Cornell Cooperative Extension | Eastern NY Commercial Horticulture Program

VOLUME 7, ISSUE 2
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BERRY NEWS

Berry "To Do" List

—ALL CROPS—

- Last chance for **early season weed management**.
- **Scout for Vole activity** - we saw a ton of damage last year especially in blueberry fields, but voles can damage ALL berry crops. Vole control is most effective in the spring before they start breeding. Get them early!
- Think about **Bird Management** – Understand the species that are your biggest problems. Great resources exist at the website for the Prevention and Control of Wildlife Damage: pcwd.info/birds/.

—STRAWBERRIES—

- ***All straw should be off berries in all locations***—delaying straw mulch removal can decrease yield nearly 30%. It will not reasonably delay bloom or prevent frost damage.
- ***Plan for frost protection***—inspect irrigation equipment and row cover. Make sure you have some type of adequate temperature detection system at the field level. Please see information about frost protection in this newsletter issue.
- ***Phytophthora control***—Wet fields last fall has resulted in a higher than normal incidence of root infection. If your fields were abnormally wet last fall, and if plants are showing the classic burnt orangey coloring in the crown and down into the root, it could be helpful to apply either Ridomil or a phosphorus acid product. Apply when the plants are showing green growth. A low rate of nitrogen may also help – keep it between 10 and 20 pounds of actual N per acre – definitely not more because too much vegetation will result at the expense of the fruit yield.

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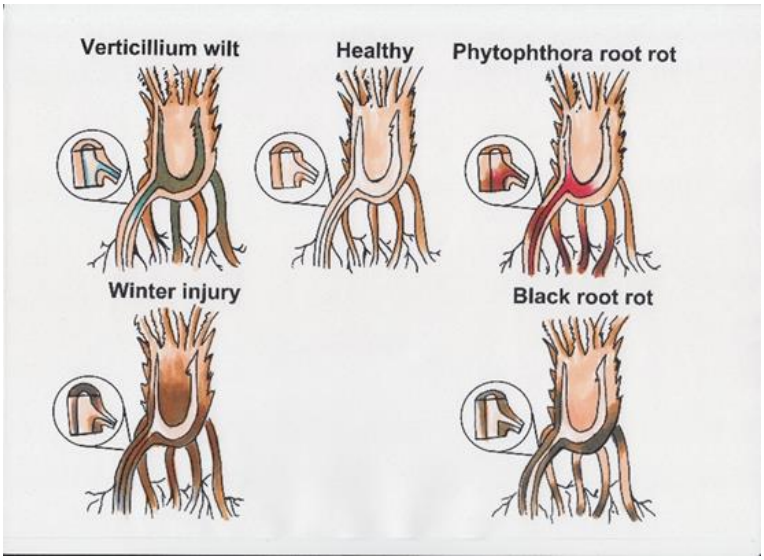

Diagnostic tips for recognizing root diseases and freeze injury in damaged strawberry crowns. Illustration by Dr. Kerik Cox, Cornell.

- ***Spray early for best leaf spot control***—if leaf spot incidence has been climbing, spring is the time to spray plants. See Kerik Cox's article in the last issue of Berry News.
- ***Apply early season herbicides***—Late winter or early spring, after winter annual broadleaf weeds have broken dormancy, but before strawberries begin to grow, is a key time for herbicide application.

—Blueberries—

- ***Prune blueberries before bud break—***Northern locations still have a pruning window. Most plantings south of Albany are at bud break and tight cluster.
- ***Look for evidence of canker***—Shoot dieback that goes down the entire cane and looks like the death happened last season could indicate canker. After bud break use Quilt Xcel, Quash, Kocide, Cuprofix, or Pristine to control canker.
- ***Green tip sprays for Mummyberry*** – if you have this disease – that's the timing for control. Abound, Captan 50WP, QuiltXcel, Captevate – read labels.
- ***Prepare for nutrient applications in early May and again in early June***—Review foliar tests. More on blueberry nutrition next issue.
- ***Apply early season herbicides***—Casuron 4G must be applied before May 1st. If you are applying it in April, make sure to apply before soil temperatures exceed 45 degree F and before any annual weed seeds germinate. Casoron CS can be applied a bit later but still needs to be incorporated by rainfall before weed germination; it is labeled for 1 year old blueberries. Casoron controls annual grasses and broadleaves, as well as some perennial grasses. Follow Casuron with a post-emergent such as paraquat to kill pre-emerged weeds or apply glyphosate when weeds are actively growing. Princep, Devrinol, Axxe, Solicam or Sinbar can all be applied for pre-emergent weed control. If you have a nutsedge problem, consider using Sandea.
- ***Apply sulfur if soil pH is higher than 5.2***—200#/A is the maintenance rate that should be applied 1-2 times annually to prevent soil pH from creeping up. Remember that the target pH is 4.5.

