

Small Fruit News

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Clemson University
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University of Tennessee

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Research Reports

Chill Out! Effects of Winter Chilling on Rabbiteye Blueberry Bloom Time

D. Scott NeSmith
University of Georgia

Old man winter has visited the Southeast a little stronger and earlier this season it seems. But not to worry, all of this winter cold weather is actually good for stimulating bloom of blueberries in the upcoming spring. While many of our friends to the North may be concerned very little with the amount of “chill hours” they get during the winter (they get plenty), here in the Southeast it is actually very important.

Chill hours is a horticultural term used to describe the number of cold hours required for many fruit crops to bloom “normally”. The conventional method of calculating chill hours is to sum up the actual number of hours that temperatures are below 45 F. In Georgia, we typically declare the period from October 1 thru February 15 as the effective chill hour accumulation period. However, neither the temperature or the accumulation time are exact, they are simply general guidelines.

Varieties of fruit plants such as blueberries are typically classified by the number of chill hours they need in order to readily break bud and bloom. If a high chill cultivar is planted in a low chill environment, then spring bud break may be erratic and prolonged. This can lead to poor pollination, especially for rabbiteye blueberries. Likewise, if a low chill plant is grown in a high chill area, then it is very likely the plant will begin to bloom prematurely, which can lead to freeze damage to blooms and severe crop loss. Therefore, growers of blueberries in the Southeast need to be mindful of the chill requirements of the varieties blueberries they select.

Table 1 depicts the average number of chill hours received near Alapaha, GA during the past 5 years, along with bloom dates of 7 rabbiteye blueberry cultivars for each year. A few things can be derived from these observations. First, the varieties differ from each other in their bloom dates indicating they respond differently to the same amount of chilling received. For example, the 5 year average bloom date for ‘Climax’ is March 7, which is nearly 2 weeks early than the 5 year average bloom date for ‘Tifblue’ (March 23). This is due to ‘Climax’ having a lower chilling requirement than ‘Tifblue’. It is very important for growers to

Table 1. Chill hours and bloom dates during the past 5 years for several rabbiteye blueberry cultivars at the UGA Blueberry Research Farm near Alapaha, GA. Dates are estimates of 50% bloom and ripening.

Year	Chill hours ^{Z/}	Variety ^{y/}						
		Alapaha	Austin	Brightwell	Climax	Premier	Ochlockonee	Tifblue
1998	620	Mar. 15	Mar. 15	Mar. 26	Mar. 4	Mar. 8	Mar. 29	Mar. 28
1999	363	Mar. 23	Mar. 24	Mar. 29	Mar. 16	Mar. 28	April 4	Mar. 30
2000	697	Mar. 17	Mar. 17	Mar. 18	Mar. 8	Mar. 13	Mar. 24	Mar. 20
2001	916	Mar. 8	Mar. 6	Mar. 5	Mar. 1	Mar. 3	Mar. 14	Mar. 11
2002	574	Mar. 25	---	Mar. 25	Mar. 8	---	Mar. 31	Mar. 26
avg.	634	Mar. 18	Mar. 16	Mar. 21	Mar. 7	Mar. 13	Mar. 27	Mar. 23

^{Z/}Chill hours are hours below 45 F (7 C) for the period from October 1 thru February 15. Data were from the Tifton, GA weather station.

^{y/}Note that ‘Alapaha’ and ‘Ochlockonee’ are new releases from the University of Georgia.

recognize the differences in variety bloom dates and to plant a mixture of varieties that will bloom at a similar time. Overlapping bloom times are especially crucial for rabbiteye blueberry production since the species requires cross pollination for successful fruit set. So, for example ‘Tifblue’ would likely perform much better, in terms of fruit set, if planted with ‘Brightwell’ than if planted with ‘Climax’. Likewise, the new releases ‘Alapaha’ and ‘Austin’ have compatible bloom dates, indicating they would be good varieties to plant together. If a grower wants 3 varieties in a field, then it might be useful to plant a mix of ‘Alapaha’, ‘Brightwell’, and ‘Premier’ to provide the most overlap in bloom time.

