the Southern Region small fruit consortium

Small Fruit News

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NC State University
Clemson University
The University of Arkansas
The University of Georgia
The University of Tennessee
VA Polytechnic Institute and State University

In this issue

Special Reports:

Did You Miss It? The 2009 Southern Region Small Fruit Consortium Berry Crop Irrigation Agent Training was Held in Savannah, GA in January

R. Allen Straw, Virginia Tech
and
Gerard Krewer, University of Georgia

Giles Padgett-Wilkes of Point Source Irrigation discusses irrigation nozzles with the agents at the Bamboo Station

When the Southern Region Small Fruit Consortium (SRSFC) Steering Committee met in January of 2008, topics for Agricultural Extension Agent trainings for the next year were discussed. Among suggested topics was an irrigation training focusing on small scale berry producers. Gerard Krewer from the University of Georgia and Allen Straw from Virginia Tech agreed to coordinate the training to be held in conjunction with the Southeast Fruit and Vegetable Conference held in Savannah in January 2009.

Many of the agents in the berry producing regions of the Southeastern U.S. are located in areas with little or no commercial irrigation companies. Therefore, much of the business is done over the phone. More times than not, poor communication between the producer and salesperson has resulted in a less than optimum systems and disgruntled parties. The goal of this training was to train Agricultural Extension Agents in basic irrigation principles, as well as give them hands on experience with irrigation systems particular to berry crops. Therefore, if agents are more educated and comfortable with the basic principles of irrigation, they should be able to help growers “design” a system or at least help them communicate better with commercial salespeople.

The training was held on Wednesday, January 7 and Thursday, January 8, 2009 just prior to the Southeast Fruit and Vegetable Conference. On Wednesday afternoon, the participants met at the Savannah International Trade and Convention Center for “formal lectures”. Tom Monaco, Executive Director of the SRSFC, welcomed the 24 participants from Arkansas, Georgia, North Carolina, South Carolina, Tennessee and Virginia. The next 3 hours were spent in PowerPoint presentations covering basic irrigation and engineering principles. After the excruciating time of lecturing, the agents were free to experience the food and hospitality of Savannah for the evening.

Bright and early on Thursday morning, the training resumed at the University of Georgia’s Bamboo Station. Stephen Garton, director of the experiment station, welcomed everyone and gave them an overview and brief history of the Bamboo Station. Brian of B.B. Hobbs, Darlington, SC was gracious enough to participate and give a presentation on large

scale irrigation design and installation. The morning was rounded off by "sprinkler" and emitter demonstrations from Giles Padgett-Wilkes of Point Source Irrigation of Mt. Dora, FL.

During lunch, Stephen Garton was kind enough to take meeting participants on a tour of the Bamboo Station. Everyone enjoyed the tour and was greatly appreciative of Dr. Gartons efforts. After lunch, Allen Straw finished up the classroom activities with a session on the utilization of overhead irrigation for frost / freeze protection in berry crops.

Warning: Agents at Work! Agents install irrigation system at the Bamboo Station.

It was then time to move on to the "hands on" portion of the training. An overhead sprinkler system for frost protection had been designed prior to the training. The agents were given the task of installing the equipment. Every participant was encouraged to be involved in the installation. This included digging ditches, splicing existing pipe, running PVC pipe to the orchard tubing and installing the sprinklers. We all had a good time and learned a lot. Some of us even learned that the installation punch would go all of the way through the orchard tubing! After turning on the system, we spent the remainder of the time looking at different examples of irrigation equipment and practiced working with different types of supply line and fittings.

That ended the "formal" portion of the agent training. However, one of the benefits of attending the SRSFC Agent Trainings in Savannah is the opportunity to attend the Southeast Fruit and Vegetable Conference.

The authors would like to thank the SRSFC and all of the participants that made this training possible. Oh . . . and for the final quiz, "How many feet of elevation does it take to produce 1 PSI?" If you came to the training you would know it is 2.31 feet.

New Information on the Prevalence and Control of Emerging Blueberry Diseases in NC and GA

Bill Cline, Plant Pathology Department, NCSU

Plant Pathologists in NC and GA have observed an increase in new "emerging" blueberry diseases not previously found in the southeastern US. In 2007 and 2008, surveys have determined the incidence of Blueberry Red Ringspot (BRRV) and a second disease suspected to be caused by a virus, a late-season necrotic ring blotch that occurs on leaves but not on stems. In 2008, I traveled to Georgia to survey fields with colleagues there, to make sure that we were seeing the same problems – and also to familiarize myself with the symptoms of bacterial leaf scorch caused by *Xylella fastidiosa*. Having seen the symptoms of bacterial leaf scorch in the field on plants in Georgia, I can now say with more confidence that I have not (yet) seen similar symptoms in North Carolina.

Figure 1. *Dead areas at edges of leaves on upper shoots. The green area remaining in the center of the leaf has a distinctive oak-leaf pattern. Most of the older leaves on this bush had already fallen off, producing the "green stem" symptom that can been seen at a distance.*

Figure 2. *Leaves from a Xylella-infected bush showing a distinct "oak-leaf" pattern of green tissue, with dead leaf margins. This disease is not known to occur in North Carolina. These photos were taken in 2008 on the cultivars 'Star' and 'V-1'.*

Figure 3. *Necrotic ring blotch, a suspected virus disease found on 'Star' and 'O'Neal' in both North Carolina and Georgia.*

Figure 4*. Necrotic ring blotch symptoms on 'Star' in Georgia. Note symptoms on both upper and lower leaf surfaces.*

Survey results

Expanded surveys were conducted in 2008 NC and GA to further investigate the incidence and severity of blueberry red ringspot virus and other diseases in the southeastern US. In NC, plants were surveyed visually with emphasis on BRRV, necrotic ring blotch (a new suspected virus), and bacterial leaf scorch (*Xylella fastidiosa*). Visual assessment of disease incidence in each of four quadrants was made on 13 farms ranging from 15 to 400 acres in size for a total of 38 fields (location × cultivar combinations). BRRV was present on 3 of 13 farms (23.0%) and in 8 of 38 fields (21.1%). This farm-level prevalence was lower than in Georgia, but the field-level prevalence was higher in NC. BRRV incidence in symptomatic fields ranged from <1% to 100%. Affected cultivars included Legacy, Blue Ridge, Biloxi, Jubilee, Star, and Duke. Previous work in North Carolina has confirmed BRRV in O'Neal, but symptoms were not observed in O'Neal in this survey. Necrotic ring blotch was also present on 3 of 13 North Carolina farms (23.0%), but these were different farms than those where BRRV was found. The field-level prevalence was 15.8% (6 of 38 fields), lower than in Georgia. Incidence ranged from 25 to 100%, but most commonly all plants in a given field were infected. In this survey, necrotic ring blotch was limited to Star and O'Neal in North Carolina; these two cultivars also showed severe symptoms in Georgia. Bacterial leaf scorch was not found to occur in NC (with P. Brannen and H. Scherm, UGA).

