutrient application is the "solution" to applying micronutrients. While several examples of specific fertilizer blends and manufacturers were mentioned in this article, Penn State does not recommend one product over another. Speak to your current supplier, shop around for products that meet your needs and always get competitive pricing. Be sure you are comparing like materials. (*Source: The Vegetable & Small Fruit Gazette, Vol. 12, No. 11, November 2008*)

UPCOMING MEETINGS:

- November 22, 2010.** *USDA Good Agricultural Practices (GAP) Training Program.* UMass Extension and Mass Dept. of Ag Resources. Farm Bureau Federation Office, 249 Lakeside Drive, Marlboro, MA 01752. 12:30 PM – 5:00 PM. Registration deadline: 11/12/10. For more information contact Doreen York at dyork@umext.umass.edu
- December 1, 2010.** *CT Pomological Society Annual Meeting.* Gallery Restaurant, Blasonbury CT. For more information and program details, contact Lorraine Los at 860-486-6449 or lorraine.los@uconn.edu.
- December 2, 2010.** *USDA Good Agricultural Practices (GAP) Training Program.* UMass Extension and Mass Dept. of Ag Resources. Sheraton Springfield/Monarch Place Hotel, One Monarch Place, Springfield, MA 01144. 12:45 PM – 2:30 PM; 3:30 PM – 4:45 PM. Registration deadline: 11/19/10. For more information contact Doreen York at dyork@umext.umass.edu
- December 7-9, 2010.** *Great Lakes Fruit Vegetable and Farm Market EXPO,* DeVos Place Convention Center, Grand Rapids, Michigan. For more information: <http://www.glexpo.com>.
- December 9, 2010.** *New Entry Sustainable Farming Project Farmer-to-Farmer Conference.* *Sturbridge Host Hotel, Sturbridge, Massachusetts.* Go to www.farmer2farmer.org to register and for more information. Contact Kimberley Fitch at 978-654-6745 or e-mail nesfp@tufts.edu with questions.
- Dec. 10, 2010.** *GAPS Food Safety Planning Workshop for Growers.* UVM Extension. White River Jct. VT. More information available soon.
- January 6-7, 2011.** *NARBA (North American Raspberry and Blackberry Growers Association) Annual Meeting,* Savannah, GA. For information see <http://www.raspberryblackberry.com/> or contact Debby Weschler at E-mail: info@raspberryblackberry.com.
- January 7, 2011.** *NEV&BGA and UMass Extension Winter Meeting and GAP Training,* Location TBA. To register and for more information contact John Howell at 413-665-3501, howell@umext.umass.edu, or Ruth Hazzard at 413-545-3696, umassvegetable@umext.umass.edu, or see www.umassvegetable.org.
- January 29, 2011.** *Winter Vegetable & Berry Meetings.* Waltham Field Station, Waltham, MA. The January 29 program will include a half day on soil and nutrient management, reduced tillage including deep zone tillage, and cover crops. Registration opens at 9:30 am and programs run from 10 am to 4 pm. To register and for more information contact John Howell at 413-665-3501, howell@umext.umass.edu, or Ruth Hazzard at 413-545-3696, umassvegetable@umext.umass.edu, or see www.umassvegetable.org.
- January 31 – February 3, 2011.** *Mid-Atlantic Fruit and Vegetable Convention* at the Hershey Lodge in Hershey, PA. For more information visit www.mafvc.org.
- February 8-11, 2011.** *7th North American Strawberry Symposium and joint North American Strawberry Growers Association Meeting.* Tampa, Florida. Details available soon.
- March 5, 2011.** *Planting, Cultivating, and Marketing Juneberries in the Great Lakes Region.* NYS Agricultural Experiment Station, Geneva, NY. More information available soon.

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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