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Small Fruit News

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Special Reports:

Blackberry Breeder John Clark Receives NARBA'S Distinguished Service Award

Debby Wechsler, Executive Secretary, NARBA

At its annual meeting on January 16, 2012 the North American Raspberry & Blackberry Association (NARBA) presented Dr. John R. Clark, University of Arkansas Professor of Horticulture , with its Distinguished Service Award. The award especially honors Dr. Clark's work as a breeder of many of the leading blackberry varieties grown today, including new primocane fruiting types which have the potential to greatly increase both the harvest window for blackberries and the geographic range for commercial production. Blackberry varieties developed by Dr. Clark include Ouachita, Natchez, Navajo, Apache, Kiowa, Arapaho, Choctaw, and the primocane varieties, Prime Jim and Prime Jan, and PrimeArk 45. His recent releases of Natchez and Ouachita have been widely planted in the eastern U.S., California, and around the world.

Making the award was grower Nathan Milburn of Milburn Orchards, Elkton, Maryland, incoming president of NARBA. Said Milburn, "We know John most as a breeder of blackberries and a friend of NARBA. He is a frequent contributor to the NARBA newsletter and has been a presenter at many NARBA conferences. He has spoken in support of NARBA's blackberry Research and Promotion Program initiative, and helps culture the visionary and collaborative attitudes that will be necessary for its success."

NARBA is a membership organization of blackberry/raspberry growers, researchers, and others with members in more than 35 states, 8 Canadian provinces, and 5 countries. NARBA's annual meeting and conference were held in Sandusky, Ohio, in association with the Ohio Produce Growers and Marketers Association Congress. Previous winners of this Distinguished Service award include grower Ervin Lineberger, Kings Mountain, NC (2010) and Dr. Marvin Pritts, Cornell University (2011). For more information about NARBA, visit www.raspberryblackberry.com.

Photo 1: left: Nate Nourse, Nourse Farms, NARBA 2011 president; center: Dr. John R. Clark; right: Nathan Milburn, Milburn Orchards, NARBA 2012 president. Photo by Deborah S. Wechsler

Photo 2: John R. Clark with priomocane-fruiting Prime-Ark 45 in Watsonville, CA, October 2011, photo by Ellen Thompson.

Southern Region Small Fruit Consortium Awards $91,393 in Grants for 2012

Tom Monaco, Coordinator, SRSFC

The Steering Committee of the Southern Region Small Fruit Consortium (SRSFC) awarded $91,393 in research and extension grants at their annual meeting held January 2012 in Savannah, GA.

Fourteen research proposals and seven extension proposals were submitted to the SRSFC. Fourteen research proposals totaling $68,945 were funded and four extension proposals for a total of $17,948 were funded. Also $4,500 was awarded to the extension efforts in updating the IPM/Production Guides.

The IR4 Performance program added a half match to three of the research proposals which added $7,000 in additional funding so the total amount invested in research for 2012 was $75,945.

Research projects funded for 2012 include:

SRSFC 2012-01 Exobasidium leaf and fruit spot development in southeastern environments and development of initial management strategies with fungicides. Brannen, Scherm, Cline $5,000

SRSFC 2012-02 Determination of Flower Type and Other Traits in Muscadine Grape Using Molecular Markers. Clark, Owens $5,000

SRSFC 2012-03 Occurrence and distribution of resistance to Elevate and Switch in populations of Botrytis cincerea from strawberries in the Carolinas. Schnabel, Fernandez-Ortuno $5,000

SRSFC 2012-04 Integrated management of blueberry (Vaccinium spp.) replant disease associated with ring nematodes (Mesocriconema spp.). Noe, Brannen, Jagdale $4,000

SRSFC 2012-05 Refining the use of fruit abscission agents in muscadine grapes. Malladi, Conner $5,000

SRSFC 2012-06 Potential impacts of within- and among-species genetic diversity of blueberry pollinators . Tarpy, Burrack $5,000

SRSFC 2012-07 How Far has Xylella fastidiosa Advanced in Field-Grown Southern Highbush Blueberry Plants with Different Levels of Bacterial Leaf Scorch Severity? Scherm $5,000

SRSFC 2012-08 Determining Optimum Date for Foliar Sampling of Primocane-Fruiting Blackberry in the Mid-South- Year 2. Garcia $4,969

SRSFC 2012-09 Visual and chemical cues attracting rednecked cane borer to primocanes. Johnson $4,996

SRSFC 2012-10 Color Reversion in Fresh Market Blackberries. Perkin-Veazie, Fernandez $4,980

SRSFC 2012-11 Understanding blueberry mosaic disease. Tzanetakis, Garcia $5,000

SRSFC 2012-12 Vegetation-free Strip Width in Young Blackberry. Meyers, Mitchem, Jennings, Monks $5,000

SRSFC 2012-13 Evaluation of Fusarium crown rot of strawberry. Louws $5,000

SRSFC 2012-14 Can we use long cane raspberries to advance the season of raspberry production in the southern United States? Fernandez, Perkins-Veazie $5,000

Extension projects funded for 2012 include:

2012 E-01 Balanced Pruning in Muscadine Grapes. Poling, Spayd $5,000

2012 E-02 Development of a web-based grape and apple disease risk assessment system. Nita, Yoder, Sforza, Knight $5,000

2012 E-03 Fresh Market Muscadine Guide. Spayd, Perkins-Veazie, Cline $2,948

2012 E-04 Nitrogen Fertilization Strategies for Blackberry. Lockwood $5,000

Grape Growers Should be Prepared

Sara E. Spayd, Extension Viticulture Specialist
Department of Horticultural Science
NC State University

Winter 2011-12 has to date been very mild. Many of the same ornamental plant species around the

NCSU campus that were in bloom in January 2007 were in bloom January 2012. Hopefully, March will not playout is 2007 did with high temperatures in the upper 70's and into the 80's for three weeks. With this in mind, there are a couple of issues for which all grape growers should prepare (if possible): 1) potential for spring cold injury and 2) Pierce's disease management.

Sap flow was reported in second leaf Cabernet Sauvingnon the second week of February – too, too early. Sap flow is going strong now in early March. If growers intend to double prune, the second pruning should be delayed as long as feasible. The terminal one or two buds should break before the more basal buds (the ones that should be left at the second pruning operation). At this point the vine has not put a lot of energy into vine growth – even if the terminal buds break and grow a bit. The more basal buds will break once the terminal buds (shoots) are removed. This delay in pruning should get the base buds past a "normal" frost event. However, should an arctic cold front descend as occurred in 2007, there is nothing that will prevent bud injury and likely wood injury.

In most growing areas, winter temperatures have not been sufficiently low enough to reduce the load of *Xylella fastidiosa*, causal organism of Pierce's disease, in vine tissues. Control of vectors for Pierce's disease will be critical this summer to limit the spread of *X. fastidiosa* from vine to vine within the vineyard. Any affected vines should be removed from the vineyard to reduce the potential for further spread.