Editor's Note: *After this article was written, the common name of 'Necrotic Ring Blotch Disorder' was proposed by Dr. Phil Brannen -- see following article.*

Blueberry Necrotic Ring Blotch Disorder

Phillip M. Brannen and Harald Scherm
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Recently, a new problem has been observed on southern highbush blueberries (*Vaccinium corymbosum* interspecific hybrids) in several southeastern states. Until fully characterized as a disease (i.e., shown to be caused by a pathogenic agent), it will be referred to as a disorder. Our current assumption is that blueberry necrotic ring blotch is likely caused by a virus, since double-stranded RNA (dsRNA) has been isolated from symptomatic leaves (Robert Martin, USDA-ARS, Corvallis, OR, *personal communication*). Initially observed in 2006, necrotic ring blotch was found scattered among 3-4 locations in Appling and Bacon counties in southern Georgia. No bacterial or fungal pathogens were observed in symptomatic

tissue, and ELISA did not indicate presence of a known blueberry virus. PCR assays for *Blueberry red ringspot virus* (BRRV) also were negative, unless there were clearly mixed infections. The initial distribution of necrotic ring blotch in Georgia was limited to very sporadic reports and observations in 2006 and 2007, but in 2008, it was found in multiple locations throughout the major blueberry production counties (Table 1); in several locations, premature defoliation occurred on severely affected plants. The disorder was also observed in Florida, Mississippi, South Carolina, and North Carolina, and it has emerged from an initial curiosity to a potential yield-limiting problem among some cultivars. To date, necrotic ring blotch has not been observed in the native, more widely grown rabbiteye (*Vaccinium virgatum*) cultivars.

Symptoms

Symptoms of blueberry necrotic ring blotch disorder are relatively easily recognized in the initial stages, but as spots coalesce, leaf symptoms can be confused with those of fungal leaf spots. Initial symptoms of necrotic ring blotch are observed as irregularly shaped circular spots or blotches with green centers on the top and bottoms of leaves (Fig. 1-3). These symptoms are distinct from those caused by BRRV (Fig. 4), which produces ringspots that are more reddish in color, have thinner margins, and are less blotchy in appearance. With necrotic ring blotch, spots generally are more prevalent on older tissue (i.e., the lower leaves of plants), but they can inundate a bush from bottom to top. A symptom variant, generally observed on the same plant, is a greasy or oily appearance on the leaves, which greatly resembles a chemical burn injury. The outer ring colors can initially vary from dark brown to purplish-black, but they often coalesce to form solid brown to black necrotic spots or blotches which are similar to Septoria leaf spot (Fig. 5) or other fungal leaf spots. However, Septoria leaf spot never has green centers, and fungal structures (pycnidia and cirri) are observed in spots caused by *Septoria*. Plants spotted severely with either necrotic ring blotch or Septoria leaf spot will defoliate prematurely.

Causal Organism

The cause of the disorder is currently unknown, but presence of dsRNA suggests a virus. If confirmed to be viral through additional research, one or more distinct and potentially new viruses may be involved.

Disease Cycle and Epidemiology

There is currently no information about the epidemiology of the disorder, including its means of transmission or spread, potential involvement of vectors, and the role of alternate hosts or other sources of inoculum. However, if viral, necrotic ring blotch is likely spread by propagation and possibly one or more insect vectors. If this turns out to be the case, then characterization of the virus will help to delineate the likely insect vector. Other means of spread could include nematodes or root grafting, but these are likely less important than propagation and insects.

Control

No control measures are currently known. However, there is strong evidence for host resistance, as some cultivars are often found to harbor extensive symptoms (i.e., Star, O'Neal, and FL 86-19), whereas others on the same farm or field tend to be symptomless (Table 2). If confirmed to be caused by a virus or other systemic pathogen, suspect plants should not be utilized for propagation through hard- or softwood cuttings. Furthermore, tissue-cultured plants would help to reduce the initial introduction of this disorder. If an insect vector is identified, vector management with insecticides may also be recommended.

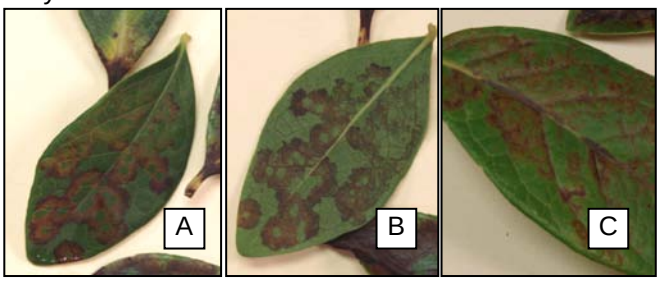

Fig. 1. *Symptoms of necrotic ring blotch are observed initially as irregularly shaped circular blotches with green centers on the top (A), which penetrate to the bottom (B) surfaces of the leaf; a variant of this symptom, often observed on the same plant, is a greasy or oily appearance on the leaves, which greatly resembles a chemical burn injury (C). The outer ring colors can vary from dark brown to purplish-black, but they often coalesce to form solid brown to black necrotic spots and blotches, and severely diseased leaves can eventually become solidly covered in spots before they abscise.*

Table 1. Prevalence of necrotic ring blotch in different counties in Georgia, based on a survey conducted in fall of 2008.

	Farm-level prevalence[a]		Field-level prevalence[b]	
County[c]	No. of farms	% farms with necrotic ring blotch	No. of fields	% fields with necrotic ring blotch
Appling	12	50.0	37	27.0
Bacon	4	25.0	17	23.5
Berrien	1	…	5	…
Brantley	7	57.1	34	25.5
Clinch	6	33.3	19	21.1
Colquitt	1	…	7	…
Pierce	8	75.0	22	45.5
Ware	6	66.7	26	19.2
TOTAL	45	55.6	167	28.7

[a] Percentage of farms where necrotic ring blotch was present in at least one field (regardless of severity).
[b] Percentage of fields where necrotic ring blotch was present. Each farm consisted of multiple fields (usually different cultivars).
[c] No percentages calculated for counties where only one farm was surveyed.

Table 2. Prevalence of necrotic ring blotch on different southern highbush cultivars in Georgia, based on a survey conducted in fall of 2008.

