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Special Reports:

NCSU Launches New Online Resource for Strawberry Growers

Debby Wechsler, NC Strawberry Association

The NCSU Program for Value-Added & Alternative Agriculture, with a grant from the NC Tobacco Trust Fund Commission, has recently developed the **Strawberry Growers Information Portal** (<http://www.ncsu.edu/enterprises/strawberries/>) to bring together on one website all the resources pertaining to business management and production of strawberries in North Carolina.

Growers (and others) can find research-based information specific to North Carolina strawberry production on this site, whether the information originated in the NCSU Department of Horticultural Science, Agricultural and Resource Economics, Plant Pathology, Entomology or the State Climate Office. Success in agriculture requires a multidisciplinary approach. The goal in designing information portals is to save growers and Extension agents time and effort by creating a one-stop shop for a specific agricultural commodity, in this case, strawberries. Development of portals for other crops is underway.

New growers will find resources specific to start-up, while new and experienced growers will recognize the convenience of the climate links. Video demonstrations of production tools and interactive budget spreadsheets are just two examples of the “virtual” resources this dynamic Web site offers.

A webinar tour of the new site, hosted by faculty contributors, was held on August 26. Those who missed this can “catch the re-run” by following a link on the homepage of the Strawberry Growers Information Portal. The webinar includes a tutorial of the interactive budgeting programs, a review of risk management resources, a guide through the weather and climate information available from the

State Climate Office of N.C. and, of course, a few words from Dr. Barclay Poling. Dr. Poling is particularly excited about the ability to post his advisories on the website, curtailing the download problems many growers experience with berry mg. He has also posted comprehensive production guidelines covering the regional specifics for mountain, Piedmont and coastal plains strawberry growers.

Comments from Barclay Poling

(Edited from a Berry Alert email on Aug 26): It is really exciting that the new Strawberry Growers Information Portal will be providing us with direct access to the NC State Climate Office (NC SCO). Growers can now access some very helpful weather related products from the NC SCO through this portal.

We do not have any immediate plan to put ‘berry mg’ (our email alerts) on mothballs, but we will limit berry mg to “housekeeping” types of information (e.g. meeting announcements) and will let you know via berry mg when a new advisory has been posted on the Strawberry Growers Information website. One of the problems with berry mg for many strawberry producers using dial-up connections has been the length of time it takes to download a large pdf file containing weather maps, charts, or color pictures.

Now, you will be able to simply bookmark the advisory section of this website and have almost instant access to the advisories. In other words, you won’t have time to go make a pot of coffee – that’s how long it would often take to download a berry mg advisory on a dial-up connection! In addition to more rapid access to advisory information on this website, you will also appreciate the fact that you can access older advisories in an archive that is organized by month. I don’t know how many times I’ve needed to go back to an earlier advisory, like the one we did this spring on fertigation (March

17), but simply can't find it quickly, or perhaps it's been deleted.

Please give us your feedback! There is a lot of new information on the Strawberry Growers Information Portal. This includes information on preliminary considerations for strawberry plasticulture production and sections on pre-planting and planting. If you are planting fresh dug this season, you definitely need to review the "Establishing Fresh Dugs" section, and there is a even a nice step-by-step illustrated guide in both English and Spanish. One thing we definitely want to avoid this year are problems associated with incorrect planting depth and J-rooting of fresh dug!

The Program for Value-Added & Alternative Agriculture, part of the NCSU College of Agriculture and Life Sciences, is located at the NC Research Campus in Kannapolis. The multidisciplinary team builds partnerships and educational resources to help North Carolina agriculture be more profitable. The team works closely with NC Cooperative Extension personnel who work with farmers across the state.

Sweet Times at Blackberry Agent Training in Lincolnton, NC

Jessica Spencer, Graduate Research Assistant,
Horticultural Science Department
NC State University



Figure 1: Diane Ducharme presents information on food safety measures for blackberries.

This past August 4th and 5th, 24 agents from six member universities of the Southern Region Small Fruit Consortium (SRSFC) as well as several local agents attended Blackberry Training in the small North Carolina town of Lincolnton. Although

"Located on the Quiet Side of Charlotte", this rural town was an ideal location for the meeting as local farmers have recently shifted from cultivating apples and squash to acres of blackberries in order to meet growing demands in the Eastern U.S. SunnyRidge Farms in particular has been instrumental with this change as they expand their production from Georgia to North Carolina to create a longer season of blackberries.