Now is a good time to plan you pesticide program for the coming season. Review the spray recommendations in the NC Agricultural Chemicals guide and plan out a schedule for applications. However, do not become so fixed on your early schedule that you ignore the growing season weather. Be prepared to revise your schedule as the season unfurls. Last year a number of folks were caught off guard by the heavy downy mildew pressure in May.

Beware of Bermudagrass and Johnsongrass

Wayne Mitchem
Extension Associate, Orchard and Vineyard Weed Management
NC State University, Clemson University, University of Georgia

The warmer than normal winter has fruit crops ahead of schedule, as well as, weeds. I have noticed (March 20th at the time of writing) bermudagrass and Johnsongrass beginning to green up and emerge from their winter sleep in western North Carolina and by the time this is published you need to be ready to deal with these perennial grasses.

Bermudagrass is very competitive and will reduce the growth of young plants as well as fruit yields in mature plantings of grape, blueberry, and caneberry crops. In caneberries the effect could not only impact this year's crop but next year's as well if competition is allowed to reduce primocane emergence. Johnsongrass can be competitive as well. Left uncontrolled and allowed to grow through the crop canopy, Johnsongrass will interfere with berry harvest.

Growers have options to control these perennial grasses, however they are not silver bullets. Poast, Fusilade DX, or clethodim (Select, SelectMax, Intensity One, Volunteer, etc.) are registered for use in fruit crops (**See Table 1**.) to control annual and perennial grasses. Poast can be used in bearing blueberry, caneberry, and grape plantings as well as newly planted fruit crops. Fusilade DX can be used in non-bearing blueberry and caneberry plantings as well as bearing vineyards. With the exception of Select Max, all clethodim products can be applied in non-bearing fruit crops **ONLY**. A supplemental label allows Select Max to be used in bearing blueberry and caneberry plantings but **ONLY** Select Max. **Always to refer to the label for directions pertaining to the use of appropriate spray additives**. Without crop oil or a non-ionic surfactant these herbicides will not perform to their full potential.

Table 1. Herbicide Use Rate and Crop Age Restrictions.

Herbicide	Rate	Blueberry	Caneberry	Grape
Poast	1 to 2.5 pt A^{-1}	30 day PHI	45 day PHI	50 day PHI
Clethodim	Rate varies with formulation	Non-bearing	Non-bearing	Non-bearing
Select Max (clethodim)	12 to 16 oz A^{-1}	14 day PHI	7 day PHI	Non-bearing
Fusilade	8 to 24 oz A^{-1}	Non-bearing	Non-bearing	50 Day PHI

Refer to product label for spray additive recommendations.

Successful use of graminicides (Poast, Fusilade DX, clethodim) depends on several factors however the most critical is application timing relative to weed growth stage. Application timing varies with grass species and somewhat with the herbicide choice which is outlined in **Table 2**. Additional factors influencing the performance of these herbicides on perennial grasses include spray volume and soil moisture. Graminicides are systemic herbicides, they enter the plant and move through the vascular system to their targeted site of action. Systemic herbicides need to be applied in spray volumes that do not exceed 25 gal. of spray solution per acre. Higher volumes dilute the herbicide and may reduce their effectiveness. Weeds free of stress (drought, etc.) also respond best to systemic herbicides because the herbicide moves into plant and through its vascular system more readily. All of these herbicides require a second application for them to be effective. It is important that the second application be timed appropriately and when the plant has regrown from the initial herbicide application. The time between the first and second application can vary depending upon environmental conditions so this requires monitoring in order to get the second application applied timely.

Table 2. Appropriate Application Time for Perennial Grass Control

Herbicide	Bermudagrass		Johnsongrass	
	1st Application	2nd Application	1st Application	2nd Application
Poast	6 inches	4 inches	25 inches	12 inches
Clethodim	3-6 inches	3-6 inches	12-24 inches	6-18 inches
Fusilade	4-8 inches	4-8 inches	8-16 inches	6-12 inches
Refer to product label for spray additive recommendations.				

If you have questions regarding the use of these products in fruit crops contact your local agent with Cooperative Extension Service. Complete herbicides labels and supplemental labels can be viewed online at www.cdms.net if you desire to obtain more information before choosing a herbicide.

Blueberry Replant Disease Associated with Nematodes

Phil Brannen, Extension Plant Pathologist
Jim Noe, Nematologist
Ganpatti Jagdale, Nematologist and Nematode Diagnostics Coordinator

Blueberry production in Georgia has a farm gate value in excess of $100 million dollars and accounts for almost one-third of the total fruit and nut crop value for the state. Most of this production is centered in southeastern Georgia. Commercial blueberry acreage has increased dramatically over recent years, and at the same time, older farms are being replanted. A slow decline in plant vigor and an associated replant disease (also termed replant disorder in many references) has been observed on a number of blueberry farms in this area of Georgia. This observation led us to investigate possible causes of this condition.

Replant disease is generally reported in many fruit commodities, and it occurs when a second planting of the same commodity quickly follows the first. The poor growth of the new planting results from a buildup of plant pathogenic microbes during the previous planting cycle. In the first planting, these organisms slowly increase in population densities as the plants mature and may cause no or limited symptoms, as a mature plant may be tolerant. However, a new immature transplant will not develop well in the presence of these pathogens that are left in the soil upon removal of the first planting. Pre-plant soil fumigation, essentially killing most living organisms in the soil prior to establishment, is one means of overcoming replant disease.

In Georgia, two initial fumigation trials, established with county agents at on-farm sites, showed clear benefits of fumigation in replant situations. Soil assays indicated that a plant-parasitic nematode, previously unreported on blueberry, was found in association with blueberry roots showing diseased replant disorder symptoms. Nematodes are among the predominant organisms that can cause replant disorder. Plant-parasitic nematodes are microscopic, soil-inhabiting, have a worm-like shape, and attack plant roots directly with their sharp stylets. It was determined that the nematodes found on blueberry in Georgia were in a group called ring nematodes. Ring nematodes were collected from infested grower fields and applied to greenhouse pots and field microplots.

In these more controlled experiments, it was further demonstrated that blueberry is a host for ring nematodes, and that the nematodes reduce plant vigor.