Another important observation from the data in Table 1 is that bloom date differs from year-to-year for a given variety depending on the number of chill hours received that year. A good example of this can be seen for ‘Premier’ when looking at bloom date for 1999 (March 28) as compared to 2001 (March 3). Interestingly, in 1999, a near record low number of chill hours were received at this location, and in 2001, a

near record high number of chill hours were received. Therefore, these two years should represent the extremes for bloom dates for these varieties. Growers can use the multi-year bloom date data for a particular cultivar to assess risks of growing it in their region. For example, in the Alapaha, GA area, March 15 is generally considered a threshold date for having reduced risk of frost/freeze damage. So, in this area varieties that bloom after March 15 (i.e., Alapaha and Brightwell,) would be at less risk than those that bloom earlier (i.e., Climax and Premier). If growers still want to plant the risky varieties, then perhaps they can utilize sites less prone to frost damage (highest elevations in the field), or can use frost protection sprinklers on these selected varieties.

While we have yet to develop accurate, long-range weather forecast models, we can still use historical information such as these for some guidance in blueberry crop management. Also, one can examine current season chill hours-to-date to determine if their orchards are receiving adequate chilling. One could also have some general idea of when bloom time might occur

based on the chill hours received for the year (again this is not exact). In Georgia, up-to-date weather data is collected for more than 50 sites across the state by UGA's Georgia Automated Environmental Monitoring Network. This service can be accessed free of charge via the internet at <http://www.griffin.peachnet.edu/bae/>. The web page has a fruit crop chill hour summary for a quick look at areas around the state. Also, the web site has a chill-hour calculator for any of the weather station locations.

In summary, growers need to recognize that indeed it is difficult to do anything about the weather; however, this should not prevent us from being informed concerning the effects of year round weather on growth of crops. Understanding how climate influences growth and development of plants is paramount to being the best crop manager possible. Although it may appear little is going on in that orchard full of leafless plants during the winter, don't be fooled. Those plants are chilling out, getting prepared to bloom!

Concerning Sanitation to Manage Strawberry Fruit Rots

Frank Louws
NC State University

The fungus that causes gray mold (*Botrytis cinerea*) survives in annual strawberry fields primarily on green leaves. When an infected leaf dies, the fungus grows throughout the leaf and produces many spores. If strawberries are blooming during the time of grey mold spore production, the spores will infect the flower parts and this will lead to fruit rot. Up to 90% or more of all fruit rot occurs due to infection of the flower parts. Therefore, if the flowers can be protected from the pathogen, the amount of fruit rot will be less (this is why fungicide applications are recommended beginning at 10% bloom and this will be featured in a future article).

Some research in perennial production systems has shown that removal of dead and dying strawberry leaves before bloom can reduce the amount of gray mold during the season. In North Carolina and surrounding states, many growers will go through fields in late February and perform several activities including hand weeding of winter annuals, pulling plants from under the plastic, and pulling off dead leaf material. This is a costly exercise. What is the current research on the benefits of sanitation to manage gray mold?

In Florida, research demonstrated that leaf sanitation reduced gray mold from 12.6% to 8.2% during one year and had a minor effect other years compared to plots with no sanitation or fungicides. However, if a weekly fungicide program was combined with sanitation, then the removal of the dead and dying leaves had no impact on fruit rot incidence. There was no benefit from sanitation when a regular fungicide program is used. In Florida, sanitation also tended to decrease yields when combined with fungicides. The Florida work also demonstrated there was no advantage in removing berries with gray mold from the field.

We have done work with sanitation although not on a large scale. Any benefit from sanitation will be experienced over large areas and most of our work is in small plots. In our work, we have not seen a statistically significant decrease in disease or increase in yield when sanitation is used. (Yields tend to be low in these trials since these are often planted late i.e. after all fumigation trials are field set).