The first day was devoted to lectures given in the local Comfort Inn State Room and the second half-day to touring farms and a distribution center. John Clark, from the University of Arkansas, started off the first day with an entertaining and instructional overview of the most popular blackberry varieties, many of which come from his own breeding program. The day continued with lectures on Cultural Practices by Gina Fernandez (NC State) and Allen Straw (VA Tech), Enterprise Budgets by Charles Safley (NC State)-Figure 1, Insect Management by Hannah Burrack (NC State), Food Safety by Diane Ducharme (NC State)-Figure 2, Disease Management by Walker Miller (Clemson(retired), CCA), Marketing by Josh Beam (SunnyRidge), Post Harvest Physiology by Penny Perkins (NC State), Soil Fertility by Brenda Cleveland (NC Dept of Ag), and Weed Management by Wayne Mitchem (NC State, Clemson, U of GA). Fresh peaches provided by Jeff Chandler from the NC Sandhills Research Station and blackberry cider, fresh blackberries and watermelon from the Mitchem Farms sweetened this long day of lectures.



Figure 2: Charles Safley reviews enterprise budgets for a 10 acre blackberry venture.



Figure 3: Gina Fernandez presents information during the ride to blackberry farms.



Figure 4: Inspecting field packed blackberries at Double B farm.



Figure 5: Forced air cooling facility at Double B farm.

The second day started out early to beat the heat as agents boarded a charter bus (Figure 3) to tour the countryside with Wayne Mitchem, acting as tour guide. As part owner of a local farm, his knowledge kept an active discussion of blackberries going between stops. Double B Farm (Figures 4&5) was the first stop to see different trellis systems, plastic mulch, and forced air-cooling in action followed by

the Mitchems' Farm (Figure 6) to view fertility issues and Fall versus Spring planted blackberries. A stop at Knob Creek Farms (Figure 7) was next where the differences between tissue cultured and non-tissue cultured plants were seen, some common pests were examined and agents got to browse a gift shop and try ice cream made with local fresh fruit. Lastly, a stop was made at the SunnyRidge Farm (Figure 8) distribution center to take a peek at how locally produced blackberries are stored (Figure 9) and shipped. One last meal catered by a local restaurant gave everyone time for final questions and comments before parting ways (Figure 10)



Figure 6: Tour guide Wayne Mitchem showing differences between fall and spring planted blackberries at Mitchems' farm.



Figure 7: Knob Creek farm retail store



Figure 8: SunnyRidge distribution center.



Figure 9: Cold storage of blackberries at the SunnyRidge distribution center.



Figure 10: Final tour stop on August 5.

The program was implemented and coordinated by Gina Fernandez, NC State; Allen Straw, VA Tech and SRSFC coordinator Tom Monaco. All the meals, snacks and charter bus transportation provided at the training were sponsored by the NC Commercial Blackberry and Raspberry Growers Association; SunnyRidge; Syngenta; Naturipe; North American Plants, LLC; United Phosphorous,

Inc.; and DuPont. Thanks to each for their support and generosity.

Most of the power point presentations given at the training and photos from the training have been posted on the SRSFC web site at <http://www.smallfruits.org/CoAgentTraining/index.htm>.

Wake County School Harvests Big Lessons from Strawberry Patch

Natalie Hampton

The following article was previously published in [CALS Perspective Online Magazine](#)



Dr. Gina Fernandez assisted second graders with their strawberry crop throughout the school year. Photo by Becky Kirkland

While North Carolina strawberry growers looked forward to a bumper crop of berries this month, second graders at Swift Creek Elementary School in Cary also were watching their small crop come in. Though the school's berries arrived a few weeks later than those of commercial growers, the students and their teachers have gained a wealth of knowledge from their year-long study of strawberries and how they grow.

The project started last fall as a collaboration between Dr. Gina Fernandez, small fruits specialist and associate professor of horticultural science in the College of Agriculture and Life Sciences, and Swift Creek second grade teacher Megan Sedaghat. Fernandez's daughter, Anya Yenko, was a student in Sedaghat's class this year. When Sedaghat learned of Fernandez's expertise with strawberries, she asked if Fernandez would help students grow and study

strawberries.

The North Carolina Strawberry Association also got involved, providing Strawberry Time coloring books for the students and some funds to help develop a school curriculum on strawberries that other schools could implement.

As a crop, strawberries fit nicely into a traditional calendar school year, Fernandez said. The strawberry plants are planted in the fall, cared for throughout the winter and harvested in May, just before the school year ends. School gardens planted in the spring won't yield their harvest of tomatoes, cucumbers and peppers until mid-summer after students have left school. In the fall, Fernandez helped the second-grade classes prepare a bed for strawberries, covered in plastic like most commercial strawberry beds in North Carolina. Each of five classes planted six strawberry plants to raise during the school year. Through the winter, students monitored night-time temperatures and covered their plants when a freeze was expected. They also had to cover their plants with netting when birds and squirrels threatened their berries.