The two on-farm preliminary experiments were established in June, 2008, where randomized plots of replanted blueberry were pre-treated with nematicidal soil fumigants. In these experiments, ring nematode numbers and plant vigor were determined and compared to untreated control plots. Positive results were observed both for Telone II (1-3 dichloropropene), which controls primarily nematodes, and methyl bromide/chloropicrin, which is a biocide and may also control other pathogenic organisms. A follow-up assessment was performed for the experiment in Homerville, GA in June 2010. Two years after initial treatment and planting, ring nematode numbers were still lower, and plant vigor was higher for all the fumigant treatments as compared to the untreated controls (Fig. 1). It should also be noted that the ring nematode populations were increasing in the treated plots as well. Blueberry yields and ring nematode population levels were subsequently determined in June 2011 for plots treated with methyl bromide and for the untreated control plots. Three years after planting, blueberry yield per plant was 300% greater in plots treated with methyl bromide/chloropicrin, as compared to the untreated control (Fig. 2). Ring nematode population levels were 61% lower in plots treated with methyl bromide/chloropicrin, as compared to untreated controls. However, ring nematode population densities had built up to more than 300/ 100 cm^3 soil in the fumigated plots over the three years. This density of nematodes is potentially damaging to blueberry, and the populations will continue to increase every year. It is apparent that soil fumigation offers only a temporary reduction in ring nematode population densities. It remains to be determined how long the higher productivity of treated blueberry plants will be extended.

Though plant parasitic nematodes have been commonly found in association with blueberries, they have traditionally been thought of as causing no or limited damage to blueberries, possibly the equivalent of an “urban legend,” assumed to be true because it was passed down from generation to generation without real evidence. It is difficult to explain why the research community largely ignored nematodes on blueberry, but initial data was not consistent, and the consensus opinion within the last 50 years was that they did not cause an issue. In Georgia, there was no reason to suspect that nematodes were capable of causing problems on blueberry, since the problem was not detectable until the industry matured to the point where farms were being replanted. In retrospect, there was clearly information which would have indicated a potential problem. As early as 1962, Zuckerman demonstrated that a nematode species on northern highbush significantly decreased root growth of small cuttings, but this type of evidence was largely ignored till recently.

In 2010, after establishing that ring nematodes were associated with blueberry replant disease, a survey was conducted of plant-parasitic nematodes infesting commercial blueberry fields in Georgia. Soil assays were conducted in June and November. Remarkably, 48% of the blueberry farms sampled in Georgia were infested with ring nematodes in the June sampling, and the percentage of farms with ring nematodes had increased to 52% by November 2010. For the blueberry survey sample areas that had ring nematodes present in the June survey, the mean nematode population density was 290/ 100 cm^3 soil, and had increased to 400/ 100 cm^3 soil in the November samples, for a 36% overall increase in ring nematode counts. The damage threshold for ring on blueberry is not known, but for the closest situation for comparison, short-life of peach, the damage threshold is 1 nematode/ 100cm^3 soil. This means that if the nematode is present at any density, the grower can expect crop losses to occur. This is not an unlikely scenario for blueberry, because like peach, the crop is grown over a period of many years. If any nematodes are present that are parasitic on blueberry, they will eventually increase to damaging levels. Due to the widespread distribution of ring nematodes in blueberry, and the demonstrated pathogenicity of this species, blueberry replant disease could become a major limitation to continued production on existing farms.

Many researchers and extension scientists are now starting to review the damage caused by nematodes, and though the consensus opinion is that nematodes are important, the nematodes found vary from region to region – likely soil type and environment related variation. A companion survey (conducted at the same time as the Georgia survey) of nematodes in North Carolina indicated a totally different spectrum of parasitic nematodes in association with blueberries; among the prevalent North Carolina nematodes was the awl nematode, whereas the ring nematode was virtually nonexistent. In New Jersey, a recent

survey of commercial blueberry fields showed that three nematodes, stubby-root, sheath, and stunt, were predominantly associated with blueberries. About 40% of the samples had stubby-root and sheath nematode counts above published action thresholds (Oudemans, unpublished).

The economic impact of blueberry replant disease could be devastating to growers establishing new plantings. The estimated cost of establishing and maintaining blueberry is $9,500 per acre per year. For the critical first 4 years, this is a total investment of $38,000 per acre. If the farm is infested with ring nematodes, as 52% of the fields sampled in Georgia were, then the grower could lose the entire investment at about the time that the blueberries would normally be coming into production. It is possible to delay the onset of blueberry replant disease by application of soil fumigants, with considerable additional cost, but eventually the ring nematode will come back, and plant vigor will suffer, thus shortening the life of the planting. At this time there is no post-plant nematode control method available for blueberry. A post-plant control would allow the grower to recover from undetected infestations of ring nematode, and help to maintain healthy plant vigor throughout the expected life of the planting. We are currently evaluating pre-plant soil treatments in combination with foliar-applied post-plant nematicides. A post-plant treatment is definitely desired, and we hope to have one available within the next few years.

Recently, new research plots were established on an additional 2 farms to further test pre-plant fumigant nematicides and soil solarization. Treatments including Telone II, methyl bromide/chloropicrin, and use of soil solarization as well. For soil solarization, beds were formed several months ahead of the late fall planting timeframe, and thick, clear plastic was utilized to seal the beds; the heat of the summer sun raised the temperatures to levels that killed many organisms in the soil, including nematodes. Initial results from these studies have indicated that fumigants lowered the ring nematode counts to nearly zero, whereas soil solarization alone reduced the nematode counts by more than 50% prior to the application of fumigants in late August (Table 1).

Based on the synopsis of several trials in Georgia, soil fumigation with either methyl bromide/chloropicrin or Telone II dramatically reduces population densities of ring nematodes. Both a 15 and 30 GPA rate of Telone II was extremely effective. Soil solarization alone, a tactic that could be used by organic growers, reduced the ring nematode counts to moderate levels, but this reduction may not be sufficient to protect the plants from subsequent damage. However, it is expected that the nematode populations will rebound in all of the treatments after planting. It will be several years before the long-term success of the soil fumigation and solarization treatments can be determined from our current research trials.

Plant resistance is the cornerstone for any integrated program for controlling plant-parasitic nematodes. Nematode-resistant cultivars have yet to be identified in blueberry, and research is needed to clearly identify sources of resistance. Greenhouse trials conducted in Oregon demonstrated that blueberry cultivars differ in their host status to stubby root nematode (Zasada, unpublished). Microplot studies in Canada further demonstrated the significant impact of stubby root nematode on blueberry establishment (Forge, unpublished). Stubby root population densities increased 10-fold on the highbush blueberry cultivar ‘Cherokee’ 15 months after planting. Two years later, inoculated plants had 31% less canopy volume and 34% lower yield than control plants – yet another indicator of the potential importance of nematodes in blueberry production.

Obviously, we have some catching up to do on the nematode and replant disease front. Research is ongoing in Georgia and the rest of the nation to determine the extent of the nematode problem under replant conditions and otherwise. To date, we do not recommend fumigation in Georgia where blueberries are planted to “new ground” after pine plantations have been removed for establishment; numerous lab samples have shown very low nematode numbers following pine. However, in other locations or following other commodities, we do not know whether nematodes would transfer and cause issues with blueberry production. Even under ideal conditions, post-plant nematicides may become important, especially for some varieties. All of this remains to be determined, but for now, fumigation should be considered for blueberry replant scenarios in order to prevent or suppress replant disease.

