New York Berry News

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What's Inside

Happy New Year! This is the first edition of the 2004 edition of the New York Berry News. The big news of 2004 has been..., yep, the weather. The warm spell we experienced late in December was followed by an arctic chill that most likely injured red raspberries. The extent of the damage is hard to predict and we welcome input from growers who have may have some thoughts on the topic. Strawberries and blueberries were, most likely, able to take the chill...blackberries, on the other hand, are toast. The unpredictability of weather is certainly an aspect of fruit production difficult to get accustomed to. In this issue of the NY Berry News some thoughts on greenhouse strawberry production and bramble production in high tunnels are given. These present real options to minimize the unpredictable, but almost certain losses due to weather. Courtney Weber and Jeremy Pattison give a brief review of their research evaluating red raspberry cultivars for resistance to Phytophthora root rot. Steve McKay discusses some observation in establishing Ribes cordons. Nicole Werner and Bill Turechek present results from their work with managing anthracnose. And lastly, Bill Turechek et al. present results from their fungicide trials conducted last year.

Upcoming Meetings

January 21-23, 2004: *Ohio Fruit and Vegetable Conference*, Toledo SeaGate Convention Center and Radisson Hotel in Toledo, Ohio. Please visit http://www.ohiofruit.org/ for more information.

January 26-29, 2004: *New York State Farmers' Direct Marketing Conference*, Best Western Regency Hotel, Binghamton, N.Y. Diane Eggert, (315) 475-1101, diane99@dreamscape.com

January 27-29, 2004: *Mid-Atlantic Fruit and Vegetable Conference*, Hershey, PA. Contact: Bill Troxell (717)-694-3596 or e-mail: wt.pvga@tricountyi.net

February 5-7, 2004: *Pennsylvania Association for Sustainable Agriculture's 13th Annual Conference*, Farming for the Future, Conference Center, Penn State University, University Park, PA. Contact: Brian Snyder (814)-349-9856.

February 9-12, 2004: *NY State Berry Growers Association Annual Meeting*, Riverside Convention Center in Rochester, N.Y. First combined show of the New York State Vegetable Growers Association (NYSVGA), the New York Horticultural Society (NYHS), the New York State Berry Growers Association and the Empire State Potato Growers. For information, contact Jeff or Lindy Kubecka at 315-687_5734.

February 18-19, 2004: *Ontario Fruit and Vegetable Convention and Trade Show*, Brock University, St. Catherines, Ontario. (905) 563-6901.

February 23-25, 2004: *North American Strawberry Growers Association Annual Meeting*, Hilton Westshore, Tampa Bay, FL. For more information

Contact Patricia E. Heuser at 814-238-3364. Email: info@nasga.org.

February 26-28, 2004: *19th Annual NY Farm Show*, Syracuse, NY. Over 400 companies and manufacturers were represented in 2003! For more information contact Scott Grigor, Show Manager at 315_457_8205, Email: sgrigor@ne_equip.com.

President Bush: Immigration Policies Needs to be More Humane

President George Bush announced Jan. 7 that he will propose immigration reform, which would affect millions of undocumented workers in the United States. In this proposal, Bush calls for the ability of undocumented workers to apply for temporary worker status that will give them legal employee benefits, including minimum wage. Under the proposal, illegal workers would also be able to apply for a green card and travel freely between their home countries and the United States. It is expected that Bush will also propose to increase the number of green cards granted each year. Our laws should allow willing workers to enter our country to fill jobs Americans aren't filling," Bush said in a Web-cast Jan. 7. "We must make our immigration laws more rational and more humane."

Bush also said that he opposes amnesty programs for illegal immigrants. "We're very excited that the president is back in the game," said Sharon Hughes, executive vice president of the National Council of Agricultural Employers. "We really appreciate his support of trying to do something with guest worker programs and recognizing that we do have a problem with undocumented workers." Hughes said that the information she has seen on Bush's proposal is in line with the Agricultural Jobs, Opportunity, Benefits and Securities Act (AgJOBS), which has been introduced in both houses of Congress. "We hope that the president's support for this action means we can get AgJOBS done early this year," Hughes said.

The president's proposed plan would apply across all sectors of labor, whereas AgJOBS specifically relates to agricultural employment, Hughes said. Bush's proposal is modeled on legislation introduced last year by Senator John McCain, R-Arizona, and representatives Jim Kolbe, R-Arizona, and Jeff Flake, R-Arizona. "At this point, we just see it as a positive that he (Bush) is endorsing the outlines of what we have set ahead in AgJOBS," she said. "We would like to see AgJOBS go through first and be a prototype for the others – it is primed and ready to go." Hughes said that she expects more details on Bush's proposal to be available after the president meets later in January with President Vicente Fox of Mexico (*Source:* The Fruit Growers News)

Narrow Exemption Leaves Few Eligible for Assessment Waiver

Greg Brown, Associate Editor, The Fruit Growers News, Sparta, MI

The USDA has proposed exempting organic producers from conventional marketing order promotion assessments. But, the proposed rule stemming from the farm bill limits the exemption to producers who are 100 percent organic. That is the rub, according to industry groups. Kevin Moffit, executive director of USA Pears/Pear Bureau Northwest said that the recommendation would have little effect on the order's bottom line. With between ½ to 1 percent of the order being 100 percent organic, the rule will not affect efforts greatly. "There probably aren't that many 100 percent organic growers of pears," he said. "We're supportive of that position, now that the USDA rules have finally been published. But, it is fairly limiting because it does exempt only 100 percent organic growers." But, Moffit said, the organization is working well with organic pear producers by reaching out to organic supermarket chains big and small.

