Small Fruit News

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North Carolina State University • Clemson University • The University of Arkansas
The University of Georgia • The University of Tennessee
Virginia Polytechnic Institute and State University

SPECIAL REPORTS:

South Carolina Fruit Grower James Cooley Named Swisher Sweets/Sunbelt Expo Southeastern Farmer of the Year for 2013

James Cooley is a member of the SRSFC Steering Committee

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(Moultrie, Ga.)— South Carolina peach and strawberry grower James Cooley, who built a beautiful farm that has become an agricultural tourism destination, has been selected as the overall winner of the Swisher Sweets/Sunbelt Expo Southeastern Farmer of the Year award for 2013.

Cooley was named as the overall winner during the Willie B. Withers Luncheon held on the opening day of the 2013 Sunbelt Ag Expo farm show. Cooley was chosen as Farmer of the Year over nine other state winners who were finalists for the award.

The Farmer of the Year award recognizes excellence in agricultural production and farm management, along with leadership in farm and community organizations. The award also honors family contributions in producing safe and abundant supplies of food, fiber and shelter products for U.S. consumers.

In This Issue

Peter Ghiloni, president and chief executive officer of Swisher International, Inc., of Jacksonville, Fla., praised Cooley for his farming accomplishments. “James and his family are outstanding representatives of the farming industry, and it is an honor for our company and our Swisher Sweets cigar brand

to recognize the Cooleys for their many accomplishments," said Ghiloni.

Ron Carroll, Swisher's vice president of marketing, presented Cooley with a $15,000 check at the farm show "James and his family welcome thousands of visitors to their farm each year," said Carroll. "They are also outstanding in how they protect the environment and in how they treat their employees and their customers."

Cooley expressed his appreciation to Swisher International, the Sunbelt Expo and the other award sponsors. "It is a humbling experience to be named Farmer of the Year, especially after meeting the other nine state winners," he said. "These are outstanding farmers. They and their families contribute much to the agricultural industry and to their communities."

Cooley and his family live in Chesnee, S.C. In addition to peaches and strawberries, he also grows blackberries and pears, along with wheat and soybeans on his 1,188-acre farm. He markets his fruit crops directly to consumers from two retail produce sheds, one located on the farm and another located near an exit on the heavily traveled I-85 highway.

At times, he employs up to 200 workers, most of them guest laborers from Mexico. Many of these workers return to his farm year after year. Cooley also overcame life-threatening injuries from a serious motorcycle accident in 2002. He credits family members, friends, employees and members of their community for their prayers and support in keeping the farm going while he recovered from his injuries. Cooley says the grace of God has allowed his family to prosper on their farm. "Our success is due to many people who have believed in our ideas and dreams," he added.

His wife Kathi manages a café located on the farm. Their daughters Brandi and Bethani also hold key positions in the farming business. Brandi is a vice president of the farm in charge of marketing. She came up with ideas for hosting a corn maze, a pumpkin patch and tours for school children. Bethani is working on the farm to install high tunnels that are similar to large unheated greenhouses for use in raising fall strawberries. James and Kathi also have two other daughters, Brooke and Brittani, who work off the farm.

The new Farmer of the Year was selected for the honor by three judges who visited his farm and the farms of the other nine state winners during early August of this year. The judges included John McKissick, a longtime University of Georgia Extension agricultural economist from Athens, Ga., farmer Brian Kirksey of Amity, Ark., who was selected as the overall winner of the award in 2008, and John Woodruff, retired University of Georgia Extension soybean specialist from Tifton, Ga.

McKissick, this year's senior judge, said Cooley's farm is one of the best farming operations he has ever seen. "They are diversified in their fruit and agricultural tourism operations," said McKissick. He also praised the farm for its outstanding management of labor, production and finances.

The judges were impressed with the appearance and beauty of Cooley's farm, along with his innovations in direct marketing of his crops to consumers. "They have short- and long-term strategic farm goals involving the entire family," added McKissick. "They have enriched their community and the farming industry by sharing their farming resources with the research and education communities."

McKissick says the judges also praised the Cooley family for their generosity, faith, hard work and courage. "They represent the strength of southeastern agriculture," McKissick added.

As the Southeastern Farmer of the Year, Cooley

will receive a $15,000 cash award plus $2,500 as a state winner from Swisher international. He will also receive the use of a Massey Ferguson tractor for a year from Massey Ferguson North America, a $500 gift certificate and a Heritage gun safe from the Southern States cooperative, the choice of either $1,000 in PhytoGen cottonseed or a $500 donation to a designated charity from Dow AgroSciences, and a Columbia jacket from Ivey's Outdoor and Farm Supply.