References:

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Figure 1. Blueberry on a replant disease site treated with methyl bromide (left) and untreated control (right).

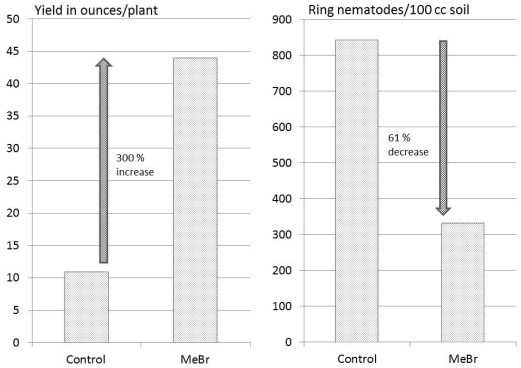


Figure 2. Blueberry yield and ring nematode population densities in plots treated with methyl bromide (MeBr) and untreated control plots. Plots were treated in June 2008, and data were collected in June 2011.

Table 1. Effects of soil fumigation and solarization on Ring nematode population densities. Combined data from two blueberry replant sites in Appling and Bacon County, Georgia.

	Ring nematodes per 100 cm^3 soil			
Treatment	Pre-treatment		Post-treatment	
Methyl bromide/ Cloropicrin (400 lbs/ acre)	498	a*	3	c
Telone II (10 gal/ acre)	453	a	6	c
Telone II (30 gal/ acre)	444	a	0	c
Soil solarization (77 days pre-fumigation)	177	b	140	b
Untreated** (with plastic cover)	411	a	238	a
Untreated (no plastic)	487	a	203	a

* Means within columns followed by the same letter are not significantly different (P<0.05). N=24 replicate plots.

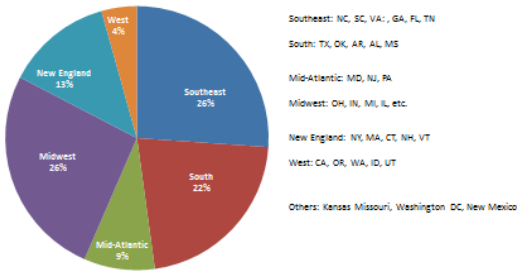
**Ring nematode counts decreased after treatments were applied in the untreated plots due to cultivation, soil mixing, and the length of time with no host present for the nematodes to feed on.

A Few Comments on a Recent Local-Market Survey of North American Raspberry and Blackberry Growers Association (NARBA) Members

John R. Clark, University of Arkansas
Debby Wechsler, NARBA

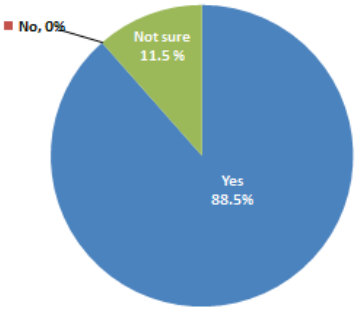
In late 2011, as I (JRC) was beginning to prepare for several presentations on blackberry marketing at grower meetings in the eastern US, Debby and I decided to conduct an informal survey of NARBA members who grow blackberries to get an idea how local market production and marketing was going. We posed a few questions in an on-line system for blackberry growers to respond. This worked out well, and although the response was a very small sample of growers of blackberries for local markets, we thought it appropriate to share responses in presentations and in this newsletter article. ***Many thanks to the members that responded!***

Where is your farm located?



It is clear that Southern growers were represented in greatest numbers among respondents. This likely is a result of higher number of local-market producers in the region that are NARBA members.

Question 1: Have your local (non-shipping) blackberry sales and consumer demands grown in the last 1 to 5 years?

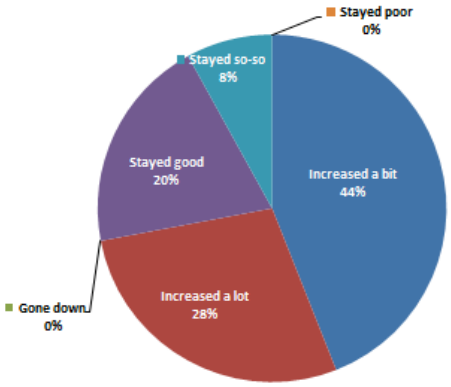


Comments included:

- *"Was the best gamble I ever took planting blackberries; the public loves them."*
- *"We can't grow enough ---but you know it is a lot of work to grow blackberries --- and it has to be done during the hottest time of the year."*
- *"We cannot keep up with the demand."*
- *"Demand has grown with folks learning more about the health benefits of blackberries and we offer no spray on any of our berries."*

The responses were very encouraging for blackberry sales. Why so encouraging? It is difficult to say for sure, but more than likely more customers are finding out about good-tasting blackberries that are available from local producers. Components that contributed to this are improved varieties that are larger, sweeter and usually thornless along with expanded interest in health benefits of blackberries.

Question 2: Has profitability increased in the last 1 to 5 years?



Comments included:

- *"Young families are finding their way to our local Farmers Market when buying blackberries as they are finding fresh-picked blackberries taste a whole lot better than the store- bought berries that were picked 1-2 weeks prior. In addition, knowing they were locally grown also helps our sales efforts."*
- *2009's crop was the best–selling; 2010 was way down because of flood/drought. 2011*
  Rebounded; this makes me optimistic about the coming years."

This is probably the most important question to ask and get positive answers for. For someone that works in variety development, with variety choice being one of the key areas that come into play in blackberry production and marketing, it is very exciting to hear of grower success.

Question 3: "Has the increased availability of blackberries in retail grocery store markets helped or damaged your blackberry sales in the last 1 to 5 years?"

- *In general, there is no clear consensus on if retail berry availability has helped or hurt local sales.*
- *Comments included:*
  - *"After tasting the berries in the store our customers definitely prefer our pre-picked blackberries as they are always picked within 12 hours of sale."*

- *"It has damaged direct sales - we have to give more away as free samples to win them back."*
- *"More blackberries in supermarkets have helped my sales by offering the public at-large more buying opportunities and enabling my customers to see how much better a fresh and fully ripe berry is that one shipped from Mexico or elsewhere."*

We asked this question because it has been mentioned that having blackberries in the grocery stores might expand consumers' awareness or desire to buy blackberries in local markets. That does not appear to be the situation, however. From the limited responses, the main benefit of supermarket berries to local growers is to highlight the locally grown quality and flavor.

Question 4: "What are the greatest limitations in local fresh marketing of blackberries at your location?"