In the move announced in December, the USDA's Agricultural Marketing Service would amend 28 fruit and vegetable marketing order programs that authorize market promotion activities. The changes would exempt producers and marketers of solely 100 percent organic products from paying commodity promotion assessments. The 2002 Farm Bill directed the USDA to issue regulations exempting any person who produces and markets solely 100 percent organic products and who does not produce any conventional or non-organic products from paying assessments under a commodity promotion law. The word "solely" really limits the impact of the proposed rule, industry sources said. Moffit estimated that there are, perhaps, fewer than five strictly organic pear growers in the Northwest. "There are a few that will be exempt from the marketing order, if they choose to be. But we plan to continue to promote organic pears through the continued use of our USA Pears logo and marketing efforts. "We promote organic pears with supermarket groups such as Whole Foods and Wild Oats, that carry a lot of organic produce," said Moffit. "We promote the product in the way they want us to promote in their stores. "In addition, we try to reach out to the smaller organic supermarkets and try to promote in those," he said. In Portland, for example, the group works with New Season, a four-chain organic operation. "It is not possible for a trade association to say this organic product is better than conventionally grown. But, by going out and working with organic supermarket groups and moving the volume of organic fruit that we have, we feel that we are giving our grower base a good shake in representing them."

The proposed rule would affect the 28 regional marketing order programs that authorize market promotion activities. These include programs for Texas citrus; Florida avocados; California nectarines; California peaches and pears; Washington apricots; Washington sweet cherries; Washington/Oregon fresh prunes; Southeastern California grapes; Oregon/Washington winter pears; cranberries grown in the States of Massachusetts, et al.; tart cherries grown in the states of Michigan, et al.; Oregon/Washington Bartlett pears; California olives; Oregon/California potatoes; Colorado potatoes; Georgia Vidalia onions; Washington/Oregon Walla Walla onions; Idaho/Eastern Oregon onions; Texas onions; Florida tomatoes; Texas melons; California almonds; Oregon/Washington hazelnuts; California walnuts; Far West spearmint oil; California dates; California raisins; and California dried prunes.

The Organic Trade Association's (OTA) executive director, Katherine DiMatteo, said that the proposed rule was not as inclusive as the association would have liked to see. DiMatteo was withholding final judgment, saying that the proposed rule had the potential to be very good news to the organic industry. "We're not clear as to the level of difficulty that producers will face with this proposed exemption. We're not sure just how easy it will be for a grower to remove their operation from a marketing order," said DiMatteo. OTA petitioned USDA soon after the rule's announcement to extend the comment period, because it fell during the busy holiday period. "We want as many producers as possible to get the benefit of the exemption," said DiMatteo. "This presents a good opportunity for growers to save some money, and get relief from an additional assessment." DiMatteo said that the OTA was going to continue looking into the proposed rule and examine how the individual marketing orders handle the promotion and assessment of organic products.

Comments on the proposed rule may be sent to the Docket Clerk, Marketing Order Administration Branch, Fruit and Vegetable Programs, AMS, USDA, 1400 Independence Avenue, S.W., STOP 0237, Washington, D.C. 20250 0237; fax (202) 720 8938; or e-mail to moab.docketclerk@usda.gov.

Strawberry Cultivar 'Earliglow' Scores High on Health Benefits

Lori Bushway, Senior Extension Associate in Berry Crops, Cornell University. Ithaca, NY

Abundant evidence suggests that berries are especially rich in a variety of natural antioxidants. Our bodies need these compounds to battle damaging free radicals, which are thought to lead to heart disease, cancer and other chronic diseases. But did you know that some strawberry cultivars (varieties) could be better than others when it comes to waging this war? And as we get older, it's even more important that we have a diet high in antioxidants, because our bodies become increasingly less efficient at fighting free radicals.

Cornell University researchers recently analyzed the antioxidants in eight popular northeastern strawberry cultivars: Sable, Earliglow, Annapolis, Evangeline, Mesabi, Allstar, Jewel and Sparkle, and they found significant differences. They think this is important because it could help breeders develop antioxidant-rich strawberry cultivars and influence which cultivars are sold commercially and used in food products. With growing concern about healthy food, many consumers may be willing to pay more for berries and berry products that deliver more health value. Cornell researchers measured three different characteristics of the strawberry cultivars: phenolic content (compounds that account for a major portion of the total antioxidant content in most strawberries), total antioxidant activity, and cancer cell proliferation inhibition. Earliglow, Evangeline and Annapolis fruit extract had the highest free phenolic content while Mesabi, Jewel and Allstar had the lowest. Earliglow's free phenolic content was 65% higher than Allstar.