Each state winner received a $2,500 cash award and an expense paid trip to the Sunbelt Expo from Swisher International, a $500 gift certificate from the Southern States cooperative, the choice of either $1,000 in PhytoGen cottonseed or a $500 donation to a designated charity from Dow AgroSciences, and a Columbia vest from Ivey's Outdoor and Farm Supply.

The other state winners this year include Annie Dee of Aliceville, Ala., Phillip DeSalvo of Center Ridge, Ark., John Scott Long of Palm City, Fla., Will Harris of Bluffton, Ga., Scott Travis of Cox's Creek, Ky., Abbott Myers of Dundee, Miss., Wilbur Earp of Winnabow, N.C., Richard Jameson of Brownsville, Tenn., and Lin Jones of New Canton, Va.

Root necrosis caused by Colletotrichum acutatum

Natalia A. Peres and Jim Mertely
University of Florida, GCREC

As most growers are aware, we experienced some issues at the beginning of this strawberry season with transplants that arrived infected with *Colletotrichum acutatum. This fungus* is widely known by growers as a cause of anthracnose fruit rot, but it can also affect other parts of the strawberry plant, including the roots, which occurred this season. Root necrosis was also an issue in the early 2000s, but severe problems had not been observed until recently.

C. acutatum frequently colonizes leaves and petioles of runner plants in the nursery. Symptoms may not be visible in the nursery environment, but if inoculum is allowed to build up and the weather is favorable, lesions may develop on the petioles (Figure 1). Little is known about how or when the pathogen spreads from colonized tissue above the ground to the root system below. However, *C. acutatum* grows freely in diseased tissues, and healthy plants may be contaminated by this inoculum during normal digging, trimming, and packing operations in the nursery.

Figure 1: *Petiole lesions caused by Colletotrichum acutatum.*

Early in the season, disease spread below ground is unlikely since the root systems are relatively isolated; however, above-ground spread does occur and may be facilitated by overhead irrigation during establishment. Even cultivars that are not highly susceptible to anthracnose fruit rot, such as Festival and Radiance, are susceptible to root necrosis. Transplants with infected roots fail to establish after overhead irrigation is withdrawn. Few functional roots are found on infected plants even 1 to 2 weeks after transplant (Figure 2). Old structural roots are brown or black, whereas new roots develop brown lesions, die back from the tip, or fail to emerge from the crown. In late stages of the disease or when infections are severe, *C. acutatum* enters the crown, causes a basal crown rot, and eventually kills the plant

(Figure 3). Surviving plants are often stunted, flower late, and produce a poor early crop (Figure 4). Infected plants may recover during the cool winter months and produce normally in February and March, if an outbreak of anthracnose fruit rot does not occur.

Figure 2: *Few functional roots on plants affected by Colletotrichum acutatum.*

Diseases caused by *C. acutatum* are best controlled by exclusion (not introducing the pathogen into the field). Therefore, transplants should be purchased from a reputable source and inspected for petiole lesions caused by *C. acutatum* (Figure 1). When the pathogen is present, pre-plant fungicide dips may be used to suppress disease development. In research trials conducted during 2003-04 and 2004-05 seasons, naturally infected runner plants were dipped for 5 minutes in Abound®, Switch® or Oxidate® just before planting. Abound® and Switch® were effective in reducing plant mortality but Switch was more effective in reducing plant colonization and increasing early and total yields. A similar trial is currently being conducted at GCREC with infected Florida Radiance plants. Results so far confirm the efficacy of Switch® in reducing plant mortality. In a separate trial, infected transplants were not dipped, but are being sprayed weekly with different fungicides. To date, these treatments have not produced many differences in plant mortality but Captan applications seem to improve growth of the surviving plants.

With our current knowledge about this disease, the best and most economical disease management recommendation for growers who still have infected fields is to follow a strict schedule of weekly captan applications. Plant mortality should slow down naturally as the season progresses (and temperatures decline) Hopefully, relatively inexpensive applications of Captan will promote sufficient plant growth and decent yields later this season.

Figure 3: *Basal crown rot caused by Colletotrichum acutatum.*

Figure 4: *Stunted plants due to root necrosis caused by Colletotrichum acutatum.*

Blueberry Tree Research Could Help Growers Branch Out

Denise Ruttan
Oregon State University

AURORA, Ore. – An Oregon State University researcher aims to lower production costs for growers by creating a new kind of blueberry that develops as a tree instead of the traditional bush.

Wei Qiang Yang, blueberry agent for the Oregon State University Extension Service, has tested a grafted blueberry "tree" that grows on a single stem on a research plot at OSU's North Willamette Research and Extension Center in Aurora every year since 2009. Yang is collaborating with researchers who are testing other blueberry varieties grafted onto rootstocks at land-grant universities in California and Florida as part of a multi-state effort.