- *Weather was commonly mentioned; in the Northeast/Midwest, winter damage is still limiting.*
- *Inadequate supply of fruit was often cited.*
- *Improved varieties needed was cited occasionally.*
- *Insects and diseases were occasionally mentioned.*
- *Limitations such as local economy/income levels, population base, remote location, labor, refrigeration, and start-up costs were also mentioned.*

So, what does this survey, and other comments I hear, indicate? Local markets sure look good with a promising future to expand marketing periods and quality for blackberries. Ideas and thoughts related to this include:

- Locavore movement and health angle are valuable in marketing to consumers
- Farmers markets expanding in number along with increased sales of blackberries in these markets expansion
- Potential organic production (one of the few fruit crops this is possible for in the East)
- Local markets are really able to maximize use of improved varieties – for example, Triple Crown (which is too soft for shipping) and the high quality shipping varieties.

What about limits to blackberry production? What are some factors that are common?

- Population, competition (too many berries produced for the area population)
- Marketing season can be short
- Adapted varieties, with hardiness a key limitation for Midwest and Northeast, where cold is a major issue

Some of these limitations are difficult to address, such as population and competition are difficult to change, although practices such as increased advertising, increased farm appeal, and attractive pricing address these issues. Growers can expand their local marketing through a wide range of options: PYO and retail market stands, selling at multiple farmers markets, selling to local stores and coops, and community-supported agriculture (CSAs). None of these markets will move the same quantities as easily as wholesale markets, and they take more work, but they can provide higher prices somewhat insulated from extreme lows that occur in the wholesale market.

Marketing season is one area with some potential to expand. The use of high tunnels might be considered to both bring the crop forward for earlier ripening, and with primocane fruiting, extend the season later. Variety diversification continues to grow as a marketing season expansion, particularly with the advent of primocane-fruiting blackberries and the potential fall marketing season that has not been possible before in many areas of the US. However, this blackberry type has been more challenging to grow in the South than in areas with more moderate summer temperature.

This is an exciting time for local marketing of blackberries!

Blueberry Industry: A History of the Relationships Between Growers, the Extension Service, and the Agricultural Research Service

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North Carolina StateUniversity
November 20, 2011

There are few fruits native to North America. Among these are the blueberry, blackberry, cranberry, pawpaw, persimmon, and grape (Cline, 2011). The ancestor of the modern day blueberry originated over 100,000 years ago and was a favorite food of birds and mammals; in more recent history they were used by Native Americans in the dried form for food and for dye making (Sciarappa, 2005). Since cultivation of the blueberry in New England in the early 1900s, production has increased to all corners of the contiguous United States.

In 2010, there were more than 416 million pounds of cultivated blueberries grown in the United States, of which, 39 million were grown in North Carolina on about 5,500 acres of land (Noncitrus Fruits and Nuts 2010 Summary, 2011). Translating that into dollar value, in 2010, the cultivated blueberry industry generated over $593 million nationwide and $58 million in the state of North Carolina. North Carolina ranks 6th in total dollar receipts generated from cultivated blueberries. Michigan, Georgia, California, Oregon, and New Jersey have larger returns (Noncitrus Fruits and Nuts 2010 Summary, 2011). California has just recently entered the blueberry market in a major way. They have nearly doubled production in the last 2 years and are expected to continue to generate higher volume over the foreseeable future (Noncitrus Fruits and Nuts 2010 Summary, 2011). How did we get to this level of cultivated blueberry production? The answer to that question lies in the relationships the blueberry industry has built with cooperative extension, agricultural research, and the United States Department of Agriculture. The blueberry industry and the extension service have origins in the same decade. As both grew in knowledge and importance on the local and national scale, they formed relationships that have lasted nearly a century.

In 1914 the federal government passed the Smith-Lever Act, which provided $10,000 to each state to fund agricultural extension programs (Smith Lever Act May 8, 1914, 2011). County agents were hired around the nation, and land-grant colleges created official extension services to coordinate their activities in disseminating information to the public. Extension took some of the burden off overworked researchers in experiment stations who had been doing both the experimenting and the demonstrating (Griffith, 2008).

In an interview with Dr. Charles 'Mike' Mainland conducted on November 15, 2011, he provided an oral history of the blueberry industry and its association with research and extension. Though not an exhaustive account of the history, he was able to put into context some of the older writings about the blueberry industry and its research and he provided information that is not otherwise available in the written records of the industry.

Dr. Mainland has a long and distinguished career working closely with the blueberry industry. "During the [second world] war Mike's father read a Life Magazine story about a fantastic new crop that had been developed in New Jersey and was being tried in Michigan and North Carolina. This exotic crop was the highbush blueberry. After he was discharged from the service, Mr. Mainland purchased land and plants, and in 1947 Mike was introduced to the world of blueberries (The Hort Report, 1994)." Dr. Mainland started his association with blueberries as a member of his family's farm in Indiana.

He strengthened his ties to the industry by studying horticulture at Purdue University where he received his bachelors and masters degrees. His master's thesis showed the results of his research on the response of blueberry plants to nitrate and ammonium nitrogen (The Hort Report, 1994). He moved from there to Rutgers University where he worked under the direction of Paul Eck, completing his doctoral research in 1968 (McCallum, 1996). His PhD research showed that gibberellic acid could induce fruit set in highbush blueberries, and that it had commercial possibilities (The Hort Report, 1994).

In 1968, Dr. Mainland accepted an Extension Specialist position with North Carolina State University at the Castle Hayne Horticultural Crops Research Station (The Hort Report, 1994). Through his 26 years of work with the blueberry industry in this position, Dr. Mainland has become internationally known as an expert in blueberry culture (McCallum, 1996). His applied research projects have encompassed the propagation,

pruning, irrigation, soil requirements, mechanization and fruit quality of blueberries (The Hort Report, 1994). Many growers in North Carolina credit Dr. Mainland with their success in blueberry farming, myself included. "His expertise and polite, patient manner have made him a cornerstone of the industry and a much sought after source of hard information in the rapidly expanding blueberry producing areas of the southeastern United States (McCallum, 1996)." With 64 years of association with blueberry culture, Dr. Mainland has been the go-to person for all questions blueberry for many years.

On any history of the cultivated blueberry industry in this country, New Jersey is the place to start as that was the scene of the early work done with this crop. Early extension dates back to Frederick Coville, a botanist with the United States Department of Agriculture (Pitt, 1945). Before he started work with blueberries, Coville was intrigued enough by the difference in price that vendors were getting for highbush [cultivated] and lowbush [wild] blueberries at the Boston market to conduct an economic analysis of it (Mainland, 2011). Prior to 1910 there were at least two cultivated plantings of highbush blueberries made with bushes selected from the wild (Darrow, 1951). “Coville looked around to see what people were doing with blueberries and where they were successful in forming some sort of blueberry culture from wild plantings. That gave him leads to figure out that blueberries needed acidic soil to thrive (Mainland, 2011).” Through his investigations and experiments, Coville figured out that blueberries needed acid-peat soil, that lime was toxic to the plants, and that they could not tolerate saturated soils but needed lots of moisture (Pitt, 1945). He also figured out that taking cuttings and rooting them (propagation) was the best method for increasing numbers of blueberry plants (Pitt, 1945). Coville made his first selection of plants from New Hampshire. From this start, he figured out how to breed and grow blueberries. This was the core of the beginning of the cultivated blueberry industry in the United States, and from it arose Coville's 1910 publication "Experiments in Blueberry Culture (Pitt, 1945)."