—Brambles—

- ***Brambles are breaking dormancy in all but a few northern locations.***
- ***Complete the necessary Pruning***—keep cane density at no more than 4 canes per square foot. There may be some winter injury so look for that and prune it out.
- ***Bud Break*** is the trigger for **sprays to control Anthracnose, spur blight, and Cane blight**.
- ***Apply early season herbicides—***Casuron 4G (granular) can be used in caneberries. Casoron CS can be applied a bit later but still needs to be incorporated by rainfall before weed germination; it is labeled for blackberry and raspberries if applied **before** new shoot emergence. Another pre-emergent is Surflan. Again there are two formulations. Surflan AS can be used in non-bearing and bearing brambles at a rate of **2-6 quarts per acre**. To broaden the spectrum of weed control, tank mix Gramaxone, Princep or Solicam. Irrigate product in to activate material. Surflan XL 2G can only be applied to non-bearing brambles.

Mummyberry—shriveled berries can be prevented with green tip spray. Photo from Cornell Berry Diagnostic Tool.

Protecting Against Spring Freeze Damage

Laura McDermott

There are plenty of resources available to help with critical decision making when it comes to frost protection. Basically it comes down to a firm understanding of when plants are the most vulnerable and then being confident in your predictive tools and the temperature measures you have right in the field. Risk tolerance varies for growers. In my opinion, the next 5-6 weeks are the most predictably challenging of the year for berry growers – good luck and get as much sleep as you can!

Blueberries:

Critical Stages:

Bud Swell: 'Visible swelling of buds; scales separated. Can tolerate 10 to 15 F (-12 to –9 C)'

Tight cluster: 'Individual flowers distinguishable. Can tolerate 20 to 23 F (-7 to –5 C)'

Michigan State Extension has a great pictorial chart that will help you better understand Blueberry growth stages and critical spring temperatures: bit.ly/MSUblueberries

Other weather management information links:

Using your sprinkler system to protect blueberries from freezes (bit.ly/MSUsprinklersystem)

Frost & Freeze Protection: Blueberries (bit.ly/FrostFreezeProtection)

Blueberry bud stages most vulnerable to freeze damage. Bud swell (L), tight cluster (R). Photos from Michigan State Extension.

Strawberries:

Strawberry flowers are most sensitive to frost injury immediately before and during opening. At this stage, temperatures lower than 28F likely will injure them. However, when strawberry flowers are in tight clusters as they are when emerging from the crown, they will tolerate temperatures as low as 22F. Likewise, once the fruit begins to develop, temperatures lower than 26F may be tolerated for short periods. The length of time that plants are exposed to cold temperatures prior to frost also influences injury. Plants exposed to a period of cold temperatures before a frost are more tolerant than those exposed to warm weather. A freeze event following a period of warm weather is most detrimental.

Overhead irrigation is used for frost control because flowers must be kept wet during a freeze in order to provide protection. As long as liquid water is present on the flower, the temperature of the ice will remain at 32F because the transition from liquid to ice releases heat. Strawberry flowers are not injured until their temperature falls below 28F. This 4 degree margin allows the strawberry grower to completely cover a field with ice and yet receive no injury from frost. However, if insufficient water is applied to a field during a freeze event, more injury can occur than if no water was applied.

Misshapen berries resulting from blooms partially damaged by frost. Photo from OMAFRA.