Year	Botrytis fruit rot (%)		Yield (lb/plant)	
	Control	Sanitation	Control	Sanitation
1998	28.6	29.1	0.54	0.72
2000	1.6	1.2	0.31	0.40
2001	1.3	1.7	1.16	1.18
2002a	1.7	0.9	0.62	0.48
2002b	0.8	0.5	0.55	0.52
Avg.	6.8	6.7	0.64	0.66

In 2002 we had a high level of anthracnose in all the plots. In one experiment (2002b), the anthracnose pathogen (*Colletotrichum acutatum*) was in all plots uniformly. In that experiment, anthracnose fruit rot levels were 17.5% in the untreated control and 19.3% in the sanitation plots. However, in experiment 2002a, the pathogen was not widespread and workers moved from one plot to the next. In this case, sanitation dramatically increased the amount of anthracnose from 3.7% in untreated plots to 14% in plots where workers hand removed leaves.

In summary, growers who use a conventional fungicide schedule will not benefit from sanitation practices. If anthracnose is present, as is the case for many growers this year, sanitation may aggravate the problem resulting in higher levels of disease.

Use of Cabrio™ in Strawberry Production

Frank Louws
NC State University

Cabrio EG is a new fungicide that has recently been registered by BASF on multiple crops including strawberries. Cabrio is interesting in that it has a wide spectrum of activity against plant pathogens. The active ingredient is pyraclostrobin (20%) which is a very similar chemistry as other strobilurin chemicals such as Quadris. Therefore, it is likely that if resistance develops to one, the resistance will be effective against the other also. Thus, in a fungicide management program, Cabrio and Quadris should be considered as the same class of fungicides and rotated (do not use either fungicide more than twice in a row before rotating to another class of chemicals). Cabrio is labeled for management of anthracnose, common leaf spot, and powdery mildew in strawberries.

Through the IR-4 program, we have conducted several trials with Cabrio and have recommendations of how Cabrio may fit into fungicide programs. Cabrio and Quadris have

similar activity against anthracnose and both have no or marginal activity against Botrytis (Tables 1 and 2).

Table 1: Efficacy of Cabrio to manage grey mold.

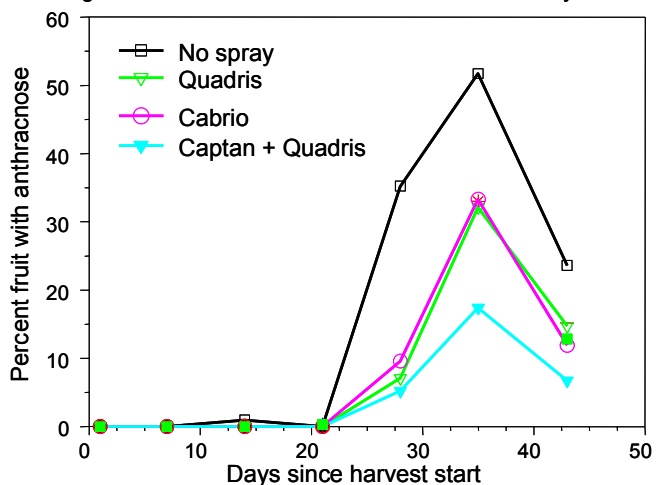
Year	Grey mold (%)		
	Cabrio	Quadris	No Spray
1999	3.7	2.6	2.8
2000	1.7	0.5	1.6

Table 2: Efficacy of Cabrio to manage anthracnose.

Year	Anthracnose (%)		
	Cabrio	Quadris	No Spray
1999	4.1	4.3	8.3
2000	0.0	0.0	1.5

Anthracnose levels can increase dramatically as the temperatures increase and if wet weather prevails. Figure 1 shows a dramatic increase of disease and highlights the similarity between Quadris and Cabrio. Both chemicals performed equally well and the best control was obtained with a tank mix of Captan + strobilurin.

Figure 1: Percent Fruit with Anthracnose Castle Hayne 1999



In summary, Cabrio will be an important tool for strawberry growers to manage anthracnose. It is similar to Quadris in efficacy and growers may choose either product with success. Refer to our tables of recommendations (strategy 1, 2 and 3) and simply include Cabrio or Quadris where anthracnose management is needed.

Pesticide Update

Benomyl Usage in Fruit Commodities

Guido Schnabel and Phil Brannen
Clemson University
University of Georgia

We have had questions regarding the legal, long-term use of existing stocks of BENOMYL. According to Joseph Nevola, Special Review and Reregistration Division of EPA, material which has already been purchased by producers can be utilized on all fruits through December 31, 2007. This means that we have several years before the product is no longer legal to use – good news in some fruit commodities.