Earliglow also ranked highest in total antioxidant activity, with more than twice that of the second-ranked cultivar Mesabi, and nearly seven times the lowest ranked cultivar Allstar. But the connection between phenolic content and antoxidant activity was weak. There was also no obvious relationship between cancer cell proliferation inhibition and phenolic compounds content or antioxidant activity. But Earliglow again ranked the highest, while Allstar inhibitory action was ranked second lowest. Although relationships among antioxidant content and antioxidant activity and inhibitory action are still not fully understood, it is clear strawberry cultivars differed significantly in antioxidant characteristics and Earliglow could ranks among the best in health value.
Further reading: The full article (*Antioxidant and Antiproliferative Activities of Strawberries*) describing Katherine J. Meyers and Drs. Christopher B. Watkins, Marvin P. Pritts, and Rui Hai Liu research can be found in the Journal of Agricultural and Food Chemistry 51 (23), 6887 -6892, 2003. You may also find a Science News Online article highlighting this research (*As If You Needed Another Reason to Eat Strawberries* by Janet Raloff Week of Oct. 25, 2003; Vol. 164, No. 17) http://www.sciencenews.org/20031025/food.asp

Strawberry Substrate System Lessens Diseases, Improves U-pick

Kimberly Warren, Associate Editor, The Fruit Growers News, Sparta, MI

When looking for ways to improve their growing conditions and the control of them, many growers turn to the greenhouse – especially when it comes to strawberries. The disease pressure is less, the harvesting is easier during rainy weather, and the environment can be more easily controlled. But what if there were a way to improve those indoor environments even more? For strawberries, there is: soil-less, table top – or similar – system. "Basically, it involves growing strawberries in containers in a substrate other than soil," said David Simpson, of Horticulture Research International, East Malling, United Kingdom (UK). "Peat is the most common, but there are others such as coir and composted bark. Containers are normally either grow-bags or 2 gallon buckets." This system, Simpson said, is normally used with 60-day plants, though everbearers could be used. And the system works better using an annual system because plants do not perform well if left in the bags for a second year, he said.

"This system has three principal advantages," Simpson wrote in his paper presented at the Great Lakes Fruit, Vegetable and Farm Market Expo. "Firstly, the artificial substrate eliminates soil-borne diseases and give the grower complete control over plant nutrition. Secondly, the containers can be placed at a convenient height for harvesting, thereby improving picking speeds and reducing costs. Finally, the system is flexible – containers can be moved in and out of the glasshouse to make it possible to produce three or four crops in a year. "Picking strawberries is never a very popular job because you get back ache," Simpson said. "It is very flexible, as the bags can be moved in and out of a glasshouse or tunnel for programmed production. It allows an extra crop per season to be achieved in the same area of a glasshouse or tunnel."

But, not all varieties will work well for this system. "It works best with the less vigorous varieties that have a fairly compact habit," Simpson said. "The optimum growing conditions are the same as for soil-grown strawberries, but because it is done under tunnels or in glasshouses, the grower has more control over the conditions and can extend the season at both ends." Though this system is popular in Holland, Belgium and the United Kingdom, it has yet to catch on in the United States. "It's certainly not being done in California or Florida, which are the main areas where strawberries are produced," Simpson said. "It's possible. There's no problem with using this system anywhere in the world, really. If you've got a climate where you can grow strawberries, then you can use this system."

One of the difficulties may be that nurseries in the United States don't often provide the types of plants needed for this system, Simpson said. In addition, the system is expensive to get started. "You've got extra costs for paying for peat, bags, and plants are more expensive to buy in the first place," Simpson said. Add to that the costs of the materials used to build the structures to put the strawberries on – straw bales, tubular steel or timber – and the costs rise. Plus, there are grow-bags specially designed for producing strawberries in this way. The bags would either have to be imported or produced locally with pre-set specifications. "It is more costly, but not necessarily less profitable," Simpson said. "I know quite a few growers in the UK who have started using this for pick your own. In fact, as with the commercial pickers, the people who come to pick-your-own farms, they pick more quickly and therefore buy more fruit." For growers looking to start this system, Simpson has some advice. "Start on a small scale and try different varieties to see which works best." (*Source*: Fruit Growers News Jan 2004).

High Tunnels for Season Extension in Bramble Crops

Lori Bushway, Senior Extension Associate in Berry Crops, Cornell University. Ithaca, NY

High tunnels offer the opportunity for the grower to get a crop started early in the season, to stay in production later in the season, and, possibly to produce a cool season crop such as greens through the winter. High tunnels also provide protection from rain and hail and can reduce disease and pest pressure. With good planning, variety selection, and close management, this low cost system (about $1.30/sq. ft, excluding labor) can add another dimension to a berry operation. Under high tunnel systems, some floricane fruiting raspberry varieties have begun fruiting as early as the end of May, with the primocane fruiting raspberries beginning in early July.