The challenges of applying overhead irrigation plus the fact that many fields are already wet have led to many growers relying on row cover for spring frost protection. Row covers modify the influence of wind, evaporative cooling, radiational cooling, and convection. Because wind velocity is less under a row cover, less heat will be removed from the soil and less evaporative cooling will occur. Also, relative humidity will be higher under a row cover, reducing heat loss from evaporation. In addition, convective and radiational heat loss is reduced because of the physical barrier provided by the cover. Plant temperature under a cover may eventually equal that of the air, but this equilibration takes longer than with uncovered plants. In other words, row covers do not provide you with additional degrees of protection, but they do buy time on a cold night as flower temperatures will fall less rapidly inside a cover. Often the temperatures fall so slowly under a row cover that irrigation is not needed. If irrigation is required, less water is needed to provide the same degree of frost protection

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under a row cover. **Water can be applied directly over the row covers to protect the flowers inside**. (Source: FROST PROTECTION IN STRAWBERRIES, Marvin Pritts, Dept. of Horticultural Sciences, Cornell)

The table below describes the amount of water needed to protect strawberries during freeze events with wind and decreasing temperatures. To measure the temperature **at bed height,** read the article about digital thermometers in this issue.

Table: Inches of Water/Acre/Hour to Apply for Protection at Specific Air Temperatures and Wind Speeds
(Martsoff and Gerber, Penn State University)

Wind speed at crop height (km/hr)	-2.8°C (27°F) air temperature at canopy	-4.4°C (24°F) air temperature at canopy	-6.7°C (20°F) air temperature at canopy	-7.8°C (18°F) air temperature at canopy
0-2	0.10	0.10	0.16	0.20
3-6	0.10	0.16	0.30	0.40
7 – 14	0.10	0.30	0.60	0.70
15 – 19	0.10	0.40	0.80	1.00
20 – 35	0.20	0.80	-	-

Find additional information on strawberry frost management here: bit.ly/OMAFRAfrost

Using a Digital Thermometer to Guide Your Decisions in Freeze Events

Barclay Poling, NCSU Former Extension Specialist

Whether you rely on overhead sprinkler irrigation or floating row covers to protect your strawberries, you will find one instrument as indispensable as a good weather forecast — a hand-held digital thermometer.

A digital thermometer can help you make critical decisions about protecting your strawberries from frost and freezing weather – by accurately measuring blossom temperature. A digital thermometer also can help you manage occasional "warm days" in April and May that can cause strawberry blossoms to abort. The thermometer can help you decide when you need blossom evaporative cooling, using sprinkler irrigation on those very warm spring days that reach the mid-80s or higher.

A digital thermometer with thermocouple will help improve your decision-making by:

1) Providing the actual temperature of the blossom, which can differ from the air temperature around the blossom.

2) Telling you when to start irrigation.

3) Telling you when to stop irrigation in the morning.

Even if you use row covers, rather than sprinkling, as your primary method of frost, the digital thermometer remains an indispensable tool for extra chilly nights when you may need supplemental heating, using irrigation on top of the row cover.

When to start irrigation in a freeze?

If you use only sprinkler irrigation for cold protection, be sure to start irrigating as soon as the digital thermometer indicates the blossom temperature is 31/32 F. The air temperature may still be as high as 38 F if the air is dry.

If you combine irrigation and row covers, we suggest starting irrigation on top of the covers as soon as blossom temperatures beneath the covers fall to 28 F.

Monitoring system performance during irrigation

The digital thermometer is an excellent tool for monitoring the success of your protection. If the blossom dips below 31 F, you need to step up your irrigation rate!

When to shut down?

The digital thermometer helps to eliminate guessing when to stop irrigation in the morning. On very cold mornings with wind, you may need to keep running well past sunrise. When blossoms provide a reading of 32 F or higher on the thermometer, you can safely stop irrigating. Again, the blossom temperature differs greatly from the air temperature, and you want to keep irrigating until the blossom temperature reaches at least 32 F.

For more information watch the related video at: https://strawberries.ces.ncsu.edu/2009/12/mauris-sed-leo-aliquam-aliquam/.