		Necrotic ring blotch prevalence[a] (%)	
Cultivar[b]	No. of fields	All incidence classes[c]	Moderate or severe incidence
Emerald	30	0	0
FL 86-19 (V1)	22	45.5	18.2
Millennia	5	0	0
O'Neal	11	45.5	27.9
Rebel	7	0	0
Star	55	58.2	25.0
Windsor	6	0	0

[a] Percentage of fields where necrotic ring blotch was present (regardless of severity).
[b] Only cultivars with at least five data points (separate fields) are shown.
[c] Includes scattered, moderate, and severe incidence levels per field.

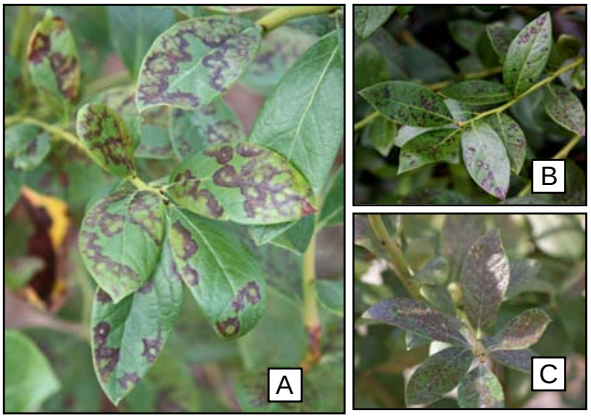

Fig. 2. *Symptoms of necrotic ring blotch as observed in the field. Symptoms can be typical (A; relatively large dark rings surrounding green), similar to Septoria leaf spot (B; smaller dark spots which may coalesce to form a solid spot), and in advanced or severe stages somewhat atypical (C; greasy blotches with most of the leaf covered). Photos courtesy of Phil Harmon (University of Florida), Eddie McGriff, and Gerard Krewer (University of Georgia).*

Fig. 3. *Symptoms of necrotic ring blotch showing multiple symptoms of greasy spots, green-centered spots, and coalescing solid spots and blotches*.

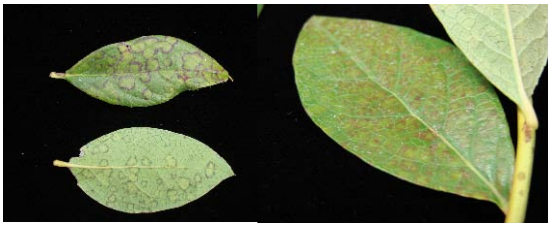

Fig. 4. *Red ringspot disease, caused by Blueberry red ringspot virus (BRRV), produces ringspots that are more reddish in color, have thinner margins, and are less blotchy in appearance than those of necrotic ring blotch.*

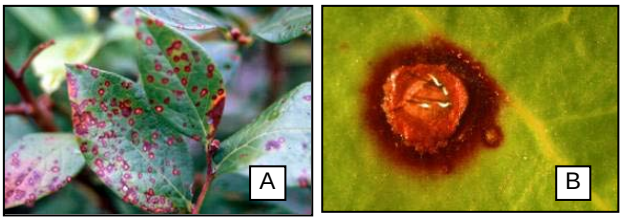

Fig. 5. *Septoria leaf spot (and other fungal leaf spots affecting blueberry) can be confused with necrotic ring blotch, but the spot centers of Septoria leaf spot are generally tan and contain dark pycnidia (A). If moisture is sufficient, white horn-like cirri (containing fungal spores) can be seen inside the spots with a hand lens (B).*

Strawberry Association Makes Research Grants

By Debby Wechsler, NCSA Executive Secretary

Each year, the NC Strawberry Association considers proposals for research funding and makes grants to various projects. Funds for these grants come from the NC Strawberry Assessment, from donations from individual growers, and from the Auction at the Southeast Strawberry Expo. Traditionally, the Association has allocated all funds raised through the Strawberry Assessment to research.

This year, the total allocated to research funding was $25,000. Approximately $21,000 of that represented assessment funds received or promised for 2008 plant sales, $1000 was from individual donations, and another $1000 was raised at the Expo auction. The remainder was allocated from the Association's reserve funds. As we received $35,064 in requests for NCSU projects and, another $9,500 in requests from Georgia researchers, there were difficult decisions to make.

Proposals are first considered by the Research Committee of the Board, which then makes a recommendation to the full board for a final decision. The following research funding allocations were approved:

- ☐ Breeding Strawberries Resistant to Anthracnose with Adaptation to the Various Regions of NC (Ballington) – $2,500.
- ☐ Linking NC to the Nation's Public and Private Breeding Programs: A Strategy to Accelerate the Development of Improved Strawberry Cultivars (Pattison) – $5,000.
- ☐ Support Travel for Grower and Agent On-Site Visits and Pre-Plant Meetings for Statewide Strawberry Extension Specialist (Poling) – $2,500.
- ☐ High Tunnel Production of 1st, 2nd, and 3rd Generation Runner Tips (Poling) – $2,000. (Funding for this project is conditional upon the success of an NCDA/NCSU project to the Tobacco Trust Fund that would support the construction of the tunnels; otherwise, the funds are re-allocated to the breeding program.)
- ☐ Developing an Integrated Two-spotted Spider Mite (Tetranychus urticae) Management Program for NC Strawberries (Burrack) – $3,500. (This project will be funded through a partnership with the IR-4 Project. NCSA will give its $3,500 to IR-4, which will provide an additional $1,500 match and then give a total of $5,000 to the project.)
- ☐ Development of the Clean Plant Program in NC through Certification, Micro-propagation, Pathogen-testing and Evaluation for Trueness-to-type of Strawberry Cultivars (Pesic-VanEsbroeck) – $5,000.
- ☐ Prediction of Latent Infections of *Colletotrichum Acutatum* and Optimization of Spray Schedules (Louws & Rahman) – $4,500.

Vineyard Records

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No one ever enjoys paperwork! However, you can appreciate paperwork in the form of records. Most winemakers are information junkies. The more information they can get the more comfortable they become with the fruit coming from a given vineyard. Records provide a basis of self-education for a winegrape grower. Let's examine the kind of records that should be kept and how they are useful.

Weather: You should consider purchasing at least one small weather station for each vineyard. If you have blocks of vines that you are aware of differences in microclimate even prior to planting, you should consider purchasing weather stations for those specific blocks. An article in "WineBusiness Monthly" discusses considerations for installation of a weather station in a vineyard (http://www.winebusiness.com/wbm/?go=getArticle&dataId=46203).
Why buy and install a weather station? Temperature and humidity records are critical for determining disease pressure within each growing season. The weather station will pay for itself very quickly if you prevent unneeded applications or if the information from it identifies a critical period for application that you might miss. Additionally, daily records of maximum and minimum temperatures will allow you to calculate growing degree days (average daily temperature minus a base temperature of 50^{o}F summed from April 1 to October 31; any negative difference is set to zero). Winter minimums can give you an indication of what the Pierce's Disease pressure may be the following summer. In the spring, you should keep monitor and record incidences of frost and freeze.