*Dr. Gina Fernandez showed the children how to take care of strawberry plants.
Photo by Becky Kirkland*

"This has been so cool," Sedaghat said of the project. "Why in the world anyone studying plants in school wouldn't grow strawberries, I don't know."

Sedaghat said the students had enjoyed the lessons that Fernandez brought to the classroom. "She's an expert, a role model. We couldn't have

done it without her," Sedaghat said.

Second-grade students don't study plants as part of the state's curriculum, but they do study measurement, so Fernandez helped the class set up a system for measuring plant growth each month throughout the growing season. The classes planted "control" plants — one for each month of the growing year. Fernandez visited the school each month to measure and weigh different plant parts. Students in Sedaghat's class kept "scientific journals" to record the progress of their strawberry crop during the year.

In early May, they measured their final plant of the growing season. First, Fernandez removed the plant from its pot, and then students rinsed dirt off the plant's roots so they could measure their length. Sedaghat, a self-proclaimed pack rat, still had the dried roots sample from the first plant the students measured in the fall. The students were able to compare how the plants' roots had grown since September. Cries of "wwwwoooooo" arose as students compared the two root samples.

The students also removed, counted and weighed the plant's leaves, then weighed the remaining crown of the plant. Fernandez told the students that the scientific measurements they took were the same research practices used by her graduate students at N.C. State. With a year's worth of plant measurements recorded in their journals, students were able to create graphs showing the strawberry plants' growth over time.

In addition to Fernandez's visits, the students heard from Apex strawberry grower Karma Lee of Buckwheat Farm, who explained how she raises strawberries on her farm. When she told them she has 56,000 strawberry plants at her pick-your-own operation, they were stunned.

The second grade strawberry patch didn't get quite enough sun to produce lots of berries, but Sedaghat already has plans to move the whole operation to a sunnier site next season. The project was such a success that Liz Driscoll, CALS youth horticulture Extension associate, is developing a strawberry curriculum with help from the N.C. Strawberry Association. The curriculum could be used in schools throughout the state, with help from Cooperative Extension agents.

Disease Identification: Is it a Fungal Leaf Spot or a Virus?

Bill Cline, Plant Pathology Department, NCSU



*Anthrachnose leaf spot caused by the fungus *Gloeosporium* results in large dead areas on the leaf*

Blueberry growers in North Carolina have long been accustomed to dealing with fungal leaf diseases through the use of fungicides and resistant cultivars. However, some new diseases have appeared recently that look like fungal leaf spots, but are not. These diseases (blueberry red ring spot, blueberry necrotic blotch) are known or thought to be caused by viruses, and cannot be controlled with fungicides. If you are having leaf disease problems that fungicides will not control, you may be seeing a viral disease rather than a fungal leaf spot. But how can you tell? Here are some tips:

- 1. The fungicide didn't work** – as already mentioned, one clue that your problem may be something other than a fungus is that the fungicide had no effect. If you sprayed recommended fungicides on schedule and still had a bad leaf spot problem or severe defoliation, take a closer look at the bushes.
- 2. The spots have green centers** – Most common fungal leaf spots have dead centers that are brown or gray in color. By comparison, spots caused by the two most common virus or virus-like pathogens most often have green or yellowish living tissue in the center of many of the spots.
- 3. Ask for help** – Contact your county extension agent about sending samples to the Plant Disease and Insect Clinic in Raleigh, or you can send samples or digital images to Bill Cline, NCSU/HCRS, 3800 Castle Hayne Road, Castle Hayne, NC 28429. With good close-up photos of leaves and stems, diagnosis is often quicker and easier via email – just be sure to use the close-up setting on your digital camera and

shoot from 6-12 inches away, with the leaves laying on a solid background so that the camera focuses properly. My email address is bill_cline@ncsu.edu. Growers in GA should send their samples or digital photos to Phil Brannen (pbrannen@uga.edu) 2106 Miller Plant Science Building, Athens, GA 30602.

- 4. Why does it matter?** Unlike fungal leaf spots, those spots caused by plant viruses cannot be directly controlled with sprays, and once infected the plant cannot be cured. Plant viruses also can spread by propagation (or by insects), so when you take cuttings you may be spreading the disease. It is in your best interest to buy virus-free plants, and to avoid propagating from virus-infected mother plants.



Blueberry necrotic ring blotch has spots with green centers, and is thought to be caused by a virus.