Cabrio Fungicide Registered for Small Fruit

Cabrio has received full registration for fruit such as berries, cherry, and strawberries. For berries it is registered for leaf spots, powdery mildew, rusts and spur blight control (PHI = 0 days). It only has suppressive activity against grey mold, and Monilinia blight. In strawberries it is registered for Anthracnose, leaf spot, and powdery mildew control (PHI = 0 days). Cabrio is one of the strobilurin type fungicides (active ingredient is pyraclostrobin) with different mode of action than benomyl or the DMI fungicides.

Bramble Chores

Winter/Spring Bramble Chores

Gina Fernandez
NC State University

Please review the fall/winter bramble chores to make sure that you have completed all tasks for winter. Here is a brief summary of chores for the next few months to prepare your brambles for the upcoming growing season. If you have any questions give me a call.

Agricultural Chemical recommendations for North and South Carolina can be found at: <http://ipm.ncsu.edu/agchem/agchem.html>.
<http://cufan.clemson.edu/pmguide/>

PRUNING

Fall Bearing Raspberries. Fall bearing (actually mid to late summer for most of NC) raspberries fruit at the top of the current season's canes ("primocanes"). The simplest way to manage these varieties is to mow them off at ground level during the dormant season. Be sure to mow them off close to the ground so that new shoots come from the roots and not from lateral buds on cane stumps.

Blackberries and summer fruiting raspberries. These types of brambles bear fruit on second year canes. During the winter prune out the spent floricanes from the previous season. The remaining primocanes are thinned 3-4 / ft².

HERBICIDES

-Apply preemergent herbicide in spring if not applied in fall. There are several chemicals that are labeled for use in NC depending on age of plating and time of application, see your states agricultural chemical recommendations.

-Apply post emergent herbicides as needed. Be sure that the chemical you are using is labeled for bearing plants, many herbicides cannot be used beyond the first year.

INSECT AND DISEASE CONTROL

Prebloom. Apply liquid lime sulfur or Bordeaux for control of anthracnose in late winter or early spring before new buds are less than 1/2" long. Crown borers can be a problem in the early spring, as well as aphids, thrips, Japanese beetle, fruitworm, rose chafer, stink bugs and psyllids. Catch these early w/ a prebloom spray, see your states agricultural chemical manual.

Bloom. Double blossom (AKA rosette). Primocanes are infected in the spring or early summer, but disease symptoms are not evident until the following year when new growth begins on the fruiting canes. The best thing to do is to remove the infected floricanes to disrupt the

cycle. With the loss of Benlate, chemical control of double blossom with that compound is no longer possible. Botrytis: Apply fungicides at early bloom and repeat at full bloom.

-EPA has approved use of Savey 50DF for control of mites on caneberrries, including black and red raspberries and blackberries. The preharvest restrictions are 3 days for caneberrries (blackberries and raspberries). Please note that it is only effective on eggs. If you need a copy of the supplemental label, contact your Gowan distributor.

IRRIGATION

Plan for the irrigation season. Bramble plants need about 1"-2" water/week applied to the soil. We have found that overhead irrigation during fruiting prevents loss of fruit due to sunscald.

TRELLISES

Now is the time for trellis repair. Recent experience with ice storms in North Carolina has indicated that blackberries benefit from a sturdy trellis. Make sure posts are firmly in the ground and wires are securely attached to the posts.

FERTILIZER

Place nitrogenous fertilizers in row before new canes emerge in spring.

-*Raspberries*. Apply 500-800 lbs of 10-10-10 per acre in split applications. Apply half in Feb-March and the remainder in April-May. Spread uniformly across the row or side dress with half on each side of row in a 3-foot wide band.

-*Blackberries*. In established plantings apply 60 to 80 lb/acre N. Nitrogen can be applied in split or single applications. If using a split application, apply the first portion at bud break and the remainder just after harvest. Ammonium nitrate is the most common form of N used on blackberries. The incorporation of P and K should be based on soil test recommendations.