Planting: From the very beginning you should record the specifics of the scion clone, rootstock, nursery from which plants were purchased, date of planting and any vineyard preparations that were made prior to or during planting. You should have a file that includes the soil test results from each test that you have done. You should record all fertilizer and lime applications.

First year: There are not a lot of detailed records to keep during the first year of growth. At the end of the season, you should note any plants that died, performed poorly, or are diseased (crown gall). As soon as you have the number of missing plants, you can put in an order for replacements. You should also monitor young plants to try to determine if they are true to the variety you actually ordered. This is hard in the first year as the leaves may not appear quite the same as on a mature vine. You should also record the date of the last killing spring frost and of the first killing fall frost.

Second year and on: Start in the spring recording some of the major phenological (development) stages of the vine. You should record date of bud break for each variety. You should also record date of bloom (50% of the flowers are in bloom), berry size (BB and pea size), bunch closure (when the berries touch and make spray penetration into the cluster difficult), veráison (when 50% of the fruit has begun to soften; white-fruited varieties, berries become translucent; red-fruited varieties, berries begin to turn red), and harvest date (if there is fruit in the second year). During fruit ripening, keep organized records of any compositional measurements of the fruit that you take. You should at least track soluble solids concentrations.

Yield and pruning weights: Select a couple of representative vines in your vineyard for detailed record keeping, at least until you have a feel for the relationship between what your eyes see and the "real" numbers. At pruning, record the weight of one-year old wood and count the number of shoots that are on the vine. You can calculate the average shoot weight with these two numbers. At harvest, count the number of clusters/vine as you harvest and weigh the harvested fruit. Cluster weight can be calculated by dividing the yield/vine by the number of clusters/vine. In the future, these numbers will guide you in estimating yield. The numbers should help you at bunch thinning to know how many clusters/vine to retain to achieve your target yield. You can also divide fruit yield by the weight of one-year old wood removed at pruning. This is known as the Ravaz Index. A target ratio for the Ravaz Index is between 5 and 10 (five to ten pounds of fruit per one pound of one-year old pruning wood). It is an indicator of sufficiency of vegetative growth for the amount of fruit produced. If it is too high then vegetative

growth is not sufficient to support the crop level. If it is too low, you are just growing a lot of leaves in relation to the potential yield capability of the vine. During pruning you should record missing or diseased plants that need to be replaced.

Harvest records: If you sell to a winery other than your own or you do not have a winery, maintain records of fruit tonnage delivered to the winery. You should ask for a copy of the fruit analysis from your vineyard. Hopefully, the winemaker will allow you to taste the wines made from your grapes and discuss the good and the bad points. You should keep tasting notes for wines made from your fruit. Learn. You can now go back and see what you did right and/or wrong during the growing season.

Pesticide records and pest incidences: You should track any pesticide applications. Some states require record keeping of all pesticide applications and the weather conditions during the application. If your state does not require this level of detail, you may still want to develop this habit because it is likely that in the future you will be required to keep these records.

You should monitor and record the incidences of insect and disease in your vineyard. By keeping records you will better learn to anticipate problems and be proactive rather than reactive in pest management. You should also note any beneficial organisms in the vineyard.

Summary: Computers should make record keeping for your vineyard much easier. Weather records can be downloaded automatically if the right equipment is purchased. Hand held computer power is very useful. Vineyard notes can be made on these hand held devices and downloaded directly onto a larger computer. You should consider record keeping an integral part of education about your own vineyard!

Choosing Blackberry Varieties

John R. Clark, University Professor
University of Arkansas

I receive calls and e-mails periodically requesting information on what blackberry varieties to plant. Many are calling late winter to early spring to plan for the following year. That is good planning on a grower's part to consider well ahead what to plant, where to get plants, site preparation, and particularly to envision where to sell the resulting fruit. Just like any grower, I learn each year something new about a variety; the newer the variety, the more I learn each year. Even old varieties can show new performance aspects at times. Here are some comments on how my recommended choices compared for several important characters. My main focus is on Arkansas-developed varieties as I think they are most adapted to the South, plus I am more familiar with them.

Time of Harvest

Blackberry varieties usually fruit over a four to six week period. The longest-season variety I am familiar with is the thorny Kiowa, the shortest the thornless Arapaho. Some say Kiowa fruits too long, some say it is just right for local sales and pick your own. The following are relative average ripening dates at Clarksville, Arkansas (west-central Arkansas just north of I-40) for the more popular University of

Arkansas-developed varieties:

- Natchez and Arapaho: June 5
- Ouachita, Kiowa and Chickasaw: June 10-12
- Navaho: June 20
- Apache: June 25
- Also, Triple Crown ripens about July 1, while Chester Thornless begins near July 10

Currently in breeding, the Arkansas program is working to develop varieties to replace Navaho and Apache and also push the season back later in the summer to extend harvest (floricane- and primocane-fruiting options). Earlier ripening has long been a goal, and major headway made in the direction particularly with Natchez which is

intended to replace Arapaho as the first ripe of the thornless options.

Flavor
The more I focus on flavor as a plant breeder, the more I recognize the variation not only in the fruit of the plants but in the preferences of those who consume the fruit. Folks vary in what they like, but in general the sweeter berries are preferred. The sweetest of the Arkansas varieties is Navaho, with soluble solids content of about 11-12%. Ouachita and Apache tend to run about 10.5 to 11%. Natchez averages 9.5% while Arapaho is often 8.5 to 9.0%. Kiowa and Chickasaw range 8.5 to 9.5%. Of course, the sweetness of the berries depends on ripeness also. There is some variation in flavor components and acidities of blackberries, but it is more difficult to consistently say who prefers what – people simply vary in what they like. Of the non-Arkansas thornless, Triple Crown is consistently preferred and a favorite of many. In breeding, I am working to increase sweetness by enhancing sugar levels and also reducing acid level.

Postharvest Handling/Shelf Life
A key focus in variety improvement is to build in good postharvest handling along with a range of other desired traits. Superior shelf life of newer developments compared to older choices has led to the development of the shipping blackberry industry. There is no reason that quality (flavor particularly) and shelf life cannot go hand in hand. The best handling variety I know of is Navaho, with nearly as good performance by Ouachita, Natchez, and Apache. Arapaho can perform somewhat poorer, but still good by most standards. Triple Crown is reported to not have good shelf life, so should not be grown for the shipping market. Chester Thornless also handles well. Key to shelf life is if the fruit has been exposed to rain during ripening or at maturity – if so the fruit may not hold very long under any circumstances. In breeding, incorporating traits that contribute to shelf life such as firmness, lack of leaking and mold, and retention of black color all are part of the goal. The thornless options provide the best shelf life compared to most thorny choices.