In 1911, Elizabeth White came into the picture. She had read Coville's publication and became entranced with the idea of creating a blueberry culture. Miss White’s experience was in cranberry production but she could see connections and possibilities between the two crops. She volunteered her assistance to Coville in his blueberry research, and a mutually beneficial, twenty year partnership was born (Pitt, 1945). Miss White, with her local area knowledge and her expertise as a grower, albeit in cranberries, scouted the region for the best selection of wild blueberries (Pitt, 1945). She paid locals to scour the swamps and woodlands for the healthiest and tastiest blueberries that were then used in the Coville experiments (Sciarappa, 2005). Coville and his research assistants cross-pollinated the blueberries to create plants with desirable characteristics of size, shape, vigor and quality (Sciarappa, 2005). Through his experiments, Dr. Coville created many varieties, several of which were economically viable cultivars (Pitt, 1945).

The first commercial shipments of blueberries created through the work of Coville and White were seen in 1916. The blueberry industry was slow in getting started because production problems had to be worked out. Appropriate fertilizer applications, pruning methods, and propagation required experimentation on the part of several people. Not only were Dr. Coville and Miss White conducting blueberry research, Mr. Charles Beckwith of the New Jersey Agricultural Experiment Station, and Mr. Stanley Coville, son of Dr. Coville, worked with them to create varieties that could be successful on a commercial scale (Pitt, 1945). Once their research progressed to the point that they had enough stock to make notable production numbers, they gained the interest of local area cranberry growers who were familiar with the soil and growing conditions. These growers quickly started their own plots with plants purchased from the Coville experimental stock (Pitt, 1945).

The Blueberry -Cranberry Research Center was originally located at Whitesbog, New Jersey as a substation of the Rutgers New Jersey Agricultural Experiment Station. It was created in 1918 under the direction of Charles Beckwith whose primary responsibility was cranberry research (Vorsa, 2011). As blueberry interest rose, more effort was devoted to blueberry research until in 1927, the station was moved to Pemberton, New Jersey, and then in 1962 to its new facility in Chatsworth, New Jersey. According to Dr. Mainland, "In 1939, Phil [Marucci] was hired as an entomologist--but he was a real plantsman and handled pretty much all blueberry extension work. If anyone were to be selected as the father of blueberry extension work in the world, it would probably be Phil Marucci. When insect problems arose, the first of which being the blueberry maggot, he worked out the control for them. At that time, it was DDT

(Mainland, 2011).” Marucci was hired as a Research Specialist in Entomology and Extension Specialist in Blueberry and Cranberry Culture at Rutgers University and began his career at the Blueberry-Cranberry Research Laboratory in 1951 (Eck, 1966).

“Through a long and beneficial relationship between the New Jersey Agricultural Experiment Station and the United States Department of Agriculture, a rich history of achievement in both blueberry and cranberry work has been recorded. Some of the noteworthy accomplishments have been the development of the first cultivated varieties of blueberries in the country, successful control of pests, breakthroughs in pollination, and sustainable use of fungicides (Vorsa, 2011).” This work was conducted by blueberry industry scientists including C.A. Doehlert, Director of the New Jersey Agricultural Experiment Station; R.B. Wilcox, USDA plant pathologist; F.B. Chandler, horticulturist; and entomologists R.S. Filmore, P.E. Marucci, and W.E. Tomlinson. Chandler and Tomlinson both later took positions with the Massachusetts Cranberry Experiment Station (Vorsa, 2011).

By 1927, there were enough growers in New Jersey to establish a marketing cooperative and they did so. The Blueberry Co-operative Association was formed (Pitt, 1945). Later the name changed to Tru-Blu Cooperative Association. Tru-Blu maintained a presence in North Carolina until the mid 1990s, after which they continued operating in New Jersey for another decade or more. This cooperative is no longer in existence today.

In 1925, Georgia got into the blueberry game. Rather than dealing with the highbush varieties from New Jersey that would not get enough chilling hours in the south to leaf and fruit normally, they chose the best available seedlings from Florida's rabbiteye varieties as the basis for their breeding program. The cuttings went to the University of Georgia at Tifton. By the 1940s, funding was secured to establish a breeding program at Tifton and in 1944, Dr. Tom Brightwell was hired (Krewer, 2011). Dr. Brightwell worked with the USDA team of Drs. Darrow, Scott, Galleta, Moore and Draper to develop a breeding program (Krewer, 2011).

By 1939, about 1,044 acres had been planted in New Jersey and plantings had been established in Michigan and New England. "The person that probably had the most influence in Michigan was John Nelson. He was the director of research for the Michigan Blueberry Growers Association. At the [Michigan State] university, one of the early ones was Jerry Hall. He would have gotten involved in extension in about 1962 or '63. There were people responsible for blueberry extension in Michigan before that but the Michigan Blueberry Growers Association had the majority of the growers and so they did a good bit of research themselves. They did a lot of variety evaluation, more than the university did. Since then Michigan State has gotten a good program: breeders, horticulturalists, entomologists, etc." recounted Dr. Mainland when asked about extension work in Michigan. Brightwell and Johnston conducted breeding and pruning research at the Southhaven Experiment Station and Fulton and Grigsby, Plant Pathologists, worked on mummy berry control through the Michigan Agricultural Experiment Station in East Lansing. There are circulars from the 1940s detailing their research and findings.

In New York a supposed lack of suitable soils and of information concerning cultural methods limited blueberry plantings about the time that surrounding states were exploring blueberry culture. However, there was interest in blueberries in New York and the research service established projects designed to learn more about varieties, cultural methods, and the adaptability of blueberries to New York State (Circular No. 189 The Blueberry in New York, 1942). The Blueberry in New York was a circular that was created as a guide for prospective New York planters. As late as 1953, there were still few plantings in New York, most on Long Island (Cain, 1953).

Blueberries on the west coast got started a bit later. Blueberry culture on the Pacific Coast began with the introduction of a few plants from New Jersey in 1922 (Schwartze, 1954). There were some plantings in Washington in the 1930s but they took a while to get established. Oregon and British Columbia are also involved in blueberry production (Mainland, 2011). In 1952 the State Department of Agriculture reported a total of 450 acres in eight western Washington counties (Schwartze, 1954). During the first 25 years of the cultivated blueberry industry in the United States, production increased on the Pacific Coast. Blueberries were sold in steadily increasing quantities to local consumers and in an ever widening market throughout the western states and in the larger population centers of Seattle and Tacoma. Some growers had satisfactory results from pick your own operations and roadside stands. Washington growers created The Pacific Northwest Blueberry Growers'

Association, Inc. to coordinate marketing and advertising (Schwartze, 1954). Schwartze attributes the slow expansion of their blueberry industry to the flood of plants on the marketplace. He said that early growers made their money selling blueberry plants and blueberry fruit. Since there were already so many plants available in the marketplace, new growers getting into blueberry production could not expect to make money selling plants, they could only realistically expect to sell fruit (Schwartze, 1954).