"The first rootstock that will come out of this research for commercial use will significantly change the way blueberries are currently produced and harvested," said Yang, a horticulture professor in OSU's College of Agricultural Sciences.

The research could benefit an industry that's economically important to Oregon. The blueberry industry contributed $107.5 million in sales to Oregon's economy in 2012, according to a report by the United States Department of Agriculture and OSU Extension. Growers produced 72 million pounds of blueberries on nearly 8,000 acres.

Growers use machine harvesters with catch plates to collect blueberries, but because blueberry bushes have multiple stems, the catch plate cannot fully encircle each stem of the bush. So growers must bear about a 15-25 percent loss in terms of the fruit that the catch plate misses, according to Yang. But cultivating a blueberry bush in a tree form would change that, he said.
"This work isn't just academically important, but it's valuable from a practical standpoint in that it will be very significant for improving machine harvesting efficiency and the adaptability of blueberry plants to different soil conditions," Yang said. "The wild-grown species is better-adapted to nutrient-poor and relatively high-pH soil. If we're successful, this is going to change the way we raise blueberries."

To make the grafts, Yang started with seeds from a wild-growing blueberry plant commonly known as sparkleberry, which originated in Texas, Oklahoma and Florida. In the wild, some plants grow on a single stem to heights of up to 10 feet. But their tiny berries are full of seeds and the fruit has a bad taste, Yang said. He then grafted three popular highbush blueberry varieties – Liberty, Aurora and Draper – onto the wild-growing plants. He wanted a blueberry plant that had a similar yield to its domestic cousins and had a good taste.

So far, yields of the grafted plants have compared favorably to their domesticated cousins, with the exception of Liberty. A grafted Liberty plant yielded an average of approximately 1.03 pounds of fruit per single tree, compared to an average of 1.68 pounds per single bush on a domesticated Liberty plant. A grafted Draper plant yielded an average of approximately 0.60 pounds of fruit per single tree, while a domesticated Draper plant yields an average of 0.55 pounds per single bush. A grafted Aurora yielded an average of 1.07 pounds of fruit per single tree, while a domesticated Aurora yields an average of 0.88 pounds of fruit per single bush. Taste has also compared well.

Yang must still analyze results of data collected on fruit quality factors such as firmness, size and total acidity. This is the first year researchers were able to collect data on yield for the project in Oregon. Yang will investigate

future yield projections and machine harvesting potential next. If results continue to show promise, the blueberry tree could be ready for release to nurseries in approximately five years for commercial use and about three years for gardeners.

Though some people have tried grafting blueberry trees on a small-scale basis in the past, Yang said this is the first major collaborative research effort to graft a blueberry tree that is viable for commercial growers.

Yang receives funding for the research from the Oregon Blueberry Commission and the U.S. Department of Agriculture's Specialty Crops Research Initiative.

For more information, go to the website for OSU's NWREC at http://oregonstate.edu/dept/NWREC.

A Quick Review of Blueberry Flower Bud Stages

D. Scott NeSmith
The University of Georgia

Often times during blueberry presentations or when reading some of our management guidelines, you might come across something referring to blueberry flower bud stages. A recommendation may instruct the user to apply a compound at stage 6 of bud development, for example. Or, you might hear someone say, "do not apply this compound after stage 4 of bud development". So, what is this referring too? Here is a brief overview of blueberry flower bud stages, along with photos to help understand the concept more clearly.

A flower bud stage scheme was developed years ago by Spiers (1978) to help designate rabbiteye blueberry sensitivity to cold damage. The stage designations we typically use in Georgia today or more or less modeled after this. Having "stages" to describe bud development helps in communication. It is too difficult to instruct usage of management or pesticides with regards to "flowering time", as that often has varied meanings to different people. Therefore, using bud stages to describe progression of plant development improves our ability to communicate. Especially, if we all refer to the same, or at least a similar, bud stage scale.

Following are updated photos of the different stages of flower bud development, along with some brief descriptions for each. Users have to keep in mind this is a simple guide. Buds can be between stages just as easily as they are at a "stage". Once buds leave dormancy (stage 2), they progress, more or less, depending on heat units accumulated. So, on cold days buds advance very little, but when it warms up buds advance very fast. Also, buds over the whole plant are at many different stages at once (Fig. 1). Therefore, one cannot simply designate a single stage to describe a whole plant or especially whole fields.

Table 1 shows data from our work several years ago on sensitivity of two rabbiteye blueberry varieties to sub---freezing temperatures at different stages of bud development. Temperatures shown are the "T50 values", which is the temperature at which 50% of the flowers examined showed damage. These data remind us that although there are some variety differences in cold hardiness (and typically highbush varieties are more cold hardy than rabbiteye), overall, as flower buds advance they become more sensitive to freezing temperatures.

