

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

Leadership Changes in the Southern Region Small Fruit Consortium

Tom Monaco, SRSFC Coordinator

Effective July 1, 2015 Tom Monaco will step down as coordinator of the SRSFC after serving 12 years in the position. He will be replaced by Wayne Mitchem, Regional Weed Science Specialist, NC State University.

Tom took over the coordinator position in June 2003 following his retirement as Head of the Horticultural Science Department at NC State. Prior to serving as coordinator, Tom served as the NC State administrative representative on the SRSFC executive committee since the inception of the consortium in 1999. He was preceded in the coordinator position by Jim Ballington who led the consortium to a successful regional partnership. During Tom's tenure the consortium membership doubled in size from three universities to six. The original three NC State, Clemson and University of Georgia were joined by University of Tennessee, Virginia Tech and University of Arkansas. The SRSFC was nationally recognized as recipient of the 2012 National Institute of Food and Agriculture Partnership Award for Multistate Efforts.

The SRSFC grant program for research and extension proposals has grown in size; over

\$100,000 in grants are awarded annually. A total of 1.3 million dollars has been awarded from 2001 to 2015. County extension agent in service training has been an integral and important mission of the SRSFC with two trainings held per fiscal year. Four scholarships are awarded to each of the member states to cover agent expenses in attending the trainings. Twenty nine agent trainings involving a total of 650 agents have been conducted from 2001 to 2015.

In This Issue

Special Reports:

Leadership Changes in the Southern Region Small Fruit Consortium

Caneberry Seasonal Checklist

The transition in leadership will be seamless since Wayne has been shadowing Tom for the last year. Wayne brings great experience to the position having successfully served as a regional specialist covering three states-NC, SC and GA for the last 15 years. He has developed a great rapport with stakeholders in those and adjoining states. He has a great deal of hands on knowledge with small fruits particularly blackberries and muscadine grapes since he and his family manage commercial production of both of these commodities. Tom will remain in a limited support role with the SRSFC coordinating budget management.

Ornamental Blueberry Variety Development at The University of Georgia

A Progress Report for 2014

D. Scott NeSmith

For nearly 70 years UGA has been involved in commercial blueberry variety development. There has been great success with the effort, and a strong viable industry exists due largely, in part, to the research. With the growth of the commercial blueberry industry has come an increased interest from homeowners and consumers in having blueberry varieties for their use as well. In fact, a rapidly growing movement across much of the U.S. is to have edible garden and landscape plants. Coupling edibility with attractive ornamental traits adds even more value to the plant material.

The expectation is that consumers can “surround themselves with flavorful beauty”.

In 2005 we initiated a pilot effort for selecting blueberries for the edible ornamental/home garden consumer. The effort quickly gained momentum from the ornamental industry, and as a result we have now made this a second major focus of our UGA Blueberry Breeding Program. We are seeking a diversity of plant types for this industry that are specifically ornamental in nature. Traits being sought include compact plant habits, colorful berries, novel plant characteristics, and attractive foliage. Blueberry varieties for these markets do not need typical commercial production attributes such as concentrated ripening and fruit quality traits for long distant shipping. Therefore, this entire effort is substantially different than the commercial production evaluations we have done for years. We have partnered with some leading ornamental nurseries to provide us input and test our edible ornamental selections for their market potential. We now have more than

150 ornamental blueberry selections we are evaluating. This report summarizes our progress to date and provides comments and photos from some of the more interesting ornamental blueberries for 2014.

We currently have two released varieties that have been patented, licensed and are now available in the market place. The first of these varieties, Blue Suede™, is a home owner blueberry variety offering striking sky blue fruit and beautiful fall foliage color development for added attraction (Fig. 1). The variety is exclusively licensed to McCorkle's Nursery, Inc, and has become part of their Gardener's Confidence Collection. More information can be found at: [Gardeners Confidence Collection - Blue Suede® Southern Highbush Blueberry.](#)

The second ornamental release, Summer Sunset™, has great appeal based on its multicolored berries (Fig. 2). An accent of sunset orange fruit, draped against a backdrop of nonglaucous, deep green foliage is present on the plant through much of the spring. As the fruit begins to ripen, berries develop a richer orange hue, followed by a deep red, until eventually the ripe berry turns midnight blue. The mature fruit are very edible, with a full flavored blueberry taste. Summer Sunset™ has been exclusively licensed to James Greenhouse and Agri-Starts, Inc. in the U.S.