Coville's influence also spread especially to North Carolina. New Jersey growers, and probably Frederick Coville himself, had already taken scouting trips this way and figured out that it was possible to grow varieties that he was breeding this far south (Mainland, 2011). “In the early 1930s, Coville's son Stanley came to North Carolina, bought land near Atkinson, and planted blueberries (Mainland, 2011).” Before long, Stanley Coville's farm was in full operation and was listed as the second largest blueberry farm in North Carolina in The State Magazine in June of 1939.

Harold Huntington was also established in North Carolina in the 1930s. Starting with three acres and expanding yearly, by 1939, Huntington's 140 acre farm was the largest blueberry tract in the state (Sharpe, 1958). He did not increase the farm above this size (Mainland, 2011). Huntington's connection to North Carolina came through Miss. White and Dr. Coville. Prior to coming to North Carolina, Huntington purchased one acre of land in New Jersey and came into contact with Elizabeth White who became his mentor. He worked with White and Coville, and developed a system of mass rooting of cuttings using a breakthrough technology (Huntington, 2011). Through the sale of thousands of cuttings, he was able to earn enough money to consider moving south. His goal was to grow a blueberry crop with a harvest window that opened before the New Jersey crop entered the marketplace. Huntington and his father began scouting soil types and climates down the east coast (Huntington, 2011). They interviewed locals and found that wild blueberries grew in Pender County. The Huntingtons looked at available land for sale and settled on property that was part of the Corbett Plantation. “They purchased 1,640 acres which included a bog that later became known as Shaky Bay that they found to be good blueberry soil (Huntington, 2011).” They began clearing land and planting blueberries. It wasn't long before they began experiencing problems with disease, namely stem canker, which caused a significant loss in production. Huntington contacted [what is now] North Carolina State University to set up an experiment station to develop canker resistant varieties (Huntington, 2011).

"The first really organized research done by someone from NCSU would have been Dr. Morrow and we could never pin down exactly when he got started. It had to have been mid 30s and that was when they saw that there was stem canker on NJ varieties. I guess there was probably a [plant] pathologist involved at the same time. That was the first threat to the NC industry. Essentially the rest of the research in those early years came from New Jersey (Mainland, 2011)."

Morrow's own information, presented in a publication about new canker resistant varieties, Murphy and Wolcott, shows that he was already generating results from his work in 1940. In this publication, he stated that "The cross from which these varieties were obtained was made by the late Frederick V. Coville of the USDA. The 900 seedlings were set in November, 1935, on the farm of Harold G. Huntington, Atkinson, N.C. The selections were made in 1940 by H. H. Moon and E. B. Morrow (Morrow, 1950)." “Dr. Morrow and Dr. Fulton from State College were very instrumental in new varieties of plants. There was a plant named after Dr. Morrow. The Murphy plant was named in honor of John A. Murphy. The Wolcott was named for Mr. Hunnington's father. Between 1940 and 1950 there were also the Croatan and the Angola, both developed to thrive in this area of North Carolina (Hunter, 2006).”

In 1937, Dr. George Darrow took over the USDA blueberry breeding program from Dr. Frederick Coville. Dr. Darrow initiated a program between the state experiment stations and private growers where researchers could put test plots on private farms to see how potential new varieties reacted to different soils and climate conditions (Grubinger, 2011). This system is still widely practiced in the industry today. Researchers also collect weather data on private farms to augment the data from the experiment stations.

“It was Phil Marucci's New Jersey growers that came to North Carolina. The Cutts brothers were among the early ones. The Cutts Bros became the largest growers in North Carolina at that time. Portions of the Cutts Farms are still in existence. Willie and Neal Moore's farm was an original Cutts Farm as was the farm of Sam Rose. Huntington didn't expand much beyond the 140 acres he had

in 1939. But the Cutts Brothers grew cranberries as well as blueberries in New Jersey and had the contacts there with Rutgers and with Phil Marucci and they were able to get the information they needed from there. Then they hired Harry Doehlert, a nutrition person that worked along with Phil. You'll see some publications by Doehlert and Shive. That was some of the early nutrition work (Mainland, 2011)."

"Phil [Marucci] provided the extension work in North Carolina mainly because the early growers were from New Jersey and they weren't real anxious to have North Carolina growers involved. They really watched the cutting wood to make sure nobody carried any off. So the first dozen or so [growers in North Carolina] were from New Jersey (Mainland, 2011)."

Locals were not completely excluded from getting into the blueberry game. The first local grower was John A. Murphy. "Jack and Billy Murphy live in Burgaw and are his sons. They are still involved in Carolina Blueberry Association meetings." recounts Dr. Mainland during our interview. Sam Ingram and others followed, including Gale Harrison in 1937 (Hunter, 2006).

Dr. Mainland provided follow-up information regarding local growers getting into the blueberry industry. "Some of the first locals included Edmund Barnhill, father of Forris and Chester Barnhill and grandfather of Chris Barnhill; John Moore, father of Harry Moore and grandfather of Willie and Neal Moore. John Moore's farm was established in 1943 when his son Harry was in the Navy in World War II which was a source of family ribbing enough to become part of the local lore (Mainland, 2011)."

To be continued. This is the first installment of three segments of this report. The next two newsletters will include segments two and three.

Blackberry and Raspberry 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. Fertilization recommendations courtesy of NCDA &CS Agronomic Division.

SPRING

Plant growth and development

- √ Plant is "dormant"
- √ Some differentiation is occurring in the flower buds

Pruning and trellising

- √ Pruning should occur in late winter. However, in some areas winter ice storms can do tremendous damage to plants and trellis systems. If you produce blackberries in one of these areas, pruning can take place early winter to help avoid severe damage.
- √ **Make trellis repairs after plants have defoliated but before pruning and training.**

Erect types

- √ Prune out the spent floricanes
- √ Tie canes to wires in a fan shape
- √ Cut lateral branches back to 8-12"
- √ Thin canes to 6-8 canes/ hill (4 ft spacing)

Trailing types

- √ prune out spent floricanes
- √ tie or weave canes to wire so that they do not overlap
- √ prune side laterals to 12-18"
- √ thin canes to 6-8 hill (6-8ft spacing)

Primocane fruiting raspberries and blackberries

- √ Prune (mow) primocane fruiting types to ground level

Weed control

- √ 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 local extension agent for cultural or chemical means to control these weeds.
- √ Establishing new plants into rows of black plastic or landscape cloth can reduce weed problems significantly