We should all familiarize ourselves with "flower bud stages". Hopefully this review helps to remind us about the progression of flower buds, and the fact that floral bud stages are good indicators for communicating what is happening with regards to plant development.

References

Spiers, J.M. 1978. Effect of stage of bud development on cold injury in rabbiteye

blueberry. J. Amer. Soc. Hort. Sci., 103: 452-
--455.

Stage 1: *Dormant bud. No visible signs of swelling. Note bud scales are very tight.*

Stage 2: *Visible bud swelling, scales starting to separate. Bud is leaving dormancy.*

Stage 3: *Bud scales noticably seperated. Tips of flowers beginning to be visible.*

Stage 4*: Bud scales have dropped. Individual flowers distinguishable. Bud has a "pineapple" look to it. Corollas beginning to elongate.*

Stage 5: *Individual flowers separated, corollas elongated, but not yet open.*

Stage 6: *Corollas completely elongated, expanded, and open. This is the time when flower can be pollinated.*

Stage 7: *Corollas have dropped. Pollination is over. A rapid corolla drop often indicates good pollination has occurred. Especially if buds look to be more erect and less "droopy".*

Figure 1: *Various flower bud stages occur simultaneous over the entire plant and field. Looking closely, flower bud stages 2 through 6 can be seen on this one plant.*

Table 1: Temperatures at which 50% (T_{50} values) of corollas, styles and ovaries for 'Brightwell' and 'Tifblue' rabbiteye blueberry varieties were damaged by freezing at various stages of floral development.

Flower Stage	Flower Part		
	Corollas	Styles	Ovaries
	T_{50} values		
	Brightwell		
Stage 4	22.8 F	21.9 F	19.8 F
Stage 5	23.0 F	22.5 F	21.0 F
Stage 6	23.9 F	23.4 F	22.1 F
	Tifblue		
Stage 4	20.5 F	22.6 F	19.9 F
Stage 5	24.1 F	23.7 F	21.6 F
Stage 6	25.0 F	23.2 F	22.1 F

Chemical Gray Mold Control in Strawberries and Blackberries; Lessons from Four Years of Resistance Monitoring

Guido Schnabel
Clemson University

Gray mold is a disease that you can always count on year after year. It is caused by a fungus, Botrytis, which infects flowers in the spring and from there moves on to the fruit. Preharvest and postharvest losses of 5 to 20 percent (depending on the year) are common. Protecting the flowers is the key to managing this disease and that is accomplished primarily with fungicides.
Besides captan and thiram, there are fungicides from seven different chemical classes available for gray mold control. They include FRAC (Fungicide Resistance Action Committee) groups 1, 2, 7, 9, 11, 12, and 17. They are typically more effective and the risk toward consumer, worker, and environment is much less. But these benefits come at a price; all seven chemical classes are prone to resistance development. You might think that SEVEN kinds of fungicides would be enough to control gray mold for the next 50 years or so, but think again. We are dealing with a 'high risk' fungus that is a champion among pathogens in adapting to stressful environments. Combine that with the selective pressure we are subjecting this fungus to (up to 15 applications per season) and you will begin to understand the results of our region-wide resistance monitoring that includes farms from many eastern states stretching from Pennsylvania to Florida. Some of the highlights include:

- There is resistance to all seven chemical classes out there. Luckily, **we do not find resistance to all fungicides everywhere.**
- **The resistance profile, i.e. the resistance phenotypes present in a population, varies with the farm.** Typically a farm that historically has not been sprayed very much will have the least amount of resistance. From year to year the resistance profile can change, influenced by fungicide choices in the previous year and new Botrytis strains either brought in with transplants or drifting in from nearby inoculum sources.
- Resistance to FRAC 1 compounds (e.g. Topsin M; **Fig. 1**) is extremely widespread and is a component of virtually all resistance genotypes we are finding. For example, strains that are resistant to Elevate are always also resistant to Topsin M. That means when you spray Topsin M or any other FRAC 1 compound you are selecting not only for increased prevalence of Topsin M resistance but also resistance to additional compounds (in this example to Elevate). **Therefore, we do not recommend FRAC 1 compounds any longer for disease control in strawberry production**.
- Our data also shows that FRAC 11 compounds (Cabrio, Quadris), which had suppressive activity, have become largely ineffective against gray mold control. That means when you spray a combination product such as Pristine or Merivon, only one active ingredient in these mixtures (FRAC 7) works against gray mold. The FRAC 11 component, which is active against anthracnose, does not have to be applied routinely every year. Instead we recommend reducing the risk of resistance development in the anthracnose fungus by only applying FRAC 11 products when needed. **For routine gray mold control FRAC 7 products should be used as solo formulations (e.g. Fontelis)**.