Managing Strawberry Fruit Rots with Biopesticides

Kerik Cox, Cornell University

Fruit Rots in Strawberries

There are two pre- to post harvest fruit rots that principally threaten strawberry production in NY: anthracnose and gray mold or Botrytis fruit rot. Anthracnose of strawberries is caused by a few species of the fungus *Colletotrichum*. This pathogen overwinters in perennial plantings on debris, but in annual plantings, inoculum comes in on transplants as it survives poorly in the soil. As the weather warms in the spring, lesions on infected tissues will produce gelatinous salmon colored droplets composed millions of microscopic spores. These spores are transported via water splash, wind-blown rain, and insects to start new infections of young flowers, petioles, and, especially fruit. Gray mold in strawberries is caused by the fungus *Botrytis cinerea*. This pathogen overwinters in plant debris but can also survive in straw mulch and in weeds. Like *Colletotrichum*, *B. cinerea* infects young flowers leaves, which are the principal means of infection for developing fruit in the spring and early summer. Once the infected tissue begins to die, it will sporulate with a mass of gray fuzzy stalks producing millions of spores which can completely envelop susceptible mature fruit and floral tissues. Spores of *B. cinerea* are dispersed by wind, rainfall, and irrigation water to new tissues. Direct infection healthy fruit is only possible if fruit becomes injured in production, at picking, or begins to senesce. In this regard, *B. cinerea* is a greater threat to overripe fruit remaining in the planting at harvest.

These fruit rot pathogens are endemic to all fruit and vegetable operations to NY, not just strawberries, and present a perennial problem. The impacts of fruit rot are most commonly realized during flooding and rainy weather at during harvest and post-harvest when consumers are expecting a shelf life of a few days to a week. Given the importance of flower infections for gray mold and anthracnose, chemical management typically focuses on protecting bloom. However, late season fungicide applications at or before harvest have best opportunity to prolonging shelf -life and reducing pre- and post-harvest rots.

Post-harvest Fruit Rot Trials

With the research funding provided by the New York Berry Growers Association, we were able to conduct pre- to post-harvest fruit rot fungicide trials on strawberries. In this capacity, we evaluated one member of each major fungicide group and the biological active ingredients most often used in small fruit production. Studies were conducted on day-neutral 'Albion' strawberries planted on white on black plastic in low tunnels from Dubois Agrinovation. At harvest from August to Oct, an application of each fungicide or biological was made to replicate plots of strawberries using a Solo 425 Backpack Sprayer fitted with XR TeeJet 8002VS nozzle, 40 gal/A, 50 PSI. The fungicide groups and active ingredients used in the experiment are highlighted in Table 1. For each material, the highest labeled rate was evaluated. Following application, healthy Strawberries where then gently harvested into 1-pint

Fungicide or Biopesticide active ingredient	FRAC Group	Product Evaluated	Manufacturer
Pyrimethanil	9	Scala SC	Bayer CropScience
Iprodione	2	Rovral	FMC Corporation
Fenhexamid	17	Elevate WG	Arysta LifeScience
Cyprodinil + Fludioxonil	9 + 12	Switch	Syngenta
Captan	M4	Captan Gold 80 WDG	ADAMA
White Mineral Oil	NA	Organic JMS Stylet-Oil	JMS Flower Farms
Pyraclostrobin + Boscalid	11 + 7	Pristine	BASF
Pyraclostrobin + Fluxapyroxad	11 + 7	Merivon	BASF
Bacillus Amyloliquefaciens	NA	DoubleNickel LC	Certis USA
Bac. Subtilis QST 713	NA	Serenade Opti	Bayer CropScience
Copper Octanoate	NA	Cueva	Certis USA
Difenoconazole + Cyprodinil	3 + 9	Inspire Super	Syngenta
Penthiopyrad	7	Fontelis	DuPont Crop Protection

Table 1: List of fungicide groups and biopesticide active ingredients evaluated in the study.

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vented clamshell containers and separate pints of strawberries were inoculated with spores of *B. cinerea* and *Colletotrichum fioriniae* at 10^4 spores/mL. Pints were incubated for five days in cold storage (40°F). After three days in storage, the untreated checks or least effective materials had nearly 50% incidence of disease. At this point, the incidence of gray mold and anthracnose was assessed for all treatments. The experiment was repeated three times.