September is a good time to look for all types of leaf symptoms, and there are pictures available on-line that can help you identify the symptoms you are seeing. Two good current sources of information are:

Small Fruit News Volume 9, No 2 (photos and descriptions of blueberry red ringspot virus and blueberry necrotic ring blotch disorder)
<http://www.smallfruits.org/Newsletter/Vol9-Issue2.pdf>

Michigan Blueberry Facts (pocket scouting guide photos of fungal and viral leaf diseases, including many photos of fungal leaf spots taken in North Carolina)
<http://www.blueberries.msu.edu/>

Welcome to my nightmare . . .

Phil Brannen

I have been banging the drum on current and potential virus issues for some time now. Within the last month or two, both blueberry shock and scorch viruses have been reported in Michigan, to include a major research station. Please read the article at the link below for additional information. This is a potential nightmare scenario for any blueberry region. Michigan did have regulations in place, but viruses obviously don't read the regs. It is hard to predict whether this will have a major impact on Michigan production, but in the short term, many plants will be destroyed where viruses are present.

<http://www.google.com/hostednews/ap/article/ALeqM5iyHnJ2wlyU9X6OTs663CAuNbO3owD9ADNCIG0>

Blueberry scorch and blueberry shock viruses are potentially very destructive, and they would likely have tremendous impact on our industry. I hate to say it, but it is probably only a matter of time before we have these, unless there is something magic about our environment, and I really doubt this. Though we do have state regulations in place, I fear they are of limited value, as inspections are limited.

We have to self-regulate if we are to prevent these viruses from entering our state in the near future, but unfortunately, we really have little power over the homeowner market for blueberries. However, we can do our part, and we need to really be careful if we are importing plants into our region. We need to encourage each other to be diligent -- to consider the impact of one release of these viruses and what it could mean to our industry. Certified, virus-tested plants should be the only ones that we bring across our state borders, and I am honestly scared of these as well.

For additional information on these viruses, please go to the following links:

- Blueberry shock:
<http://www.blueberries.msu.edu/shock.htm>
- Blueberry scorch:
<http://www.blueberries.msu.edu/scorch.htm>

Invasive fly a threat to small fruit production

Hannah Burrack
Department of Entomology,
NC State University
hannah_burrack@ncsu.edu



Figure 1 Male SWD. Note spots on wing tips.
Photo by Martin Hauser via UC Statewide IPM Program.

After rapidly spreading along the west coast, a new fruit feeding fly has made its way to the southeast and poses a serious threat to small fruits. Formerly known as the cherry vinegar fly, the spotted wing drosophila (*Drosophila suzukii*) has rapidly progressed from recently detected invader to a significant pest of fruit in California. The fly was first detected in fall 2008 and was confirmed in backyard and commercial cherry plantings in spring 2009. Experts in California believe it has been present for at least a year prior to that detection. It has also been found in at least 6 counties in Oregon. On August 4, 2009, the spotted wing drosophila (SWD) was detected in Hillsborough County in central Florida.

The southeast has abundant potential SWD hosts and a climate favorable for its establishment, so it is just a likely a matter of time before the SWD is detected here. Because of the significance of the damage observed in California, cooperative extension agents, growers, and consultants should keep on the lookout for SWD.

The SWD is presumed to be native to China, Japan, Korea, and Thailand and has been present in Hawaii since at least the mid 1980s, although it has not been reported as a crop pest there. Japanese records of SWD date to 1916, and the insect has been recorded from cherry, grape, peach, plum, persimmon, blackberry, raspberry, and blueberry. In the United States, the SWD has been found

feeding in cherry, raspberry, blackberry, blueberry, peaches, and strawberry.

Biology

Adult SWD males have distinctive spots on the tips of their wings. Females lack these spots require identification by an entomologist. Initial trap captures in Florida were both males, which are much easier to identify.

SWD develop rapidly, in as little as a week under ideal conditions. The optimum temperature for SWD development and activity is 68°F, and performance decreases at higher temperatures. Males are sterile at 86°F and above. This suggests that SWD may be less problematic in hot southeastern summers but that spring temperatures may be conducive to rapid development. None of the life stages of the SWD can survive freezing temperatures, but despite this, the fly persists in very cold areas in Japan, so winter temperature may not limit establishment in the southeast. A female SWD can lay up to up to 300 eggs in its 3 to 9 week lifespan at a rate of 7 or more per day. It is believed that the SWD has approximately 10 generations in California.



Figure 2 Female SWD.

Photo by Martin Hauser via UC Statewide IPM Program.