Our current recommendation is to use captan or thiram prior to bloom if needed. During bloom use captan during low disease pressure (during

dry weather or during short rain events when temperatures are less than 60 F). Use a mixture of captan plus either FRAC 7 (e.g. Fontelis), 12 (e.g. Switch), or 17 (e.g. Elevate) during bloom prior to major rain events (rain lasting more than 12 hours at temperatures between 60 F and 70F). Make sure you are getting at least 6 hrs of drying time.

Our lab at Clemson offers a (still) free resistance monitoring service that lets you identify what FRAC group to use during bloom together with captan for optimal control. For more information on sampling go to http://strawberries.ces.ncsu.edu/2014/02/ideal-photograph-of-dead-blossom-for-botrytis-sampling-now-latest-instructions-feb-26-2014/ and download the 2014 Collection Instructions (1).

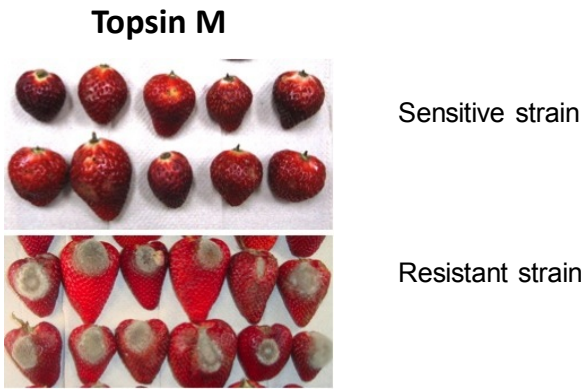

Figure 1: *While 'normal' Botrytis fungus can be effectively controlled with Topsin M (upper berries), mutant field strains resistant to Topsin M cannot be controlled even with highest label rates (lower berries).*

Winter Injury in Caneberries

Gina Fernandez, NC State University

Extracted from a presentation to the NC Commercial Blackberry and Raspberry Growers Association on February 6, 2014

"Winter" injury, caused by cold temperatures has different symptoms depending on the time of year it occurs. The plant's ability to withstand cold also varies through the year.

In fall, early frost damages terminate fruiting on primocane fruiting cultivars
In winter, very cold temperatures kill canes, damage roots
In the late dormant season, fluctuating temperatures cause cane and/or bud damage
In spring, late frosts cause death of flower buds

Winter injury may kill floricanes but not new primocanes. Damage is not always apparent until fruiting laterals begin to grow.

This year, our primary concern (at this date) is injury that may have occurred in the winter and early spring. We have seen temperatures fall below 0º F in the mountains of NC twice (1/7 and 1/30/14) at the Mountain Horticultural Crops Research Station in Mills River, NC. At the Piedmont Research Station in Salisbury, NC, temperatures were in the single digits on those same dates. These temperatures are below what has been determined as critical temperatures for injury in blackberry (see chart on previous page).

In early February, we collected canes from our research sites across the state. In general, we found damage to blackberry buds collected from the mountains but not many from than in those grown in the piedmont region. This past week (mid March), I was in the coastal plain region of the state and did not see any damage to blackberry buds.
Practices for Reducing Freeze Damage

Plant on north-facing slopes to avoid fluctuating winter temperature effects

Delay pruning as long as possible; extremities are usually more susceptible to damage.

Place row covers over RCA trellises berries to protect western caneberry varieties in the Midwest.

Avoid cultivation. Cultivation in late winter and early spring tends to increase freeze damage.

Soil temperature on a radiation-frost night will be much warmer than air temperature, and if the soil has been cultivated, the surface layer will contain more air and less water. With less water, the surface layer will hold less heat. Also, the increased soil air will cause the surface layer to be a better insulator, which will decrease the amount of heat released from deeper in the soil. Bushes will probably stay 1 to 2^{o} F warmer on uncultivated soil than on cultivated soil.

Maintain soil moisture. By increasing the amount of water in the soil, the soil will absorb more heat during the day and conduct more heat to the surface for plant protection. Excess water for extended periods must be avoided to prevent flooding or phytophthora root rot damage. Sprinkler irrigation is not recommended.

Below are some examples of what to look for when dissecting caneberry buds.

The cold temperatures have permanently damaged this Navaho bud. Notice that in the center of this bud there is a dark dot (necrosis). This will not produce fruit in the spring. Photo: Gina Fernandez

This picture is a great example of healthy Navaho bud. Notice that the bud looks green and there are no signs of necrosis. Photo: Nicholas Basinger

Southern Region Small Fruit Consortium Awards $108,851 in Grants for 2014

Tom Monaco, Coordinator, SRSFC

The Steering Committee of the Southern Region Small Fruit Consortium (SRSFC) awarded $108,851 in research and extension grants at their annual meeting held January 2014 in Savannah, GA.

Seventeen research proposals totaling $84,351 were funded and four extension proposals for a total of $20,000 were funded. Also $4,500 was awarded to the extension efforts in updating the IPM/Production Guides.