Berry Size
The enhancement of berry size in more modern varieties is a substantial blessing to all that have picked wild blackberries. A full container is much more quickly realized with large berries. For size, the largest berries are Apache and Natchez (9-11 g)of the thornless, along with Kiowa (the largest overall at 15 g) and Chickasaw (10-12 g) of the thorny options. Ouachita averages 7 to 8 g, while Navaho is the smallest thornless at 5 to 6 g. Small size late in the season is the biggest complaint with Navaho. Large berries are usually preferred, unless packing in smaller clamshells is required in which making minimum weight can be difficult. What is the best berry size? For shipping is likely 8-9 g, while for pick-your-own and local sales larger berries can be more popular.

Yield
The highest yielding blackberry of modern varieties is Chester Thornless developed by the USDA. Its yields can be near twice that of other choices. The biggest disadvantage is that this high yield comes with what most consider a compromise in quality, particularly flavor. But, I have met folks in other parts of the country that hold it as the yield standard, and if other varieties do not match its yield, they lose interest in other options. Chickasaw, Kiowa, Natchez, Apache, and Ouachita can all be high yielding, in the area of 10 to 12,000 lb/acre. Navaho tends to yield slightly lower, while Arapaho is considerably lower averaging 5,000 to 6,000 lb. Yields can vary by variety based on location, depending on variables such as hardiness, chilling requirement, and overall adaptation to the area grown.

Winter Hardiness
In general, the Arkansas varieties have adequate cane hardiness across the mid to upper South and into the lower Midwest. Navaho has proven to be dependably hardy over the years, but few reports of problems have been

made concerning Apache or Ouachita. These two may be as hardy as Navaho. Chickasaw and Kiowa can have winter injury at times, particularly with winter lows below 10F. Arapaho has shown hardiness problems and is the least hardy of the Arkansas thornless. Natchez is very new, and there have not been as many years to observe it after freeze events. However, no injury has been noted with lows between 5 and 10F. Chester Thornless is very hardy, among the best of the currently grown options. There is a vast difference in concern among growers in the South with hardiness; those in southern Georgia have no concern with hardiness in general, while the expanding industry in North Carolina needs to watch this closely as winter injury will be seen in the more highland areas. In current breeding, the incorporation of primocane fruiting is envisioned to be an approach to addressing winter hardiness, with canes fruiting in the first year and not requiring overwintering and being subjected to the extreme cold of winter.

Primocane Fruiting

I get questions often on the status of primocane-fruiting options. In general, Prime-Jan® has proven to be the pest primocane fruiter, but not so much in southern testing as in trials out west. Prime-Jim® has not worked out to express this trait as strongly in more marginal locations. What about new choices? One selection, APF-45, is in the process of being released and is hoped to be on the market in spring 2010. Its key merit is much improved postharvest quality and flavor. However, its adaptation to the South is yet to be proven fully. I still believe that the Appalachian region holds the greatest promise for this type of berry due to lower summer extreme temperatures compared to most of the South. Have you checked blackberry shipping prices in September and October? This is worth checking out as far as encouragement to figure out how to make a crop for these months.

Disease Resistance

There are few clear-cut guidelines with most varieties and disease resistance/ susceptibility. The most well-known facts are:

- Navaho is susceptible to orange rust, the others seem to be resistant
- The thornless options are resistant in most instances to double blossom/rosette
- Virus susceptibilities are not clear cut at this time as to what viruses are really present plus if any differences among varieties in susceptibility are present

What Are Folks Planting?

Of the Arkansas developments (the only group I track by sales – not the USDA options), Ouachita has far and away been the biggest seller for 2006-08. Navaho has continued to sell well in 2007-2008, but since the patent has expired as of late 2008, sales are no longer tracked. Natchez was a rapid seller in 2007-08 although limited plants were available in its first year on the market. Apache and Arapaho are consistently purchased, although at a rate substantially less than Ouachita. The thorny options Kiowa and to a lesser extent Chickasaw continue to maintain a place in the market, although at much lower levels than thornless options.

Sources of Plants

There are a number of licensed propagators of University of Arkansas blackberry varieties as these varieties are patented (unless patent has expired as with Navaho), and licensed propagators can be found at http://www.aragriculture.org/horticulture/fruits_nuts/default.htm. I always appreciate if growers will check to see if the nursery is licensed by the University to propagate and that royalties are being paid on plants. This helps the effort in keeping the variety development going.

All the best for an outstanding 2009 blackberry season!

New Restrictions on Chateau Use in Vineyards

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NC State Univ., Clemson, Univ. of GA

Chateau has become a very popular herbicide for use in fruit crops. It is broad spectrum and provides long lasting residual control. A Few years ago there was isolated incidence of crop injury associated with Chateau/glyphosate tank mixes applied after fruit set in apples and peaches in both Carolinas. The problem was

due to an inversion occurring with the glyphosate which carried the Chateau into the crop canopy and resulted blemishes on fruit. Damage was also observed on leaves. Since those incidences we have recommended that after bud break Chateau be applied in combination with only paraquat or Rely and as a result neither I nor Valent is aware of injury problems associated with Chateau occurring in the Southeast. Unfortunately fruit growers in other regions of the country have not been as diligent as Southeast fruit growers and there has continued to be problems on the West Coast and in Michigan. The result is more restrictive use pattern for fruit however grapes were impacted less than tree fruit.

The label changes have little impact on grapes grown for wine or juice. Currently Chateau can be applied after leaf out through harvest only in vineyards producing fruit for wine or juice so long as the herbicide is applied with "*shielded application equipment and applicator can ensure spray drift will not come in contact with crop fruit or foliage*" and Chateau is not applied in combination with any product containing *glyphosate.* Grapes grown for fresh market consumption (table grapes, fresh market muscadines) are subject to a more restrictive use pattern that prohibits Chateau applications until after the completion of final harvest through bud swell. In non-bearing vineyards growers may use Chateau in same manner that is allowed for vineyards producing wine or juice grapes.

Valent has developed a supplemental label for the Southeastern United States that will allow growers in this region to use Chateau as they have in the past so long as they do not apply it with glyphosate ater vines break dormancy. This supplemental label is pending approval by the EPA so until then growers in the Southeast will need to follow the more restrictive label. If you want to review the supplemental label for Chateau you may do so at www.cdms.net by searching for "Chateau" and scrolling down through the various supplemental labels until you see the one for grapes.