PLANTING

-*Get your plants*. Order plants from nurseries in late fall early winter to ensure that what you want is available. Bare root dormant nursery plants are usually available from November to

March. Be sure to get clean and healthy plants. New stock should be purchased from nurseries that have grown plants on fumigated land well isolated from other brambles, have been sprayed regularly for insect and disease control, are virus tested and have inspected by state officials. A list of nurseries is available at:

<http://www.smallfruits.org/Recent/miproc4.htm> this database has column headings that allow you to search the list by crop (blackberry, strawberry, blueberry ect), cultivar, nursery, state etc. This was up-to-date as of this summer. Contact the nursery for latest information on availability of plants.

-*Prepare land for spring planting*. The land should be plowed thoroughly before for planting. NC recommendations suggest that land preparation should be done in mid- to late-February in the coastal plain region and during March in the mountains. Fumigation is recommended to give newly set blackberry plants an advantage by killing most weed seeds and soil pathogens. Optimal row orientation is north - south to minimize sunscald on fruit.

-*Planting*. Early spring planting of dormant stock is best. If plants set late in the spring may be adversely affected by drought or drying winds. Make sure irrigation is available. Some nurseries sell erect blackberry root pieces as planting stock. These are usually cheaper but, you will need more root pieces to fill your row. Root cuttings should be placed 2 to 3 feet apart in a row. Tissue culture plants should be set after the last frost in spring.

From the Plant Problem Clinics...

Compiled by Margaret A. Williamson, Clemson University

Shown below is a summary of small fruit samples received between June - November, 2002 from the clinics in South Carolina (SC), North Carolina (NC), Georgia (GA) and Tennessee (TN)

HOST	DIAGNOSIS	CAUSAL ORGANISM	NUMBER OF OCCURENCES				
			SC	NC	GA	TN	
Blackberry	Anthracnose	<i>Glomerella cingulata</i>		1			
	Cane blight	<i>Coniothyrium diapleella</i>		1			
	Leaf spot	<i>Cercospora</i> sp.			1		
	Leaf spot	<i>Pestalotia</i> sp.			1		
	Leaf spot - bacterial	<i>Pseudomonas</i> sp.			1		
	Root rot	<i>Pythium</i> sp.			1		
		<i>Rhizoctonia</i> sp.					
	Stem canker	<i>Phoma</i> sp.			2		
		<i>Phomopsis</i> sp.			1		
	Stem lesion	<i>Colletotrichum</i> sp.			1	1	
Blueberry	White druplet	physiological			1		
	Canker/dieback	<i>Botryosphaeria</i> sp.	3	1			
		<i>Fusicoccum</i> sp.			1		
		<i>Phomopsis</i> sp.	1				
	Cold damage					1	
	Leaf spot	<i>Cercospora</i> sp.			1		
		<i>Phyllosticta</i> sp.			1		
	Root rot	<i>Phytophthora</i> sp.	1	2			
		<i>Pythium</i> sp.			3		
	Rooting problem	<i>Rhizoctonia</i> sp.			1		
Boysenberry	Stem lesion	<i>Cylindrocladium</i> sp.			1		
		<i>Gloeosporium</i> sp.			1		
Fig	Leaf spot	<i>Cercospora</i> sp.				1	
	Cold damage		1				
Grape	Anthracnose (Bird's eye rot)	<i>Elsinoe</i> sp./ <i>Gloeosporium</i> sp.			1		
	Black rot	<i>Guignardia bidwellii</i>	1	1	1	8	
	Coulure (excessive fruit drop)	physiological	1				
	Downy mildew	<i>Plasmopara viticola</i>		1	1		
	Leaf spot	<i>Phyllosticta</i> sp.			1		
		<i>Pseudocercospora</i> sp.			1		
	Pierce's disease	<i>Xylella fastidiosa</i>		1			
	White rot	<i>Coniella diplodiella</i>			2		
	Grape, Muscadine	Black rot	<i>Guignardia bidwellii</i>	1			
		Bitter rot	<i>Greeneria uvicola</i>	1			
Raspberry	Canker	<i>Coniothyrium fuckeli</i>		1			
	Cold damage		1			3	
	Leaf spot	<i>Septoria</i> sp.				1	
Strawberry	White druplet	physiological	1				
	Angular leaf spot	<i>Xanthomonas fragariae</i>		3			
	Anthracnose	<i>Colletotrichum acutatum</i>		27			
	Anthracnose	<i>C. gloeosporioides</i>	1	6			
	Anthracnose crown rot	<i>Colletotrichum</i> sp.	1	6		3	
	Botrytis blight	<i>Botrytis cinerea</i>				3	
	Botrytis crown rot	<i>Botrytis cinerea</i>				1	
	Cold damage					2	