Across all materials, the incidence of gray mold and anthracnose ranged from (0 to 45%) and (0 to 55%), respectively, Of the materials tested, we found that applications of materials containing iprodione, fludioxonil, difenoconazole fluxapyroxad, and pethiopyrad provided the best control of gray mold (Figure 1, page 7). Interestingly, many fungicides were ineffective against grey mold in the this test with incidences equivalent ($P > 0.05$) to the untreated check plots. The biopesticide based on *Bacillus amyloliquefaciens* was able to provide better gray mold control than the check and several of the conventional products ($P < 0.05$) despite the high pressure of this inoculated test. Against anthracnose, we found that materials containing iprodione, fludioxonil, and pethiopyrad resulted in the lowest incidence of fruit rots (Figure 1, page 7). In contrast to gray mold, many fungicides (with the exception of Pristine) were effective against anthracnose in this inoculated test and provided more than 50% control. The biopesticide based on *Bacillus amyloliquefaciens* was able to provide a level of anthracnose control equivalent to or better than several of the conventional products ($P < 0.05$) during this high pressure inoculated test.

Considering Fungicides for Managing Fruit Rots 2019

It's important to bear in mind that the study shown here is high pressure test and is not representative of levels of inoculum and conditions experienced in grower fields. Also, the applications were perfectly timed in to the infection event, which did provide some advantage to the fungicides being test. The test does give one an idea of the effectiveness of the different fungicides relative to one another in a head to head comparison. It's also important to note that the isolate of *B. cinerea* and *C. fioriniae* used has resistance to QoI fungicides (Group 11), which may explain the poor performance of Pristine, which has a weaker SDHI (Group 7) than Merivon. In general, all these fungicides are effective against fruit rot diseases under natural inoculum conditions and using each fungicide group will contribute to a successful disease management program in strawberries. Finally, it's important to note biopesticides have a potential fit even against aggressive fruit rot diseases and can provide a reasonable level of control.

Overall, fruit rots aren't often observed at harvest unless there has been considerable rainfall and flooding at the end of the season. However, fruit rots may show up a few days after harvest on apparently healthy fruit and disappoint

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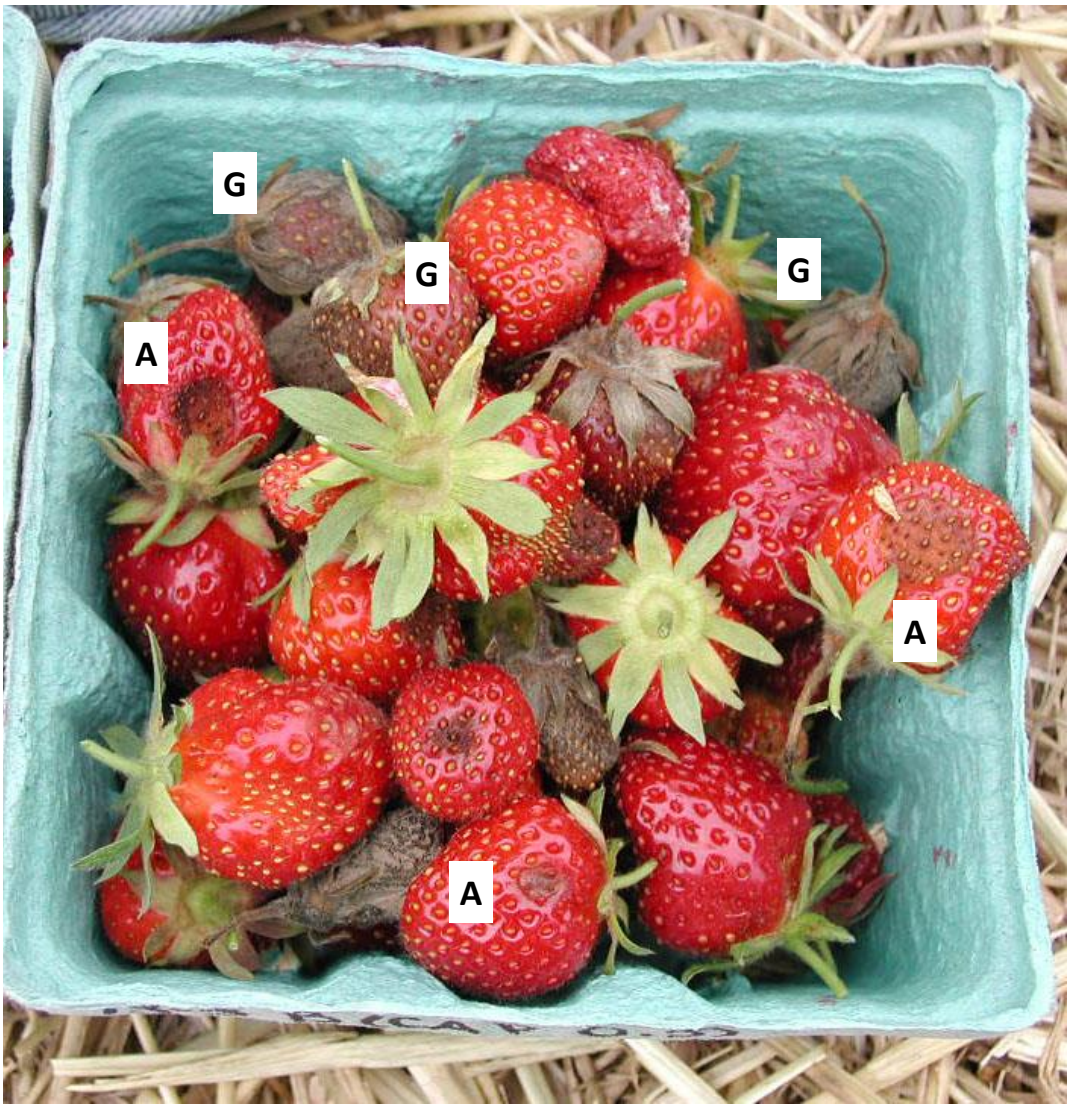