The IR4 Performance program provided a half match to three research proposals which added $7,500 in additional funding so the total amount funded for 2014 was $116,351

Research and Extension projects funded for 2014 can be viewed at http://www.smallfruits.org/SRSFCReserchFunding/2014.html

Retail Demand for Fresh Berries

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Agricultural economists at the University of Arkansas have examined retail demand for fresh berries. The goal is to improve understanding of consumer sensitivity to prices

and retail competition among different types of berries. Results show that the demand for each berry is highly responsive to changes in its own price.

Supermarkets offer many fresh fruits, most of which can serve as substitutes for berries to one degree or another. The easy access to substitute fruits is the main reason why fresh market demand for each type of berry is price responsive. There are, however, important differences among the different berries. Strawberries and blueberries are the least price responsive, with demand falling by 1.26% and for every 1.49%, respectively, for each 1% increase in the retail price. Consumers can reasonably expect to find fresh strawberries all year and so strawberries are likely to be a planned purchase item on consumer shopping lists. Blackberries and raspberries, on the other hand, are the most responsive. Blackberry demand falls by 1.88% for every 1% increase in retail price. Relative to strawberries and blueberries, year-round access to fresh blackberries is more recent and so black- berry demand is likely to still be tied to impulse purchases, which are sensitive to perceptions of a good deal. Blackberry demand is also the most responsive to the prices of competing berries. For example, if the price of strawberries increases by 1% blackberry demand increases by 0.52 percent indicating that consumers that may have been planning to buy strawberries switch to blackberries when con- fronted with higher strawberry prices.

Promotion of health benefits is sensible given these findings because it reduces price sensitivity by making other fruits less appealing substitutes. Because ber- ries are substitutes, promotional efforts that raise the price of one type of berry are likely to create positive spillovers to competing berries.t

Dr. Thomsen spoke about this topic at the 2013 Berry Health Benefits Symposium. See www.berryhealth.org.

Responsiveness of retail berry demands to price

	Price of:			
Demand for:	Strawberries	Blueberries	Blackberries	Raspberries
Strawberries	-1.26	0.12	0.05	0.08
Blueberries	0.32	-1.49	0.06	0.10
Blackberries	0.52	0.24	-1.88	0.13
Raspberries	0.39	0.20	0.06	-1.66

Numbers in the table indicate the percentage change in volume demanded resulting in price.
Numbers that are larger in absolute value indicate a degree of price sensitivity.

POSTHARVEST KITS FOR FRUIT QUALITY TESTING

Penelope Perkins-Veazie, NC State University

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Postharvest experts generally follow fruit and vegetables from field to consumer. The general guidelines are cleanliness, cold chain management, adherence to packaging guidelines and weights, and reduced mold/decay of the product. Extensive postharvest research, along with the boom in technology and relatively cheap tools, has made it possible for small acreage growers to better monitor their commodities for quality control.

I developed this kit with the idea that extension specialists and county extension agents could use the kits for on farm visits and grower demonstrations at meetings. After putting

several together, it was also clear that anyone could do this themselves, if a short list of items and how they are used, was put together. The key to the kit is that most items can be found at Walmart, Harbor Freight, or Amazon. Some items can be purchased directly from the vendor, and some items can be obtained on sale. Outlined below are the lists of items, what their uses are, sources, and relative costs. NCSU will sell the kits for $300 if you don't want to be bothered to put your own together (contact Penelope_perkins@ncsu.edu for details). Or, you may want to tailor a kit to your specific needs.

Category:

Weight and diameter

Scale (600 g or 1.3 lb): used to check individual weights of clamshells to make sure 1 lb weight is met. Can be used as a training device for new pickers. Also good for the 'biggest berry' competition.

Calipers give a quick gauge of diameter or thickness, depending on the fruit. It may be that you want to call attention to your large blueberries (over 1 inch across!) or determine if standards will be met for berry size. Also can be used to size onions, apples, peaches.

Sweetness

Refractometers are used as a quick means to determine the sugar level of fruits. This model uses infrared light beamed through a sample and reads out the result digitally (easier on the eyes than the stick model). Refractometer readings (in brix or % soluble solids) are capturing sugars, acids, and other water soluble components. For some fruit, the reading will reflect the sugars to 90%. For other types, the sugars may only represent 60 to 70% of the brix reading. It is a good instrument to check fruit quality, especially after heavy rain or irrigation, when the brix often falls as water moves into the fruit, to see if those blackberries are really ripe enough, or to see if your fertilizer regime (more potassium for sweetness) is working for strawberries. Note: if you just want the refractometer, Milwaukee (in Rocky Mount, NC, milwaukeeinstruments.com) sells the refractometer plus the box (an extra $12 or so); I recommend getting the box-it won't fit in the insulated bag we use but if you just want the refractometer, the box protects it nicely. Also, the range on these refractometers is 0 to 85 Brix, which means they can be used to monitor jelly (Brix should be 50 and above for jams and jellies to suppress bacterial growth).