High tunnels are generally quonset-shaped, constructed of metal bows that are attached to metal posts which have been driven into the ground about two feet deep. They are covered with one layer of 6-mil greenhouse-grade polyethylene (some growers have reported better production with special light-diffusing plastic that increases light interception on lower laterals), and are ventilated by manually rolling up the sides. The floor of the structure is covered with a layer of black weed barrier which also helps to raise the temperature inside the house and prevent evaporation of soil moisture. The use of high tunnels does require an increase in both the level and the amount of management required to grow the crop. The sides must be raised and lowered to regulate temperature and humidity. Plants must be irrigated regularly and fertigated as needed. Unless supplemental heat is provided the tunnel may not be able to provide adequate protection to the plants after the November/ December time frame depending on the year. Ventilation to avoid high temperatures or high humidity is very important in managing diseases such as powdery mildew and late yellow leaf rust which may occur under the high tunnel climate. Insects will also find the microclimate to be favorable and scouting must begin when the plants are set out. The use of beneficials may be the most practical way to deal with some insect and mite problems.

Further, bumble bees may be required to maximize production in the early and late part of the season when the sides are rolled up infrequently. **Additional resources:** http://www.fruit.cornell.edu/Berries/hightunnels.html

Resistance to Phytophthora Root Rot of Red Raspberry Cultivars

Courtney Weber, Assistant Professor, and Jeremy Pattison, Ph.D. Candidate, Department of Horticultural Sciences, Cornell University, 630 W. North St.-NYSAES, Geneva, NY 14456

Cultivar selection is a key factor in establishing a productive and profitable raspberry planting. Growers need to know the relative strengths and weaknesses of new cultivars to be able to plan effective management programs. Root rot caused by *Phytophthora fragariae* var. *rubi* is the most prevalent disease found on red raspberry in temperate production regions of the world including New York. Serious yield and plantation losses are common in the absence of control and are increasing with the declining effectiveness of current fungicides. An integrated management approach is recommended for controlling the disease, which employs cultural methods to ameliorate poorly drained soils, use of registered fungicides, and growing resistant cultivars. Growing resistant cultivars is the most effective means for avoiding economic losses from this disease, especially in regions with moderate to high rainfall and/or heavy, poorly drained soils. Many cultivars are known to possess high levels of resistance including 'Latham', 'Asker', 'Autumn Bliss', and 'Newburgh', although inferior horticultural traits or poor fruit quality relegate many of these to a minority of the planted acreage. Conversely, many commercially popular cultivars including 'Canby' and 'Titan', possess insufficient resistance and succumb to disease over time. Many newer cultivars are currently available to growers, but studies describing the relative resistance to Phytophthora root rot among these cultivars are limited.

We tested 18 cultivars and test selections for resistance to Phytophthora root rot using a growth chamber hydroponic assay developed at Cornell University that has been shown to produce results consistent with greenhouse and field studies. Tissue cultured plugs were obtained from several nurseries and evaluated for resistance based on four characteristics: 1) plant disease index (Table 1); 2) root regeneration index (0-3 with 0=crown and root tissue dead and 3= vigorous new root production); 3) stem lesion size (cm); and 4) incidence of petiole lesions. 'Latham', 'Boyne', and 'Killarney' were included in the study as resistant standards and 'Titan' as the susceptible standard.

Cultivars possessing resistance equivalent to 'Latham' were 'Anne', 'Prelude', 'Nova', 'Boyne', 'Caroline', and NY258. Ranking of these cultivars varied little based on the different criteria measuring resistance (Table 2). Susceptible cultivars included 'Dinkum', 'Cowichan', BC89-2-89, 'Autumn Byrd', 'Encore', 'Lauren', 'Polana', and NY283. With high levels of root rot resistance and good fruit quality and growth characteristics, 'Prelude' and 'Caroline' are good choices for growers. Others with good resistance but lesser fruit quality include 'Latham', 'Boyne', and 'Killarney'. 'Anne' showed high levels of resistance, however, under field conditions at Geneva, N.Y., plant stands tended to be thin and unproductive possibly due to poor winter hardiness and low production of root suckers. 'Josephine', a sibling to 'Anne', showed similar high levels of resistance although one plant displayed a stem lesion, which in the other cultivars was indicative of susceptibility. Based on all the scored criteria, 'Josephine' is classified as possessing moderate to high levels of resistance. This cultivar is untested in Geneva, N.Y. so field observations on fruit quality and stand characteristics are unknown. 'Nova' has been described as a susceptible genotype in nursery catalogs. However, in this study 'Nova' possessed resistance equivalent to the resistant standards as well as other cultivars including 'Prelude' and 'Caroline', which have been observed to possess field resistance to Phytophthora root rot in variety trials at Geneva, N.Y. It is possible that other species of *Phytophthora* or other disease organisms are able to colonize and cause similar disease symptoms on 'Nova' resulting in this apparent contradiction.