Close up of strawberries in a vented paper pulp 1-pint berry container. There are several with gray mold (**G**) displaying the typical lesions covered with gray sporulation of *Botrytis cinerea*, and others with anthracnose (**A**) displaying the classic sunken lesion filled with pale salmon-colored sporulation of *Colletotrichum fioriniae*.

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consumers; impacting return business. Hence, it's important to the be mindful of the potential level of fruit rot diseases even in covered production, especially if rains have led to flooding conditions. When heavy rains and flooding occurs at harvest, consider selecting a fungicide group with excellent activity against pre- to post harvest rots. Consider the data here, but also look at the labels as many have 0-day PHI allowing one to make an application during harvest.

Literature

Maas, J.L. 1998. Compendium of Strawberry Diseases. APS Press. 98 p.

Pritts, M. and Handley, D. 1998. Strawberry Production Guide for the Northeast, Midwest, and Eastern Canada. NRAES-88. Cornell cooperative Extension, Ithaca, NY, 162 p.

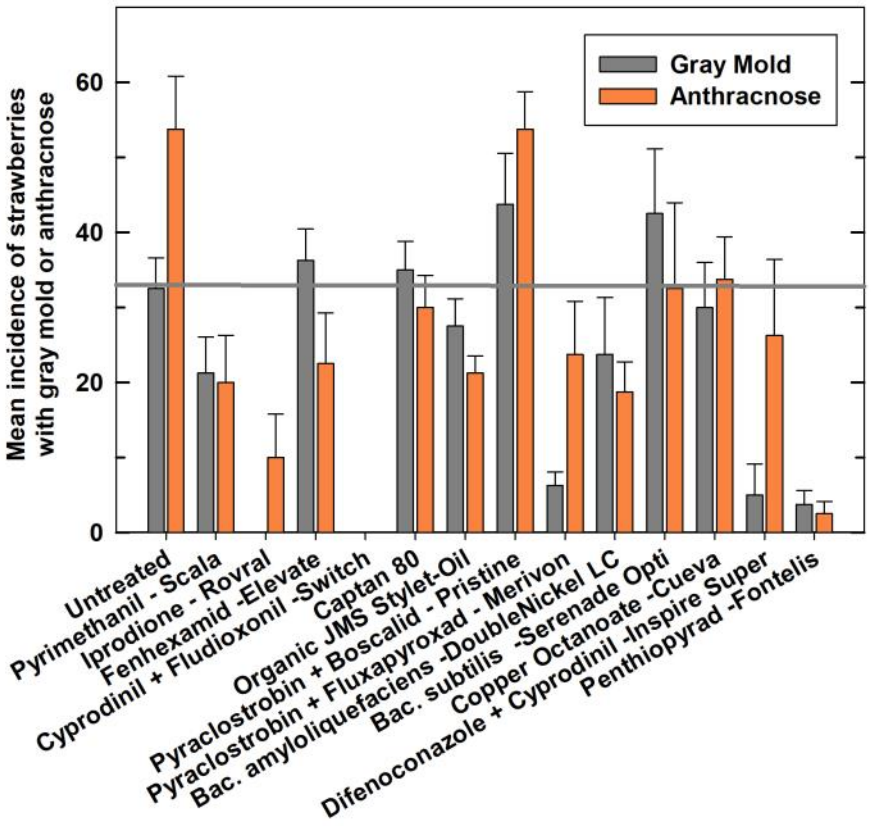

Figure 1. Mean percent incidence of gray mold (grey) and anthracnose (orange) post-harvest on 'Albion' day-neutral strawberries treated in a planting on plastic in a high tunnel for different fungicide and biopesticides. Values represent means and standard errors of six replicates from three experimental repeats. Statistical significant differences mentioned in the text were assessed at the ($\alpha = 0.05$) using to the LSMEANS procedure of SAS 9.4 with an adjustment for Tukey's HSD to control for family-wise error.

For Your Information:

- **Specialty Fruit Survey:** Are you interested in diversifying your farmers market, farm stand, or CSA offerings with specialty fruit crops?

  Have you ever thought about growing currants, kiwiberries, goji berries, beach plums, or other 'unusual' fruits? Tell us about it! The Eastern NY Commercial Horticulture Program is gauging grower interest in growing specialty fruit crops. Your input will help guide a project that will aim to develop growing recommendations and enterprise budgets for unusual fruit crops in New York. Fill out our online survey by visiting: bit.ly/SpecialtyFruitSurvey