Slurpee straws are added to transfer puree to the refractometer sampling dimple (or you can squeeze the fruit directly onto the sampling stage). Lens wipes are added to clean the surface. Avoid paper towels as these will scratch the lens coating of the refractometer.

Temperature management

This is the heart of maintaining shelf life for fruits and vegetables. Usually it's a matter of keeping fruit cold enough; sometimes some commodities want to be warmer (like tomatoes).
Anemometer:
Thanks to balloonists, these units now come in handy pocket sizes. Anemometers measure wind speed, and can be used to check your cooler fans to see how much movement you're getting, and if the air movement is uniform.

Thermometers:

a. Digital Shelf thermometer. Gives a quick glance when you open the cooler door as to the status of the cooler. The humidity measurement is not very accurate but will distinguish 10% from 60%.
b. Digital Stick-in thermometer. This is needed to comply with food standards where an actual destructive measurement is taken of produce (stick it into the fruit and read the temperature)

c. Non contact thermometer. My personal favorite. The beauty of this little thermometer is that you can aim it at the center pack of fruit and get an idea of what the temperature is relative to the cooler temperature, without having to stick a fruit or even walk inside. A great way to isolate hot spots in your truck or cooler too-check corners, floor, roof areas for relative temperatures of solid surfaces.

While not included in this kit, check out ibutton loggers at QA supplies.com. These come as temperature or temperature plus humidity buttons ($28 to $85 plus $15 software) that can be placed anywhere in your cooler or produce load, and changes in temperature followed by computer by increments of minutes or hours. You can follow the cooling curve from anywhere using this system.

Other parts:

pH paper: useful for checking acidity of fruits and also for pH where cleaning of produce is being done. If chlorine is used as a wash step, check the pH of wash water to make sure it is 6 to 7 so chlorine will remain active. A useful hint: fruit pH is usually between 3 and 6. So if you want to check fruit pH, get pH paper that covers these ranges and has ½ point increments (3, 3.5 etc). If you want to check chlorine levels, use pH paper that covers 0 to 14 range in 1 unit intervals.

Chlorine test strips: used to see if free chlorine levels are correct. Usually not done with small fruits, but chlorination of wash water is done with peach, apple. Free chlorine should be 100-200 ppm. The chlorine level of tap water should be 1-2 ppm if city chlorinated.

Container: this is a 9-can insulated cooler bag. The idea is to offer insulation and protection to the instruments inside without adding excessive bulk or weight.

POSTHARVEST KIT

1. INSULATED BAG (HOLDS AND PROTECTS CONTENTS)
2. REFRACTOMETER (MEASURES SUGARS)
3. SCALE (MEASURE CLAMSHELL OR FRUIT TO 1.5 LB)
4. ANEMOMETER (MEASURE FAN WIND SPEED)
5. CALIPERS (MEASURE DIAMETER, LENGTH, THICKNESS)
6. LASER THERMOMETER (NON CONTACT TO CHECK FRUIT TEMPERATURES IN STORAGE)
7. pH PAPER (CHECK ACID LEVEL OF FRUIT)
8. SHELF THERMOMETER (QUICK LOOK IN COOLER TO SEE IF TEMPERATURE AND HUMIDITY ARE IN RANGE)
9. CHLORINE WIPES TO CLEAN HANDS, SURFACES WHEN TESTING
10. COLD PACK (CAN REFREEZE IF NEED TO KEEP SAMPLES COLD)
11. STICK THERMOMETER (TO CHECK INTERNAL FRUIT TEMPERATURE)
12. LENS WIPES FOR REFRACTOMETER LENS
13. WATER AND SUGAR (SUCROSE) TO CALIBRATE REFRACTOMETER

Description of item	Source	Cost
digital refractometer (Milwaukee)	Amazon	$ 120.00
laser (no contact) thermometer	Harbor Freight	$ 30.00
digital penetrating (stick) thermometer	Walmart	$ 10.00
pH strips (0 to 14 units by 1 or 0.5 units)	Amazon	$3.00-10.00
anemometer	Amazon	$ 36.00
Digital shelf thermometer	Amazon	$ 12.00
Digital calipers	Harbor Freight	$ 4.00
Scale (600 g)	Amazon	$ 10.00
500 g wt	Amazon	$ 10.00
wet wipes	Walmart	$ 1.00
small insulated cooler/9 can size	Amazon	$ 20.00
lens cloths to clean refractometer (bulk)	Walmart	$ 10.00
slurpy straws (disposable) (bulk)	Amazon	$ 24.00

Spring Caneberry (Raspberry and Blackberry) Chores 2014

Gina Fernandez, Small Fruit Specialist
NC State University.