HOST	DIAGNOSIS	CAUSAL ORGANISM	NUMBER OF OCCURENCES			
			SC	NC	GA	TN
Strawberry (cont.)	Fruit rot	<i>Botryosphaeria</i> sp.	1			
	Fusarium surface rot	<i>Fusarium solani</i>		1		
	Leaf spot	<i>Mycosphaerella</i> sp.		2		3
		<i>Cladosporium</i> sp.			1	
	Leaf spot/blight	<i>Phomopsis</i> sp.	1	1	1	
		<i>Phoma</i> sp.		1		
	Petiole lesion	<i>Rhizoctonia</i> sp.			1	
	Powdery mildew	<i>Oidium</i> sp.		3	1	
	Phytophthora crown rot	<i>Phytophthora cactorum</i>		4		
		<i>Phytophthora</i> sp.		1		1
	Root rot	<i>Pythium</i> sp.		1	1	
		<i>Rhizoctonia</i> sp.		2		
	Root and stem rot	<i>Rhizoctonia</i> sp.				1
	Slime mold	<i>Physarum</i> sp.			1	
Southern blight	<i>Sclerotium rolfsii</i>		1			

Focus

Small Fruit News Favorites

Compiled by Guido Schnabel
Clemson University

New Southern Highbush cultivars for 2003, by Susan Rooks and Jim Ballington, Horticultural Science, NCSU, North Carolina Blueberry News, Vol 7, No. 4, Nov. 2002

New Blueberry cultivars for warm climates, by Daniel P. Hartman, Northland Berry News, fall 2002

A brief summary of health benefits from berries, by Sandy Kuhn, Northland Berry News, fall 2002

Profitable organic strawberry production, by Thaddeus McCamant, Northland Berry News, fall 2002

Order your blueberry pruning video via phone at (800) 561-6719 from Oregon State University

Planting blueberries on raised beds can be an economical alternative to growing on flat soil

with tile drainage, by Laura Elia, Fruit Grower Nov/Dec 2002.

To request a copy of one (or more) of the above articles contact Guido Schnabel at schnabe@clermson.edu or call 864 656 6705. Don't forget to indicate which article you would like.

Meetings

January, 9-12, 2003 Wine Grape Conference as part of the Georgia Fruit and Vegetable Growers Association Annual Conference, Savannah, GA. Contact Charles Hall 877-994-3842.

January, 9-12, 2003 SE Blueberry Conference as part of the Georgia Fruit and Vegetable Growers Association Annual Conference, Savannah, GA. Contact Charles Hall 877-994-3842.

January, 9-12, 2003 Strawberry Conference as part of the Georgia Fruit and Vegetable Growers Association Annual Conference, Savannah, GA. Contact Charles Hall 877-994-3842.

January, 9-12, 2003 Muscadine Conference as part of the Georgia Fruit and Vegetable Growers Association Annual Conference, Savannah, GA. Contact Charles Hall 877-994-3842.

January 25-29, 2003 NABGA International meeting in Puerto Vallarta, Mexico. See website www.nabga.com for details.

February, 3-10, 2003 North America Farmers Direct Marketing Association Conference, Charlotte, NC. Call 888-884-9270; www.nafdma.com.

February, 7-8, 2003 NABGA regional Mid-Atlantic meeting in Leesburg Virginia. The meeting will be held at the Holiday Inn at the Historic Carradoc Hall. Contact Jason Murray at jamurray@vt.edu or call 703-737-8978.

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Editor and Contributor.....**Guido Schnabel**

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