Juneberries ripening. This berry resembles blueberries, but has its own unique flower profile. Photo by Lee Reich.

- **Technology in the Field:** This link will take you to a three and a half minute video showing work done in the northwest to scout berry crops using a UAV (drone): bit.ly/UAVremotesensing

- **Berry Harvester Videos:** The following videos were assembled by the Northwest Berry Foundation in their recent Small Fruit Update. It seems that we aren't the only ones wondering how we'll get the berries picked. For in-person looks at harvest aids, consider the August 8th event in Vermont, plus keep your eyes on the calendar as new opportunities arise.
  - Haven 5440 Top Load Harvester (11/5/19)
  - Kokan Air Blueberry Harvester (2/11/19)
  - Oxbo Raspberry & Blueberry Harvesters (7/1/18)
  - Weremczuk Berry Harvesters (11/9/18)
  - Old BEI sway machine (12/5/18)
  - PPHU "Wachowski" (9/10/18)

Calendar of Events

April 29, 2019—Last Monday Grant Webinar for Fruit & Vegetable Growers
12:00pm monthly webinar

Monthly webinar to disseminate information on available grants relevant to fruit and vegetable farmers in Eastern NY. Visit the CCE ENYCHP website to register online

May 7 - 9, 2019—Berry Health Benefits Symposium
Portland, Oregon

An International conference dedicated to showcasing the latest scientific research into berries and health, it will feature cutting-edge findings in many areas, including breast and colon cancer, leukemia, diabetes, gut health, metabolism, brain aging, and heart health. For more information and to register, visit: berryhealth.org.

August 8, 2019—Vermont Berry Growers Workshop
Rochester, Vermont

Rob Meadows and Patricia Rydle invite you to a tour of htier 6-acrea PYO organic blueberry and raspberry farm. Come see, and possibly try out, their new East Harvester for blueberries. Rob will explain his laser distress call systems for bird control, and we will see their farm store and cool room setup. The farm is open until 6pm, please park so as not to compete with customers. Attendance is free for members of the Vermont Vegetable and Berry Growers Association. The cost is $10 per person for non-members, payable on-site. Refreshments will be served. For more information, visit: bit.ly/VTberryworkshop.

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