Table 1. Plant disease index for assessing susceptibility of red raspberry genotypes following inoculation with *Phytophthora fragariae* var. *rubi*.

Score	Symptoms
0	*No root rot, no shoot symptoms*
1	*Slight root rot, no shoot symptoms*
2	*Slight root rot, slight shoot symptoms*
3	*Moderate root rot, moderate shoot symptoms*
4	*Severe root rot and shoot symptoms with some living crown tissue*
5	*Death of the perennial crown*

Table 2. Response of red raspberry cultivars with respect to the different criteria used to evaluate the relative susceptibility to *Phytophthora fragariae* var. *rubi*.

Cultivar	Plant disease (1-4)	Root regeneration (1-4)	Stem lesions (cm)	Petiole lesions (%)
Prelude	*1.0*	*2.8*	*0*	*15*
Anne	*1.5*	*2.8*	*0*	*13*
Latham	*1.6*	*2.4*	*0*	*20*
Nova	*1.8*	*2.1*	*0*	*33*
Josephine	*2.0*	*2.0*	*0.75*	*25*
Boyne	*2.3*	*2.0*	*0*	*19*
Caroline	*2.3*	*2.0*	*0*	*19*
NY258	*2.3*	*1.5*	*0*	*23*
Killarney	*2.6*	*1.4*	*0*	*20*
Dinkum	*4.3*	*0.75*	*9.6*	*64*
Cowichan	*4.3*	*0.25*	*6.0*	*55*
BC89-2-89	*4.3*	*0.25*	*3.8*	*58*
Autumn Byrd	*4.3*	*0*	*3.5*	*67*
Encore	*4.4*	*0.5*	*6.0*	*59*
Titan	*4.4*	*0*	*3.9*	*78*
Lauren	*4.6*	*0*	*4.6*	*79*
Polana	*4.6*	*0.25*	*17.0*	*79*
NY283	*4.8*	*0*	*8.0*	*83*

We thank the North American Bramble Growers Association for generously providing the funding for this study. The information gained can be used by growers to choose the best cultivars for their operations and by raspberry breeders for developing cultivars with improved Phytophthora root rot resistance.

Additional Suggestions for Establishment of Ribes Cordons, 2003

Steven A. McKay, Extension Educator, Columbia County, Hudson, NY

This article is based on observations made during summer, 2003 at two plantings in Columbia County, New York, and continued consultation and observations in Holland with Adri Van Eck.

In 2002, I wrote an article which discussed how to establish a cordon-trained planting of gooseberries or red currants, and an explanation on how to convert established bushes to cordons. As I get more experience in growing these plants, and in discussing production methods with experienced growers, I will continue to pass along new tips.

Fertilizer

One of the most important observations was made in a commercial planting in Germantown. Red currant plants (one year old) started out the season green and vigorous, but after about a month of growing began to show yellowing and a lack of vigor. I had applied 50 pounds of actual nitrogen per acre the previous year and did the same in May this year, injected through the irrigation system. When no significant change in vigor or yellowing occurred, I decided to follow up with two additional 50 pound applications, one in June and one in July. The plants greened up, and put on 1-2 feet of new shoot growth which was nicely branched for fruiting the cordons. I had not gotten branching in the previous year.

My approach for the previous year was to be conservative on fertilizer applications because the site had a soil test which showed nutrients to be plentiful. If the plants were to be grown as bushes for mechanical harvesting, the approach may have been okay as a way to check excess plant vigor. I had mistakenly thought that restricting growth to a few branches would have invigorated them sufficiently.....not the case. In consulting with Adri Van Eck, he stressed that a heavy

fertilization program in the first years when plants are established is important. Lailaiang Cheng has offered to help me set up some trials this year to better define the nutrient needs of ribes on cordons.

Pest Control
In another plot with some new cordons, I had a minor problem with currant aphids at the beginning of the season. I figured that the natural predators would take care of the problem. By August, a combination of aphids and leaf spot had defoliated the plants. This is another illustration where good pest control is important, especially in the years of cordon establishment when rapid, healthy growth is needed.

Other Thoughts
Bamboo poles are susceptible to degradation, and when in contact with the soil can rot out a lot faster. I have tried running two wires along the row, with the bottom wire about a foot off the ground, and the second wire a few inches below the top of the post (and a distance from the bottom wire that allows a bamboo pole to fit between the wires. The bamboo is attached to the two wires, and is kept off the ground. As the plants grow up the posts, they are tied on with tie-tape.