Chores and timing may be somewhat different in your area or for your cropping system.
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 floricanes 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.
- Hand-weed perennial weeds in and around plots.

Insect and disease scouting

- Growers with a history of cane diseases and/or mites often find that certain fungicides and oils are most effective just prior to bud break. The period of time in the spring when the plant is flowering is the most important season for control of insects and diseases. Know what your pests are and how to control them.

Water management

- Bramble plants need about 1"-2" water/week. This amount will be especially critical during harvest.

Nutrient management

- Apply second half of nutrients if doing split application.

Marketing and Miscellaneous

- Service and clean coolers.
- Make sure you have enough containers for fruit in the coming 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.
- Check buds and canes for cold damage.

Strawberry Seasonal Checklist April/May
Growers Checklist

Dr. E. Barclay Poling
Professor Emeritus, NCSU

1. Maintain vigilance for late frosts; April may continue to be cool. Be sure to sign up to receive strawberry advisories and weather alerts (send a message to mj2@ lists.ncs.edu with the following message in the message body: subscribe berry-mg). Advisories are posted at http://strawberries.ces.ncsu.edu/

2. Leave overhead irrigation in field for evaporative cooling of blossoms in the first half of April and monitor daily forecasts closely in April and May for high temperatures that can be damaging to open blossoms - consider sprinkler irrigation for evaporative cooling to protect fresh blossoms from temperatures above 87/88°F. Growers using heat mitigation measures were successful in saving much of their crop from early and mid-April heat waves in 2002 and 2010; it seems that 2-3 days of extreme heat during pre-bloom and bloom have the potential to cause greater losses in Camarosa than Chandler.

3. During warm/hot days in the harvest season you can drip irrigate for a few hours in the early morning (around sunrise) to keep plants "fresh" and to minimize the possibility of heat damage to late blossoms and berries that are directly exposed to the sun. Do not use overhead sprinkling for evaporative cooling once picking is underway. In addition to being "proactive" in your drip irrigation on warm/hot days, be sure to "pick closely" as fully red berries on the edges (shoulders) of the bed are highly susceptible to sun-scalding. "

4. 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 adequately; in warmer conditions, 1.5 inches of water per week per acre is needed. One inch of water per week equals 27,154 gallons/acre, or 3,789 gallons/acre/day. Don't let the shoulders of the beds become dry. In spring 2014 we are noticing that row-covered fields are further ahead than non-covered plants by as much as 10-14 days – the larger, more advanced plants will need close water and fertility management!

5. 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), e.g., Switch, a 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. Warm, dry weather also helps the wounds on green berries to heal.

6. Scout fields for mites, insects, and diseases, especially Botrytis. Protecting the flowers is the key to managing Botrytis (gray mold), which infects flowers in the spring and there moves on to the fruit. *Botrytis cinerea* historically has a high potential to develop resistance, and recent data suggest some fields have a high percentage of strains resistant to several important fungicides. It is important to limit the number of times fungicides of the same class are applied in 1 year; and sample gray mold populations for their resistance profile through Clemson University. For instructions to submit your samples see: http://strawberries.ces.ncsu.edu/2013/06/instructions-for-collecting-and-mailing-gray-mold-samples-to-clemson-for-fungicide-resistance-profiling/

7. Send suspicious-looking NC Plant Disease and Insect Clinic. When the weather "turns" and becomes warmer, you often see some plants wilting or collapsing – it is important to get these to a professional lab for correct diagnosis.

8. Send in leaf samples for plant tissue testing every 14 days from the early bloom period through the first half of the harvest season. Fertigation is generally done on a weekly basis for 10-12 weeks. Use the rate of N recommended in your most current plant tissue report.

9. Estimate when the crop will ripen so that you can anticipate yields; schedule and train sales people; coordinate promotions, and picking labor accordingly – watch for announcements and updates from your local Department of Agriculture on crop ripening and different promotional programs.

10. If weather conditions are cooler than normal in March, like this year in the Carolinas and most of the mid-South, expect up to 40 days from open blossom to a fully red-ripe fruit for the first 10-14 days of blooms. But, once the weather warms up, it usually takes about 28-30 from the open blossom stage to ripe berry.

11. Provide hand-washing facilities and single-use paper towels for both workers and customers. Have porta-potty service delivered and emphasize proper sanitation for farm labors and customers.

12. Put out signs on the roadside to direct customers to your fields when berries are ready. Be sure to post a good message on your telephone answering machine. Keep fields picked every 2-3 days. Post signage on prices clearly. Figure out a system to collect customer names, addresses and emails for your mailing list.

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