Management of gray mold/Botrytis rot in the early harvest season of 2009

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Symptoms and signs- Gray mold of strawberry caused by *Botrytis cinerea* can be damaging in a strawberry season with frequent rain and damp weather. Infected berries may remain firm, yet become covered with gray spores and mycelium, giving the fruit a velvety gray appearance (Figure 1). High humidity favors mycelial formation that is visible as a white cottony mass. On undeveloped fruit, lesions may develop slowly and fruit may become mis-shapened and die before maturity. Fruit that are completely rotted become dry, tough and mummified. Gray mold is a problem not only in the field, but also during storage, transit, and market of strawberries, due to onset of severe rot as the fruits begin to ripen. Other parts infected by the fungus include leaves, crown, petals, flower stalks, and fruit caps. Disease is most severe during bloom and harvest in seasons with lengthy periods of cloud and rain. Botrytis primarily enters the field on transplant foliage. The fungus can live in the green tissue but be latent or dormant without causing any symptoms. As the infected strawberry leaf begins to senesce, the pathogen goes into an active stage, colonizing the leaf and obtaining its nutrients from the dead tissue (Figure 2). Spores then form and, once environmental conditions are appropriate (between 65-75^0 F, and damp or rainy weather), they are dispersed by water splash and/or wind onto newly emerging leaves or blossoms. Immature fruits become infected primarily through blossom infections. At temperatures in the range of 65-70^0 F, the pathogen requires only 2 hours of leaf wetness (free moisture) for the spores to germinate and infect. Once the berries begin to ripen, the

fungus is able to colonize them and sporulate, producing the mold often seen in the field. Lush foliage and excessive tissue growth are ideal for *Botrytis,* because the interior of the plant canopy will remain wet longer, and the newly emerged tender tissue more easily infected. Excess nitrogen fertilizer specifically can contribute to such foliar growth. Therefore, higher levels of inoculum will result in more disease in damp and rainy weather.

Figure 1. *Typical gray appearance of infected fruit*

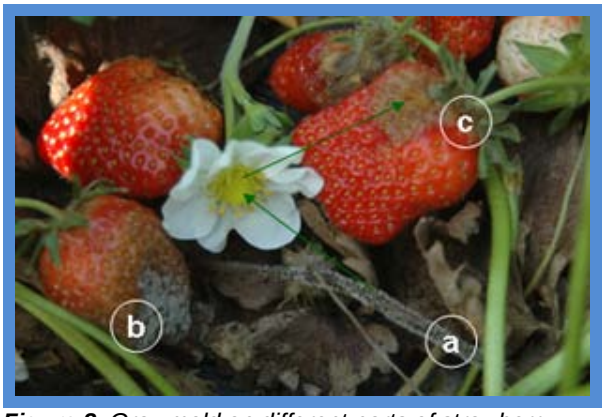


Figure 2. *Gray mold on different parts of strawberry; a) Sporulation on dead petiole and leaf; b) fruit infection from colonized dead tissue; c) lesion appearance from internal infection that have occurred through flower parts such as stigma.*

Disease management:

I) CULTURAL CONTROL

To avoid over-fertilization, base fertilizer programs on leaf tissue nutrient analysis reports. Research has demonstrated increasing nitrogen levels beyond an optimum level does not increase yield but does increase fruit rot incidence. Removal of senescing tissue from the field may be helpful in the fall, but is likely of most benefit in the early spring, just prior to bloom, to help lower inoculum levels. Early spring growth of foliage sometimes can be trapped underneath the plastic where relative humidity can reach close to saturation during periods of cloud and rain supporting rapid colonization of the senesced as well as live tissues by *B. cinerea* to cause severe petiole rot. Plant mortality from this kind of heavy infection is not uncommon. Plastic needs to be reset after rescuing any growth from underneath. Use of row cover also has the potential to increase relative humidity around the plant canopy. If weather remains damp and humid in the early spring and *Botrytis* growth is detected, row cover use needs to be minimized or intermittently removed to allow air circulation. After harvest fruits should be monitored for disease, and infected berries removed. Rapid removal of field heat and keeping fruit at around 34^0 F and increasing carbon dioxide levels during shipping (12-15 % concentration in gastight storage bags) will help keep *B. cinerea* down.

II). CHEMICAL CONTROL

Fungicides play a major role in the management of this disease. Fungicide applications are critical in problem fields during early and full bloom. These fungicides are targeted to limit flower infection that leads to fruit infection, and should limit the need for late season applications to the fruit. Internal infection that is manifested as post harvest rot is primarily happens by flower infection. A few well-timed sprays are less costly and more effective in controlling gray mold than frequent fungicide applications through harvest. Fewer sprays during harvest should also provide strawberry pickers a sense of exemption from chemical residues on the berries they are picking. Results from a multiple year study in North Carolina on fungicide schedules based on the information generated on Botrytis infection biology and resistance management produced consistent results to suggest comparable gray mold control from reduced spray as opposed to season long spray program (Table 1). Schedules containing Pristine will also reduce the risk of anthracnose fruit rot as it contains two active ingredients pyraclostrobin providing protective (some curative) activity against *C.acutatum* and other a.i. boscalid is a good Botryticide. Switch also has 2 types of fungicidal a.i. (Cyprodinil, fludioxonil) and is a superior botryticide with wide range of other activity. Our research results from last 2 years indicated that Switch reduces post-harvest fruit rot incidence as well.

Table 1. Evaluation of fungicides to control anthracnose fruit rot on strawberry cultivar Chandler, 2008.

Treatment and rate (amount of formulation)/Acre[w]	Schedule [x]	Gray mold incidence (%)[y,z]	Marketable Yield (lb/A)[z]
1) Non-treated	xxx	17.8 a	34960 c
2) Switch 62.5 WG, 12.0 oz	Spray# 1-9	9.1 bc	36657 ab
3) Captan 50 WP, 4.0 lb			
+Topsin-M 70W, 1.0 lb	Spray# 1		
Pristine WG, 23.0 oz	Spray#2		
Switch 62.5 WG, 11.0 oz	Spray#3		
Pristine WG, 23.0 oz	Spray# 4	7.3 c	36103 b
4) Captan 50 WP, 4.0 lb			
+Topsin-M 70W, 1.0 lb	Spray# 1		
Pristine WG, 23.0 oz	Spray# 2,4,6,8		
Switch 62.5 WG, 11.0 oz	Spray# 3,5,7,9	6.1 c	37025 a

[w]Plus signs "+" indicate tank mixes of two or more products
[x]Numbers indicate week of application during a 4/9-week period in the spring from 7 April through 27 May, 08 (1st application started at 10% bloom).
[y]Incidence of gray mold as a percentage of all marketable and diseased fruits harvested.
[z]Means within a column followed by the same letter are not significantly different according to Fisher's protected LSD test ($P \leq 0.05$).