Effect of Pre- and Post-Infection Period Applications of Cabrio on the Development of Anthracnose

Nicole Werner and Bill Turechek, Department of Plant Pathology, Cornell University, Geneva, NY

Strawberries are the third most valuable fruit crop in New York. In 2002, NY growers produced about 6.30 million pounds of strawberries on 1100 acres retuning an estimated $8.82 million. Strawberry anthracnose, caused by the fungus *Colletotrichum acutatum*, is one of the most serious diseases in commercial strawberry production. The disease has become an increasing problem in the Northeast and has resulted in substantial yield losses when conditions favored disease development. Currently, growers rely on calendar-based protective applications of fungicides for disease management. Ideally, growers would prefer to apply fungicides only when necessary, but this requires a good understanding of the conditions suitable for disease development as well as knowledge of the efficacy of the available control options.

Wilson et al. (1990) developed predictive curves to estimate the incidence of anthracnose on immature and mature berries based on the duration of berry wetness and the average temperature during the wetting period. In general, they found that the optimum temperature for infection for both immature and mature fruit was between 25 and 30 C, with greater than 80% infection occurring after 13 hr of leaf wetness. No infection occurred on either immature or mature fruit below 4 C, nor was any infection observed on immature fruit above 35 C. The infection curves developed by Wilson et al. (1990) do not help grower's time fungicide applications to prevent disease from reaching some damage threshold, nor do they provide any insight to the level of disease that would result if a grower were to apply a fungicide under a particular set of conditions. Research was initiated to study the efficacy of pre- and post-infection period applications of Cabrio on the development of anthracnose under different environmental conditions.

Materials and Methods

Plant Production and Maintenance: Day neutral plants of the variety 'Tristar' were grown in 6 inch pots in a 6:1 ratio of Cornell mix and sand. Plants were deflowered for the first 6-8 weeks of growth to encourage uniform flowering and berry production and, afterwards, bumblebees were introduced and utilized for pollination. The plants were fertilized weekly to provide plants 50 ppm N per week. Greenhouse temperatures were kept at approximately 22 C and supplemental overhead light was used when necessary.

Inoculum Preparation and Inoculation: Local strains of *C. acutatum* were isolated from infected berries collected in commercial strawberry fields in NY in 2001 and maintained on suitable growth media. Inoculum was prepared by flooding a Petri plate containing an actively growing culture with sterile distilled water and adjusting the final concentration to 2.5 x 10^4 conidia/ml. The conidial suspension was applied to berries with a handheld, hand-pressurized atomizer until runoff.

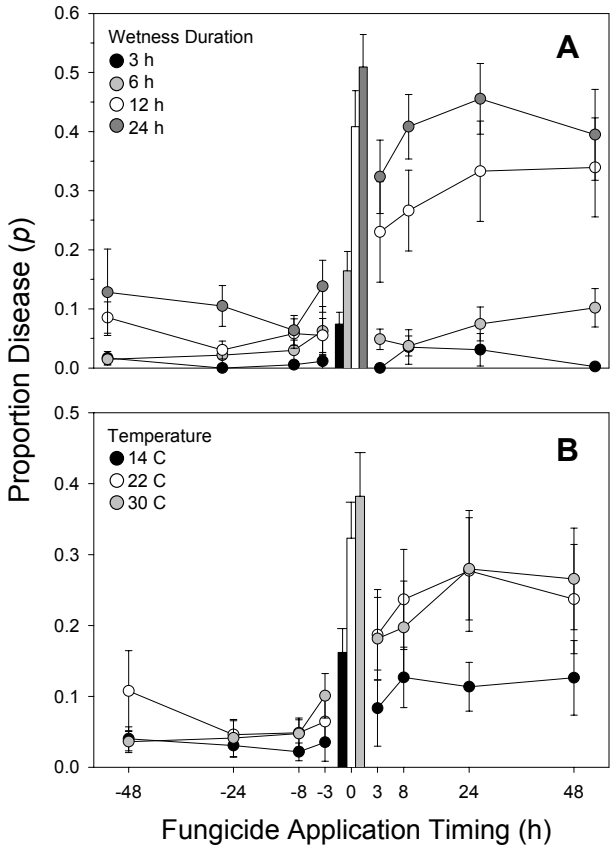
Fungicide Treatments: Cabrio EC (pyraclostrobin) was applied to the berries at concentration equivalent to 12 oz/A at 3, 8, 24, and 48 hr prior to inoculation and exposure to their wetting period (defined below); these are defined as pre-infection or protective applications. Another set of plants was treated 3, 8, 24, and 48 h following inoculation and exposure to their wetting period. These are the post-infection period treatments and are designed to look at how long after a wetting event Cabrio can be applied and still give reasonable control. Elevate 50WDG was mixed with Cabrio to control *Botrytis cinerea*; Elevate has no activity against *Colletotrichum acutatum*.

Environmental Conditions: Four plants per fungicide treatment were placed in each of three walk-in mist chambers set at 14, 22, or 30 C at 100% relative humidity. The plants were removed from each of the mist chambers according to their

treatment (i.e., 3, 8, 24, or 48 hr), moved to greenhouse benches and dried with box fans. (Remember, half of the plants were treated with Cabrio before exposure to their wetting period; the other half will be treated after exposure.) Six to ten days later, fruit were classified as either mature or immature and rated for the presence or absence of disease. An appropriate set of inoculated and uninoculated controls was included.