Damage

The SWD is attracted to ripe, sound fruit. The ability to infest sound fruit makes the SWD different from other *Drosophila* species, which are commonly referred to as vinegar flies. Of the thousands of known *Drosophila*, only 2 are known to feed on sound fruit. The vast majority of *Drosophila* feed on the microorganisms in rotting, overripe fruit and are not crop pests. Female SWD have a serrated ovipositor (egg laying devise) that allow them to penetrate the skin of ripe fruit and lay their eggs (2 to 3 at a time). This behavior makes the SWD similar to the “true fruit flies”, such as the apple maggot (*Rhagoletis pomonella*) and the blueberry maggot (*R. mendax*). The SWD can be readily distinguished from either of these fruit flies by its small size; SWD larvae (maggots) are

approximately 3 mm long at their biggest, while apple or blueberry maggots are 5 to 7 mm long.

Fruit infested by the SWD appears to have a bruised or sunken area on the outside, under which the larvae are found. This damage can also foster secondary fungal growth, which further damage fruit. SWD pupate both inside and outside the fruit and can survive in culled or dropped fruit. SWD appear to only attack soft skinned fruit in the United States to date, but may feed on other fruit. It is unlikely that SWD will feed on vegetables, soft skinned or otherwise, (i.e. tomatoes) because they are attracted to the sugars in ripe fruit. SWD also does not appear to feed on developing fruit for this same reason.



Figure 3 SWD oviposition scar on blueberry.
Photo by D. Bruck, USDA-ARS Horticultural Crops
Research Laboratory, Corvallis OR.

Detection

SWD is attracted to ripe fruit and yeast odors. A mixture of Brewer’s yeast and sugar dissolved in water has been shown to be attractive, and there are also commercially formulated yeast lures for true fruit flies that may be effective for SWD. Several trap types are effective for monitoring the SWD, include the commercially available McPhail, Liquibator, IPMT, and Ball traps. A Nalgene bottle with hole in the lid is also effective. Any of these traps should be checked weekly and cleaned at each checking. These traps will also attract non SWD flies, so check with an extension entomologist to confirm identification if SWD is suspected. A volunteer SWD monitoring network will be established in NC, SC, and VA this winter with monitoring to begin in spring. Please contact Hannah Burrack, hannah_burrack@ncsu.edu if you are interested in learning more about this effort.

What if I suspect SWD damage?

Contact your cooperative extension agent or specialist immediately. Although southeastern states are not actively monitoring for the SWD to date, state regulatory agencies need to know when a new pest is detected. Agents and specialists can also help develop management plans for specific crops and assess spread of the SWD in an area. Small trials with several widely registered, broad spectrum insecticides have shown promise for SWD suppression in California. Cultural control via good sanitation will also minimize populations. In locations where SWD has become widespread, area wide management may be the best solution.



Figure 4 SWD larvae in cherry.
Photo by Larry Strand via UC Statewide IPM Program.

More information on the SWD can be found at the following websites:

An overview of SWD in CA:

<http://www.ipm.ucdavis.edu/EXOTIC/drosophila.htm>

SWD biology:

<http://ucanr.org/blogs/blogcore/postdetail.cfm?postnum=1483>

Information on FL detection:

http://www.doacs.state.fl.us/pi/enpp/ento/drosophila_suzukii.html

NARBA to Sponsor Blackberry Sessions at Savannah Conference

January 7-8, 2010

Debby Wechsler, Executive Secretary, NARBA

The North American Raspberry and Blackberry Association (NARBA) has taken responsibility for organizing a track of blackberry sessions at the

Southeast Regional Fruit and Vegetable Conference in Savannah, Georgia January, 2010. This event will serve as a regional meeting for NARBA, complementing our main conference in Monterey, CA, in late February. NARBA had its annual meeting as part of this Georgia conference in 2006, and is pleased to cooperate with the Georgia Fruit and Vegetable Association to hold this meeting.

Blackberry sessions will begin on Thursday, Jan. 7, 2010 with two workshops. "Getting Started in Blackberries" is for new growers intending to focus on local, direct marketing, and is also for vegetable and strawberry growers seeking to diversify. "Caneberry Marketing Strategies" will cover deciding what type of marketing is best for you, developing a market strategy, negotiating sales agreements, and resolving issues.

Thursday afternoon will include sessions on viruses and post-harvest evaluation, and a panel of growers will talk about their farms. In the evening, a blackberry growers "Dutch treat dinner" at a local restaurant will offer opportunities for informal visiting – this is fast becoming a NARBA tradition!

Sessions on Friday morning, Jan. 8, will include presentations by blackberry breeder John Clark on variety testing and progress for the Southeast; an analysis of blackberry prices/volume; and discussion on developing industry-wide promotion for blackberries. The main conference (Jan 8-10, 2010) include tracks for blueberries, strawberries, vegetables, grapes, peaches, and more, as well as a large trade show.