Insect and disease scouting

Check the Southern Regional Bramble integrated Management Guide for recommendations. www.smallfruits.org

- √ To learn more about the spotted wing drosoplila and how it may impact your fruit in 2012, check out Hannah Burrack blog, she has lots of links in addition to her blog posts
- √ Scout fields for insect and disease damage and remove those canes
- √ Remove wild brambles within 600 ft of your planting during the winter
- √ Apply liquid lime sulphur or Bordeaux for disease control before new buds are 1/8”

Planting

- √ Growers in warmer regions can plant in December.
- √ Take soil tests to determine fertility needs for spring plantings.
- √ Prepare list of cultivars for next years new plantings. Find the commercial small fruit nursery list at http://www.smallfruit.org

Nutrient management

- √ Establishment

  Broadcast any recommended lime, P_2O_5 and K_2O along with 30 lb N per acre before plowing. Do not add additional fertilizer when plants are set out. In July, topdress with additional nitrogen at the rate of 30 lb per acre.
- √ Maintenance
  a. If you limed and fertilized the crop at setting according to soil test recommendations, follow this fertilization schedule. In March, broadcast 40 lb N, 40 lb P_2O_5 and 80 lb K_2O per acre. In July, topdress with additional N at the rate of 60–80 lb per acre.
  b. If you did not lime and fertilize the crop at setting according to soil test recommendations, follow this fertilization schedule.
     - Have the soil tested.
     - Broadcast any recommended lime as soon as possible.
     - In March, apply the recommended rates of P_2O_5 and K_2O along with 40 lb N per acre.
     - In July, topdress with N at the rate of 60–80 lb per acre.
     - The following year, use the maintenance schedule outlined under a. above.
     - Have the soil tested at least once every three years.

Water management

- √ Make repairs to irrigation system (check pumps, lines, etc)
- √ Plants generally do not need supplemental water in winter

Marketing and miscellaneous

- √ Order containers for next season
- √ Make contacts for selling fruit next season

Strawberry Seasonal Checklist

E. Barclay Poling
Professor Emeritus & 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

April/May Grower Checklist (20 points)

1. Leave overhead irrigation in field for evaporative cooling of blossoms in the first half of April & monitor daily forecasts closely in April and early May for high temperatures that can damage to open blossoms – consider sprinkler irrigation for evaporative cooling to protect fresh blossoms from temperatures above 87/88 F. Hot weather in early to mid-April can kill blooms needed for fruit production on Mother's Day Weekend (May 12-13, 2012)

2. For growers who do not have sprinkler irrigation, it is critical to drip irrigate for a few hours in the early morning on warm-hot days to minimize blossom and fruit damage from warm-hot temperatures.

3. A critical equipment requirement for evaporative cooling of blossoms is a digital thermometer with a thermocouple that is inserted into the open blossom – learn more about this equipment and how to use it on the Portal website: http://ncsu.edu/enterprises/strawberries/2009/12/26/mauris-sed-leo-aliquam-aliquam/

4. A less expensive Infrared Thermometer costing around $30 may also be used measuring strawberry blossom temperatures. A Centech digital laser thermometer (item 96451) is available thru Harbor Freight Stores with a coupon for about $27 each.

5. Never allow strawberry plants to wilt. Provide drip irrigation on a daily basis in warm/hot weather; in milder conditions, every other day is fine. Strawberries need an average of 1 inch of water per week in order to grow vigorously; in warmer conditions (e.g. late March 2012), 1.5 inch of water per week per acre is needed. One inch of water equals 27,154 gallons/acre per week, or 3,879 gallons/acre per day. Don't let the shoulders of the beds become dry.

6. If you get hail damage in April/May, be sure to use a fungicide afterwards to reduce growth of fungi that take advantage of the wounded tissue to colonize the berry (so-called opportunistic and secondary pathogens). Warm, dry weather is best to allow the wounds on green berries to heal. Switch is a more broad spectrum fungicide with 12 hr REI and 0 day PHI. If Switch cannot be used, a broad spectrum product like captan would also work well.

7. Try to keep pest problems under control with pre-harvest sprays. Customers don't like to see sprayers in the field when they are picking.

8. Scout fields for mites, insects, and diseases, especially botrytis, anthracnose, powdery mildew, mites, aphids, thrips, and clippers.

9. Bloom sprays are the most important for managing botrytis because 90% of the infection occurs through the blossom. Recent research suggests bloom sprays are also critical for anthracnose ripe fruit rot control (Source: 2012 Southeast Regional Strawberry Integrated Pest Management Guide (http://www.smallfruits.org/SmallFruitsRegGuide/Guides/2012/2012_strawberry.pdf)

10. Botrytis has acquired resistance to several fungicides in some grower fields. Tests can be secured through Clemson University in 2012 to help determine farm specific recommendations. To have a test made, go to the advisory, *Collecting and Mailing Gray Mold Samples for Fungicide Resistance Testing*: http://ncsu.edu/enterprises/strawberries/wp-admin/post.php?post=2195&action=edit

11. Send suspicious-looking plants to the NC Plant Disease and Insect Clinic. Manage pesticides carefully. Avoid making more than two consecutive sprays of Elevate for botrytis. Rinse out spray tank thoroughly after each chemical use and read and follow pesticide labels carefully.

12. Send in leaf samples every 14 days and adjust fertility accordingly. The NCDA & CS has recently sent out a news release about strawberry tissue samples and included a statement about fees for out-of-state growers. It is at this link http://ncagr.gov/agronomi/release/3-12sberry.htm

13. Estimate when crop will ripen so you can anticipate yields and schedule sales, promotions, and labor accordingly. Schedule and train picking/sales -labor.

14. It will take about 28–30 days from open blossom to a fully red-ripe fruit. Cooler temperatures will increase this time by a few days and warmer temperatures will decrease this time. Check with your buyers to make sure they are ready for your berries.

15. The NC strawberry crop is up to 10-14 days earlier in 2012 than 2011 – many farms in the Southeastern CP, the Sandhills and East Central NC, will begin picking Easter Weekend. The crop is quite concentrated this year. It will not be uncommon for some fields to be potentially be picking 3-4 thousands pounds of fruit per acre (in a single picking) in the 2nd half of April 2012.

16. Have porta-potty delivered and emphasize proper sanitation for farm laborers and customers.

17. Fire up refrigeration systems (walk-in cooler, etc.). For pre-pick berries, rapidly forced-air cool late season fruit in properly ventilated containers. High humidity condensate on prechilled fruit must be VENTILATED uniformly or it will cause a quality disaster.

18. Put out signs on roadsides to direct customers to your fields when berries are ready.

19. Figure out a system to collect customer names, addresses, and emails for your mailing list.

20. Be sure to post a good message on your telephone answering machine (mention the early crop). Keep fields picked every 2-3 days. Keep records, even when you get busy!

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