Results and Discussion

All Cabrio treatments suppressed disease compared to their corresponding untreated controls. In general, the highest incidence of disease occurred on plants subjected to long wetness durations (12 and 24 h; Fig 1A) or higher temperature treatments (22 and 30 C; Fig 1B)). As anticipated, post-infection period applications of Cabrio tended to be less effective than those applied prior to inoculation. However, there is a notable exception. Cabrio applied up to 48 hours after a short (i.e., 3 or 6 hr) wetting period gave comparable control to Cabrio applications applied protectively (Fig 1A, black and light gray symbols). It was also interesting to note that Cabrio applied 3 hr before inoculation typically had higher disease incidence than when Cabrio was applied 8 hr before inoculation; this was most evident in Figure 1B.



Results of this study suggest that growers may have some options for managing anthracnose. Currently, growers concerned about anthracnose are advised to apply fungicides on a calendar schedule or prior to rain events. In the Northeast, this recommendation is difficult to follow mainly because wetting events during fruit set and harvest are associated with sporadic thunderstorms that are difficult to predict. If a grower were to apply a fungicide each time the threat of a thunderstorm existed, they could possibly be spraying all season long. Our study suggests that for short wetting events, such as those associated with seasonal thunderstorms, growers may have the option of waiting until the infection event occurs before applying a fungicide. However, our study also suggests that for longer wetting events, such as those associated with a weather front, growers should apply fungicides protectively, i.e., before the rain starts.

The results of this study have yet to be validated under field conditions. Our next step is to develop a forecaster or a set of rules to time applications based on the results of this study. Particularly, we are interested in validating the efficacy of Cabrio as a post-infection material. It should also be emphasized that we do not expect these results to transfer to other fungicides, particularly Captan or Switch. Additional studies would be necessary to develop similar information for these and other promising fungicides.

Figure 1: Incidence of anthracnose on immature and mature strawberry fruit treated with Cabrio 3, 8, 24 or 48 hr before inoculation or 3, 8, 24, or 48 after inoculation with *Colletotrichum acutatum* versus: **A)** exposure to 3, 6, 12, or 24 h of wetting (averaged across the three temperature treatments) or **B)** exposure to temperatures of 14, 22 or 30 C (averaged across the 4 wetting durations). The vertical bars show incidence of anthracnose in the untreated checks. The bar and line-symbol colors corresponds to the same treatment.

Literature Cited

Wilson, L.L., Madden, L.V., and Ellis, M.A. 1990. Influence of temperature and wetness duration on infection of immature and mature strawberry fruit by *Colletotrichum acutatum*. Phytopathology 80:111-116.

Evaluation of Fungicides for Control of White Pine Blister Rust on Black Currant

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Trials were conducted in a 2-year-old planting of 'Ben Alder' in Geneva, NY. Treatments were arranged in a randomized complete block design with five replications. All treatments were applied to drip using a 2 gal garden sprayer at approximately 30 PSI. Application timings were as follows: 21 May (fruit set), 13 Jun, 18 Jun, 1 Aug

(harvest), 14 Aug, and 27 Aug. The incidence of white pine blister rust (WPBR) was evaluated by examining all leaves on 3 canes per plant on 31 Jul. Canes were tagged on the same date just below the four most fully expanded new leaves and data taken again on all new fully expanded leaves 11 Sep. Data were arcsin square root transformed before statistical analysis and analyzed in an ANOVA using SAS PROC MIXED. Treatment means were separated using the pairwise difference option (PDIFF) in PROC MIXED ($P<0.05$).

The season was very conducive for the development of WPBR. The controls and the poorest performing treatments began defoliating from WPBR infection by 14 Aug and some control plants were completely defoliated by 1 October. All treatments significantly reduced WPBR incidence early in the season (i.e., 31 July rating). Programs incorporating sterol inhibitors (Indar, Nova) or Kocide gave the best early and late season control of disease. Use of copper based compounds for WPBR control will provide a good organic alternative for disease control. As projected, Switch and Elevate gave little reduction in WPBR incidence. The 11 Sep rating was difficult to interpret because ratings were done only on new growth. Many of the poorest treatments on 31 Jul had delayed or very little new growth, consequently the availability and/or susceptibility of tissue to WPBR infection was much variable after the 31 Jul rating. Application timings need to be investigated more closely to determine if even higher levels of early season disease control may be achieved.