All NARBA members in the Southeast (Maryland to Tennessee to Texas and points south!) will definitely receive the full program booklet later this fall; if you are out of that area you may not receive the information. Contact the NARBA office for details. Information will also soon be posted at www.raspberryblackberry.com and www.gfvga.org

New tool to be included in NC strawberry integrated disease management

Mahfuzur Rahman and Frank Louws
Department of Plant Pathology, NCSU

Natalia Peres
Gulf Coast Research and Education Center,
University of Florida

Strawberry crop production systems can be better aligned with the objectives of integrated disease management. Strawberry integrated disease management (IDM) as applied previously in North Carolina and neighboring southern region states has not included all possible tactics such as cultural, biological, host-plant resistance, and optimum chemical timing to provide acceptable yield and quality at the least cost and also be compatible with the tenets of environmental stewardship. For example, NC strawberry growers are not able to utilize host-plant resistance due to its absence in popular varieties such as Chandler and Camarosa; no biological products have shown acceptable levels of disease suppression in field research. However, other major components of an IDM program such as prevention, monitoring, correct disease diagnosis, development and use of acceptable thresholds, and optimum selection of management tools are either in practice by growers, in the developmental stage, or under continuous refinement through an effective interaction of growers and researchers. For example, in the 2008 harvest season one grower did not obtain satisfactory control of anthracnose fruit rot (AFR) by applying Quadris™ (a.i. azoxystrobin) after a sudden outbreak during harvest. In the same season, a similar product Abound™ with the same a.i. and previously known to be an effective chemical for this disease, did not provide satisfactory anthracnose control in an experimental setting. This observation led us to investigate the efficacy of two related active ingredients azoxystrobin and pyraclostrobin (a.i. of Pristine™). In three separate experiments comparing either spore germination or fungal colony growth, azoxystrobin consistently showed lower suppression of *C. acutatum* compared to pyraclostrobin. Consistent with 2008 field experiment results, our 2009 field experiment showed little or no efficacy of Abound™ in controlling AFR. However, in the same study under very high disease pressure, Pristine™ provided satisfactory disease control (Fig 1). This underscores the requirement of a revision of chemical recommendations for anthracnose control

in North Carolina. However, more studies are required to determine the cause of azoxystrobin's lost efficacy against AFR.

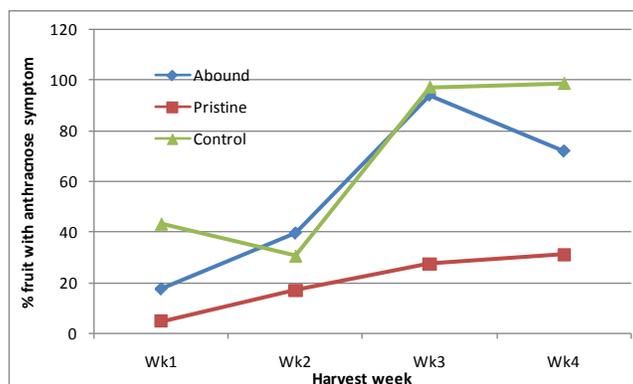


Fig. 1. Anthracnose control with fungicides in 2009. Recommended rate of fungicides (Abound 12 fl. oz/acre; Pristine 1.45 lb/acre, Control-no fungicide) were applied weekly starting April 7, 2009 in an inoculated replicated trial. First application was made with Captan + Topsin-M in both treatments. Harvest started on April 28.

Anthracnose is manageable: In the 2008-2009 growing season a North Carolina grower had to make a rough start due to the presence of *C. acutatum* in the tips diagnosed during the plug production phase. Plug plants with acute symptoms were discarded. Due to the unavailability of an alternate plant source, the grower had to use plugs that did not show any symptoms at that time. Leaf sampling and field inspection were done by us during the early spring and data indicated the presence of infection in leaves as expressed by small black spots (Fig. 2) or quiescent infections that were detected after paraquat treatment of leaves and by running DNA based analysis.



Fig. 2. Black spots appear occasionally on leaves due to quiescent infection by *Colletotrichum* spp.