In this study in 2008, gray mold incidence was high at the beginning of the harvest season. At the end of the season, however, none of the treatments had any gray mold incidence. *A reduced spray schedule (4 applications) showed statistically similar efficacy as a season long schedule (9 or 14 applications).* This result is applicable only for the strawberry fields that were not over fertilized or did not have extra foliar growth.

Recommendations/Check list

Even though we are having a prediction of wet spring, if weather seems normal or dryer than expected our recommendations will need to be adjusted with prevailing conditions.

1) Rescue the foliage trapped underneath the plastic and at the same time remove the senesced foliage
2) Maintain optimum fertility/do not over fertilize
3) Follow spray schedule 3 mentioned above starting from 10% bloom, if weather remains damp and humid throughout the harvest season spray schedule 4 will be needed for no risk takers. As mentioned earlier first 4 sprays are more critical.
4) Do not allow berry pickers in the field when foliage and berries are wet.
5) Cool down fruits at around 34^0 F and use 12-15 % carbon di oxide gastight storage bags for shipping.

Bunch Grape Nutrition Management

David Lockwood
The University of Tennessee

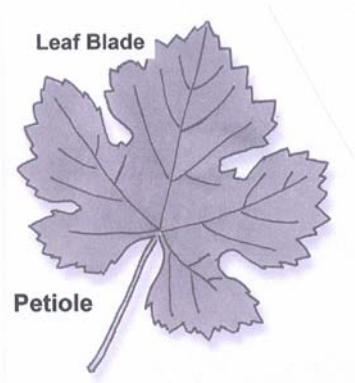
The nutritional needs of established vineyards are best determined by utilizing several things: soil testing, tissue analysis, observations of vine growth and fruiting, and past experience. The role of soil testing is primarily to monitor soil pH since soil analysis results in established plantings may correlate poorly with plant tissue analysis and plant response. Tissue analysis indicates the level of nutrients in the entire plant. It may be done for two reasons: the first is troubleshooting to confirm or deny a suspected nutrient problem within a plant, and the second is to monitor nutrient levels within the plant to detect a nutritional problem before it negatively impacts yield and quality. This process entails sampling an area annually or every couple of years over a period of time to establish background information for comparison of analytical results. Frequently, by the time visible symptoms of nutrient problems become evident, yields and/or fruit quality have already been negatively impacted. Tissue analysis can help avoid this problem.

The tissue to sample for analysis may vary depending on the crop. For many fruit and nut crops, entire leaves or leaflets are sampled.

Grape Petiole Analysis: Sufficiency Ranges

Element	Full Bloom	Veraison
N (%)	1.6 – 2.8	0.9 – 1.3
P (%)	0.20 – 0.60	0.16 – 0.29
K (%)	1.50 – 5.00	1.50 - 2.50
Ca (%)	0.40 – 2.50	1.20 – 1.80
Mg (%)	0.13 – 0.40	0.26 – 0.45
Mn (ppm)	18 - 100	31 – 150
Fe (ppm)	40 – 180	31 – 50
B (ppm)	25 – 50	25 – 50
Cu (ppm)	5 – 10	5 – 15
Zn (ppm)	20 – 100	30 - 50

With muscadine grapes, only the leaf blade is used for analysis. While leaf blades can also accurately reflect the nutrient status of the vine for bunch grapes, leaf petioles (the slender stem connecting the leaf blade to the shoot) are more commonly utilized.



Troubleshooting a suspected nutrient problem

When to sample:

- Anytime during the season when symptoms are visible.

What to sample:

- Collect 80 to 100 petioles per sample from leaves displaying symptoms regardless of their position on the shoot.
- Collect the same number of petioles from the same position on healthy vines of the same variety/rootstock and age in a location near the affected vines.
- Be sure to label and submit the samples separately to enable comparison of results.

Monitoring the nutrient status of a vineyard

When to sample:

The times for sample collection may be at full bloom or at veraison. Advantages and disadvantages exist for each. Select the sampling time based on the recommendations of the laboratory where the samples will be sent as the sufficiency ranges will vary somewhat based on sampling time.

Full bloom is considered to be when about two-thirds of the flower caps have been shed. Since nutrient element concentration changes throughout the growing season, the more consistent that the timing of sample collection is, the more valid the comparison of elemental concentration from year to year will be.

Nutrient Concentration as Affected by Time Throughout the Growing Season

Decreases	Stable	Increases
Nitrogen	Magnesium	Calcium
Phosphorus (slight)	Iron	Manganese
Potassium	Copper	
Boron		

Sampling at full bloom may provide a more accurate reflection of the nitrogen status of the vine and is early enough to allow amendments to the fertility program to be made during the same growing season.

Sampling at veraison may provide a more accurate assessment of the status of other elements. Due to the timing, adjustments to be made to the fertility program will be applicable to the next growing season.

While the best results would occur through the use of samples collected at both full bloom and veraison, the expense and time involved would be excessive. However, if results from samples collected at full bloom indicate problems, especially for potassium, a second sample collected 70 to 100 days following bloom may be warranted.

Collecting the sample:

To obtain the best analytical results, certain steps need to be taken in sample collection.

1. Collect only one variety/rootstock combination per sample from vines of approximately the same age.
2. Sample areas displaying different growing patterns separately.
3. Select petioles from leaves that are well-exposed to sunlight and free from injury and disease
4. Collect petioles from the same approximate locations in the canopy.
    a. Take petioles from the most recently matured leaves (usually five to seven leaves from the shoot tip and opposite from a fruit cluster).

   b. Collect samples from shoots occupying approximately the same position on vines.
5. Collect only one to two petioles per vine.
6. Restrict the area of collection to a maximum of 10 acres per sample.
7. Separate petioles from leaf blades immediately, place them in a clean paper bag or envelope and store in a clean, warm, well-ventilated area until air dry (about one day).
8. Label bags containing samples and make a map of where samples were collected for future reference.
9. Take soil samples from the same areas where petiole samples were collected.
10. Send samples to laboratories for analysis.

As previously mentioned, vine growth and fruiting along with experience from previous years should be considered when formulating a fertility program. Cropping levels and climatic conditions from previous years may have an impact on vine growth and should be considered when evaluating reports from petiole analysis. Keep in mind, also, that some other factors may mimic certain nutrient disorders. The herbicide simazine may cause interveinal chlorosis patterns on leaves similar to magnesium deficiency. While poor fruit set, straggly clusters and uneven berry size could indicate boron deficiency, these same symptoms could be caused by tomato ringspot virus.