Treatment, rate/A	Percent white pine blister rust July 31*		Percent white pine blister rust September 11*	
Indar 75WP 2 oz	21.3	a	77.5	bcd
Captan 80WDG 3.75 lb + Indar 75WP 2 oz	26.5	a	70.0	cd
Switch 62.5WG 0.875 lb + Nova 40W 5 oz	27.4	a	55.0	bc
Kocide 2000 7.5 lb + Nova 40W 5 oz	28.3	ab	45.4	ab
Kocide 2000 7.5 lb	28.6	ab	98.8	cd
Nova 40W 5 oz	28.8	ab	27.4	a
Cabrio EG 0.875 lb + Nova 40W 5 oz	36.7	abc	41.9	ab
Dithane RSNT 4 lb	40.3	abc	98.9	cd
Amistar 80WG 3 oz	47.1	bc	100.0	d
Cabrio EG 0.875 lb	52.2	cd	99.0	cd
TM45002 68WDG 5.25 lb	53.0	cd	100.0	d
Captan 80WDG 3.75 lb	69.2	de	100.0	d
Switch 62.5WG 0.875 lb	70.9	de	100.0	d
Elevate 50WG 1.5 lb	84.5	ef	85.5	cd
Untreated check	91.6	f	83.8	cd

* Mean WPBR from 5 replicate plots per treatment are shown. Means within a column not followed by a common letter are significantly different.

Evaluation of Fungicides for Control of Botrytis Fruit Rot on Strawberry

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Trials were performed in a 3-year-old 'Honeoye' planting on a Cornell research farm at the Geneva Experiment Station. Plants were grown in a matted-row system, with fruiting rows approximately 1.5 ft wide on 4 ft centers. Individual plots consisted of 12 ft sections of row with 3 ft buffer zones on both ends of each treatment. Treatments were replicated 4 times in a randomized complete block design. Fungicides were applied with a 2 gal hand sprayer (approx. 30 PSI) during bloom on 22, 27, 30 May, and 3 Jun. To provide disease pressure, approx. 3 berry halves inoculated with 3 strains of *B. cinerea* were placed evenly throughout each plot after treatments were dry on the first date of application. Fruit were harvested on 20, 24, 26 Jun, and 2 Jul. The number of berries with and without symptoms was recorded the same day they were harvested and the percent of berries infected was calculated. Subsamples of unblemished, symptomless berries from each plot were placed on individual deep-well plastic trays. The number of fruit sampled per replication per harvest date was typically 25, unless the number of berries available for screening was less than 25, in which case all berries were subjected to the post harvest treatment. The berries were incubated 4 days at 68 F and 95-97% relative humidity. After incubation the proportion of diseased fruit was recorded. Data were arcsin square root transformed before statistical analysis and analyzed in an ANOVA using SAS PROC MIXED. Treatment means were separated using the pairwise difference option (PDIFF) in PROC MIXED ($P<0.05$).

The 2003 season was exceptionally wet, with 17 days of recorded rainfall between bloom and harvest. Three major infection periods occurred during bloom. For each infection period, the date, inches of precipitation and average

temperature during this period are listed, respectively: 20-21 May, 0.31 in., 56 F; 23-25 May, 0.97 in., 55 F; and 31 May-1 June 1, 1.04 in., 52 F. Surprisingly for such a rainy season, Botrytis fruit rot at harvest was relatively low; however, one-third of all berries developed post harvest Botrytis fruit rot. BAS 516 (Pristine), BAS 510 (Endura), TM45002 (Captevate), and Vangard gave 50% or better control of post harvest disease. Interestingly, the lower rates of both TM45002 and BAS516 gave numerically better control than higher rates of these products. Switch, Elevate and Scholar provided significant reduction in disease relative to the untreated check. As expected, the strobilurin fungicides Amistar and BAS 500 did not provide control of Botrytis. Oxidate, a commercial formulation of hydrogen dioxide, did not provide any control of gray mold; no phytotoxicity was observed.

Treatment, rate/A	Botrytis fruit rot post harvest (%)*		Botrytis fruit rot at harvest (%)*	
BAS 516 38WG 1.18 lb	5.41	a	0.07	ab
BAS 510 70WG 0.53 lb	9.29	ab	0.04	ab
BAS 516 38WG 1.45 lb	11.56	ab	0.25	abcd
TM45002 68WDG 3.50 lb	13.71	abc	0.12	abc
Vangard 75WG 0.44 lb	14.32	abc	0.05	ab
TM45002 68WDG 5.25 lb	18.04	bcd	0.18	abcd
Switch 62.5WG 0.88 lb	18.13	bcd	0.03	a
Elevate 50WG 1.50 lb	18.34	bcd	0.07	ab
Scholar 50WP 0.44 lb	22.86	cd	0.03	a
BAS 500 20WG 0.90 lb	24.23	cd	0.47	cde
Captan 80WDG 3.75 lb	29.28	de	0.23	bcd
Oxidate 128 fl oz	31.78	de	0.94	e
Amistar 80WG 0.19 lb	43.07	e	0.81	e
Untreated check	30.42	de	0.52	de

* Values are actual means of 4 replications per treatment. Treatment means within a column followed by the same letter are not significantly different from each other using the PDIFF option in PROC MIXED ($P \leq 0.05$).

Check out the NYSAES Tree Fruit and Berry Pathology web site at:

www.nysaes.cornell.edu/pp/extension/tfabp

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