We recommended our optimized spray schedule for this particular grower based on Captan and Pristine which started in the early spring prior to onset of flowering and continued throughout the harvest season. Quiescent infections in leaves were grown out in our lab setting from weekly samples from the same spots in the field and population dynamics (Fig.3) were determined. Fungicide applications caused a sharp decline in leaf quiescent infections and subsequent fruit infections in spite of rain and damp weather at the middle of the harvest season. Evaluation of leaf quiescent infections thus can be helpful in determining the necessity of preventive measures growers need to take. Currently we are evaluating a sampling protocol for detecting quiescent infections in fruiting fields to determine if chemicals for anthracnose control can be fully avoided in the absence of inoculum. However, prevalence of inoculum in the field together with prevailing weather condition determines whether disease will occur or not. This fact opens up the opportunity of active collaboration of plant pathologists and agro climatologists to formulate spray schedules to best manage diseases.

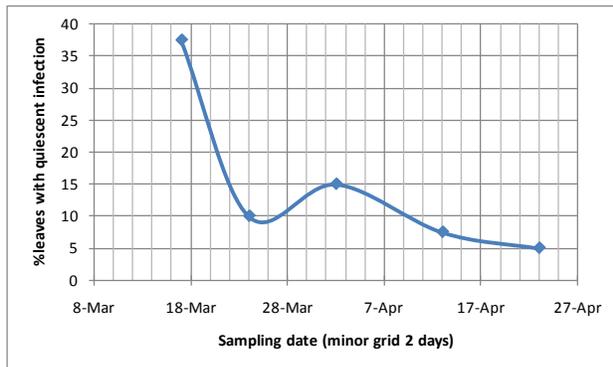


Fig. 3. Leaf sampling from a grower's field for determining quiescent infections (1st sampling date 17 March 09 is prior to spray applications and before flowering initiation and the last sampling was close to first harvest)

New tool for NC-Fungicide use decision support system for anthracnose management. Many plant disease outbreaks are triggered by suitably warm temperatures during periods of leaf wetness. Measurements or estimations of leaf wetness duration provided by Agrometeorologists have allowed Plant Pathologists to devise weather timed spray schemes which often reduce the number of sprays required to control plant diseases, thus lowering costs and benefiting the environment. In the near future, tools such as numerical weather models with small grid spacings, and improved weather radar, are expected to reduce the need for tight networks of surface observations. The weather models will also provide growers with forecast

warnings of potential upcoming disease outbreaks, which will further enhance the contribution of agrometeorology to plant disease management (Gillespie and Sentelhas 2008). For example, Wilson et al. (1990) developed predictive curves to estimate the incidence of anthracnose on immature and mature strawberries relative to the duration of berry wetness and the temperature during the wetting period. The optimum temperature for infection for both immature and mature fruit was 25 to 30°C, with greater than 80% infection occurring after 13 hr of leaf wetness. No infection occurred on immature or mature fruit below 4°C, nor was there any infection on immature fruit above 35°C. The infection curves developed by Wilson et al. (1990), however, do not explicitly help growers to time fungicide applications to prevent disease since the curves do not predict the level of disease that would result if a fungicide application had been made under the same conditions. Researchers in Florida utilized this work to develop a prediction model for timing fungicide application for controlling strawberry anthracnose. The predictive system uses temperature and leaf wetness duration (LWD) from weather stations operated by regional or national weather services and predicts when conditions are favorable for disease development. These data are then entered into a web-based risk management information system *AgroClimate* (Fig. 4 is an illustration for Florida) that can be accessed by concerned growers as well as extension agents who can remind growers of potential threat and measures to take ahead of time. *AgroClimate* (www.agroclimate.org) was created by the Southeast Climate Consortium (SECC) that is a coalition of seven universities: Florida State University, University of Florida, University of Miami, University of Georgia, Auburn University, University of Alabama- Huntsville, and North Carolina State University. We recently established collaboration with state climate Office and State climatologist Dr. Ryan Boyles who is interested in conducting simulations using special software such as Simetar© (Simulation & Econometrics to Analyze Risk) and weather station data to develop a forecast system for anthracnose disease in NC that may work in the neighboring states as well. The decision support system will calculate near real-time risk infection indices based on 15-minute weather data collected at the North Carolina Automated Weather

Network (NCAWN) stations combined with 7-day weather forecasts to provide producers with current and short-term risk levels. An alert system will be implemented to inform producers when “moderate” or “high” risk levels are observed at their station of interest. A system to send SMS text messages and e-mail alerts will be implemented to notify producers of the need to consider fungicide applications. Short Message Service (SMS) should be a very suitable technology for delivering alerts and notifications of important events because of two reasons:

1. Mobile phones are carried by strawberry producers most of the time. Whenever an SMS text message is received, the mobile phone will notify producers by giving out a sound or by vibrating.
2. They can check the content of the SMS text message immediately and take action as needed.