The pattern of symptoms in the field could give some clues as to whether nutritional disorders are to blame. Nutritional disorders are generally widespread in the field as opposed to being confined to a single vine or small number of vines. In hilly sites, especially where erosion has occurred, nutrient deficiency symptoms will appear first on higher sites. Uniformly weak vine growth may be a symptom of low nitrogen or water stress, disease and overcropping.

The location of symptoms on a shoot should also be considered when diagnosing problems. As a rule, deficiencies of mobile elements (nitrogen, potassium and magnesium) appear first on older or midshoot leaves whereas symptoms of less mobile elements (iron, zinc) appear first on the youngest leaves.

The patterns of the symptoms on a leaf may also serve to indicate a nutritional problem. With nitrogen deficiency, there will be a general fading of green to a pronounced yellowing of leaves beginning with the basal to midshoot leaves and progressing to the younger leaves. It will be accompanied by slow shoot growth; short intermodal length; small leaves; reddening of leaves, petioles and shoot stems; and a reduced number of clusters, berries or a poor fruit set. Potassium deficiency is characterized by interveinal and marginal chlorosis progressing to chlorosis or scorching of leaves from the margin and inward. Magnesium deficiency shows up as interveinal chlorosis that does not extend to the leaf margin. It will progress to necrotic spots and leaf chlorosis including the leaf margins. Symptoms occur first on basal to midshoot leaves.

Soil & Plant Tissue Testing Laboratories

A & L Analytical Laboratories
2790 Whitten Rd.
Memphis, TN 38133
800-264-4522

A & L Eastern Agricultural Labs, Inc.
7621 Whitepine Rd.
Richmond, VA
804-743-9401

Brookside Farm Laboratory
P.O Box 456
New Knoxville, Ohio 45871
419-753-2448

Agricultural Analytical Service Lab
The Pennsylvania State University
University Park, PA 16802
814-863-6124

Plant Analysis Laboratory/ICP
Fruit & Vegetable Science Dept.
Cornell University
Ithaca, NY 14583
607-255-1785

Plant Analysis Laboratory
Agronomic Division – NCDA
4300 Reedy Creek Dr.
Raleigh, NC 27607-6465
919-733-2655

Soil Testing Lab
145 Smyth Hall
Virginia Tech
Blacksburg, VA 24061
703-231-6893

Soil, Plant & Pest Center
5201 Marchant Drive
Nashville, TN 37211-5112
615-832-5850

Soil, Plant and Water Testing Laboratory
The University of Georgia
2400 College Station Rd.
Athens, GA 30602-9105
706-543-5350

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

SPRING

Plant growth and development

- √ Plants deacclimate quickly
- √ Bud differentiation (additional flowers formed)
- √ Bud break
- √ Flowering
- √ Primocane emergence

Pruning and trellising

- √ Finish pruning and make sure all canes are tied to the trellis before budbreak
- √ Rotate shift trellises to horizontal position before budbreak, rotate to upright position immediately after flowering

Weeds

- √ Weed growth can be very vigorous at the same time as the bramble crop peaks, don't let weeds get out of control
- √ Weed control is best done earlier in the season before harvest commences.
- √ Handweed perennial weeds in and around plots

Insect and disease scouting

The period of time in the spring when the plant is flowering is the most important season for chemical control of **insects** and diseases. Know what your pests are and how to control them. Check the Southern Regional Bramble integrated Management Guide for recommendations. www.smallfruits.org

Insects

- √ Raspberry crown borer burrows into cambium
- √ Stink bugs (white drupelets in summer)
- √ Rednecked cane borer adults (starting at bloom)
- √ Raspberry cane borer adults
- √ Thrips
- √ Tarninshed plant bug
- √ Japanese beetle
- √ Raspberry fruit worm
- √ Midge
- √ Raspberry sawfly
- √ Blackberry psyllid
- √ Two spotted spider mites
- √ Aphids
- √ Whiteflies

Diseases

- √ Antracnose
- √ Botrytis (gray mold)
- √ Spur blight
- √ Cane blight
- √ Septoria leaf spot
- √ Leaf and cane rust
- √ Powedery mildew
- √ Viruses

Water management

- √ Bramble plants need about 1"-2" water/week, and this is amount is especially critical during harvest.
- √ Consider installing an overhead system for evaporative cooling. Turn on once or twice a day from 10 am to 3 pm for short periods of time (approx. 15 minutes) until mid afternoon

Nutrient management

- √ Apply second half of nutrients if doing split application
- √ Take leaf samples after harvest and send to a clinic for nutrient analysis for recommendations for next year

Marketing and miscellaneous

- √ Service and clean coolers
- √ Make sure you have enough containers for fruit next season

- √ Prepare advertising and signage for your stand
- √ Contact buyers to finalize orders
- √ Hire pickers
- √ Prepare signage for field orientation, it is easier to tell pickers where to go if rows are numbered

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

Spring (March-May)

- ✓ Send in leaf samples to testing lab every 14 days starting in late February/March
- ✓ Adjust fertility according to the recommendations
- ✓ Scout fields for mites, insects and diseases. Botrytis, anthracnose, powdery mildew, aphids, thrips, mites and clippers will be your primary pest problems at this time
- ✓ Remove old leaves and open plastic where any branch crowns might be growing underneath plastic
- ✓ Get pest problems under control with dormant, pre-bloom, pre-harvest and harvest sprays, customers don't like to see sprayers in the field when they are harvesting
- ✓ Make sure your irrigation systems for frost protection and drip are ready
- ✓ Monitor weather forecasts closely, frost protect as needed, start on a date that is typical for your area, any earlier may result deformed fruit and unnecessary loss of sleep
- ✓ Check your frost alarm to make sure that it is working properly
- ✓ Control weeds or ryegrass in aisles with herbicide if not done so already
- ✓ Apply straw mulch in aisles, if rye grass did not take
- ✓ Place 2 hives of honeybees/acre near your field
- ✓ Schedule picking and sales labor
- ✓ Order portable toilets and emphasize proper sanitation for farm labor and the public
- ✓ Get sales stand ready, tidy up, paint, make new signs, get new baskets…
- ✓ Check and organize supply inventory
- ✓ Clean out and fire-up refrigeration units
- ✓ Have scales checked by proper authorities in your state
- ✓ Harvest each plant 2x week (start early to mid April)
- ✓ Figure out a system to collect customer names etc for your mailing list
- ✓ Keep harvest records even when you are busy

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Editor and Contributor..... Tom Monaco

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