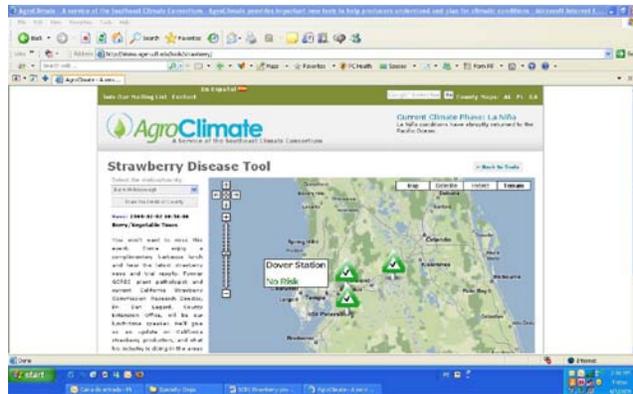


Fig. 4. Main page of strawberry decision support system for fungicide applications on AgroClimate

Expected Outcomes

We expect that the decision support system will successfully predict outbreaks of AFR and provide accurate forecasts of the need to make fungicide applications. The use of the system should reduce the number of fungicide applications made industry wide and greatly reduce grower costs without loss of disease control or any affect on yields. We expect that the economic analysis will show considerable benefit to the industry in reduced fungicide and application costs. The alert system should advise growers of the need to apply fungicides on a timely basis and provide adequate control of AFR.

Bramble (Caneberry) Seasonal Checklist

Gina Fernandez, Small Fruit Specialist
North Carolina State University

This checklist was originally developed for blackberry growers in North Carolina. Many of the items apply to raspberry production as well. You may have to adjust your work activities either earlier or later depending on your location. For more detailed information, check the Southern Region Integrated Bramble Management Guide and the Southeast Regional Bramble Production Guide at: <http://www.smallfruits.org/SmallFruitsRegGuide/index.htm>

FALL

Plant growth and development

- ✓ Primocanes continue to growth but slow down
- ✓ Flower buds start to form
- ✓ Primocane leaves senesce late fall

Pruning and trellising

- ✓ Spent floricanes should be removed asap
- ✓ Optimal time to prune is after the coldest part of the season is over. However pruning can start in late fall if plantings are large (late winter for smaller plantings).
- ✓ Start trellis repairs after plants have defoliated

Weed management

- ✓ Many summer weed problems can be best managed in the fall and winter using preemergent herbicides. Determine what weeds have been or could be a problem in your area. Check with your states agricultural chemical manual and local extension agent for the best labeled chemicals to control these weeds.

Insect and disease scouting

Continue scouting for insects and diseases. Remove damaged canes as soon as possible.

- ✓ Check the Southern Regional Bramble integrated Management Guide for recommendations.
<http://www.smallfruits.org>

Planting

- ✓ Growers in warmer areas (e.g. extreme southeastern NC) can plant in December. Preparations for winter

planting should have already been made. If you have questions about winter planting please contact me at the above email address.

- ✓ Prepare list of cultivars for next years new plantings.

Fertilizer

- ✓ Take soil tests to determine fertility needs for spring plantings.

Marketing and miscellaneous

- ✓ Order containers for next season
- ✓ Make contacts for selling fruit next season
- ✓ Plan on attending the North American Bramble Growers Association meeting. (www.nabga.com) For more information contact:

Quarterly Strawberry Plasticulture Checklist

Gina Fernandez, Small Fruit Specialist
North Carolina State University

This checklist was originally developed for growers in North Carolina. You will have to adjust your work activities either earlier or later depending on your location. For more detailed information, check the Southern Region Integrated Strawberry Management Guide and the Southeast Regional Strawberry Plasticulture Production Guide at:

<http://www.smallfruits.org/SmallFruitsRegGuide/index.htm>

Fall (Sept-Nov)

- ✓ Fumigate (or apply compost) early Sept in NC, and put down plastic
- ✓ Plant ryegrass in aisles (1 bu/acre) before you punch holes in plastic
- ✓ Plant in October (most of NC), use overhead irrigation as needed for plugs or fresh dug plants
- ✓ Check for dead plants and reset asap
- ✓ Watch for pest injury, including deer
- ✓ Fall irrigate only if soil is dry
- ✓ Hand weed emerging winter weeds
- ✓ Watch for pest injury, including deer
- ✓ Fall irrigate only if soil is dry
- ✓ Consider placing row covers on plants first 10 days of Nov. for additional flower development this fall and higher yields next spring (optional) apply beneficial mites shortly after planting
- ✓ Inspect plants late fall and winter for crown

- development, you should see 2-3 crowns by December in a normal year
- ✓ Protect plants and plastic from deer

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