In addition to the ornamental blueberry varieties mentioned above, we have three new varieties that have been licensed in 2014. The first of these is 'TO-1088' which has been developed for home garden and landscape usage (Fig. 3). This new variety generally flowers and ripens in between late season highbush and early season rabbiteye varieties. 'TO-1088' has small, dark berries, and typically has a very good crop load (Fig. 4). Plants are compact/dwarf, but are vigorous, being well suited for home gardeners, landscapes, and container production (Fig. 5). In mild winters the

evergreen habit makes an attractive fall and winter plant as well.

The second new variety, 'T-460', is primarily intended for home garden usage (Fig. 6). The new variety is mid season, ripening after early commercial rabbiteye varieties in south and middle Georgia. 'T-460' has large berries, with a good scar and very good color. Plants are vigorous, but not overly vigorous, being well suited for home gardeners. The sky blue fruit of 'T-460', along with the glaucous, blue-green foliage makes the new variety aesthetically appealing as well. 'T-460' has demonstrated considerable self-fruitfulness in greenhouse studies, which is a highly desirable trait not frequently found in most rabbiteye varieties.

Compact or dwarf plants often have considerable appeal to consumers for certain landscape settings or for container production. The new dwarf southern highbush variety 'TO-1319' is expected to be a very interesting ornamental for a patio type container blueberry (Fig. 7). The plant is very compact and full, yet fills a container in reasonable time. Fruit are medium to large size, light blue, and have good taste. Under field trials 'TO-1319' has flowered profusely and produces an abundance of berries on a dwarf plant (Fig. 8). The plant will likely be suitable for a number of landscaping usages (Fig. 9).

In addition to the three newest varieties described above, we also have additional new blueberry selections under trial that appear to have a range of home garden appeal.

We are trying to develop blueberries that have a desirable plant type, nice fruit during harvest, and attractive foliage for extended appeal. T-1223 (Fig. 10) is a rabbiteye selection with stunning silver-blue foliage that remains attractive much of the growing season. Fruit of T-1223 are very light blue and flavorful, and flowers have a great pink hue.

Another selection, TH-1089, offers a compact plant habit that produces an abundance of highly flavorful berries (Fig. 11). The robust blue fruit clusters contrast well with the blue-green foliage of the plant. Fruit of TH-1089 ripen uniformly, and will hold 2 to 3 weeks on the bush while retaining superior eating quality.

A final noteworthy selection, TO-1398, displays berries with a 'gold rush' appearance for much of the season (Fig. 12). As they begin to ripen they turn orange and red, and eventually ripen as a dark blue fruit. Flavor of the berry is very good at maturity, and ripening is protracted giving a long harvest season. The selection could make a nice screen plant, and should be adaptable to a variety of soil conditions.

In summary, we have a number of new ornamental blueberry varieties and additional selections under development at UGA. We continue to look for unique plant types and combinations of traits that appeal to consumers from both an edible and ornamental perspective. Our goal with this entire effort is to have consumers "surround themselves with flavorful beauty". The effort will continue over the next few years, with many selections yet to come.

For up to date information on UGA Ornamental Blueberry licenses, licensing opportunities, and plant availability, contact UGA's Technology Commercialization Office at 706-542-5942.





Figure 1: Blue SuedeTM sky blue berries and colorful fall foliage.



Figure 3: 'TO-1088' plants during early (upper photo) and later (lower photo) flowering.

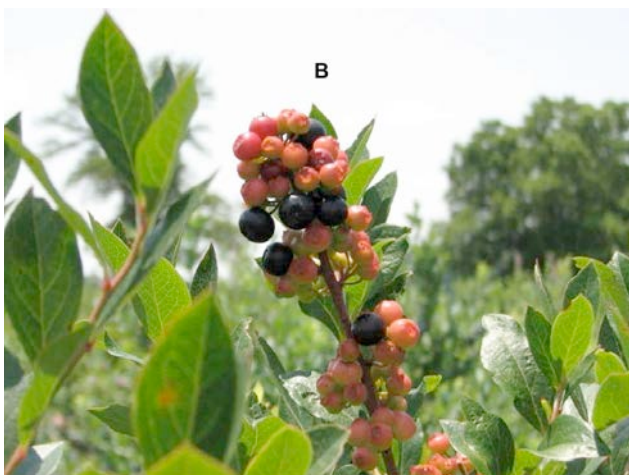


Figure 2: Summer SunsetTM ornamental blueberry plant (A) and fruit (B) growing in south Georgia.



Figure 4: Plants of 'TO-1088' during fruit ripening in Alapaha, Ga.



Figure 6: 'T-460' flowers and fruit in Griffin, Ga.



Figure 5: 'TO-1088' as container grown plants.

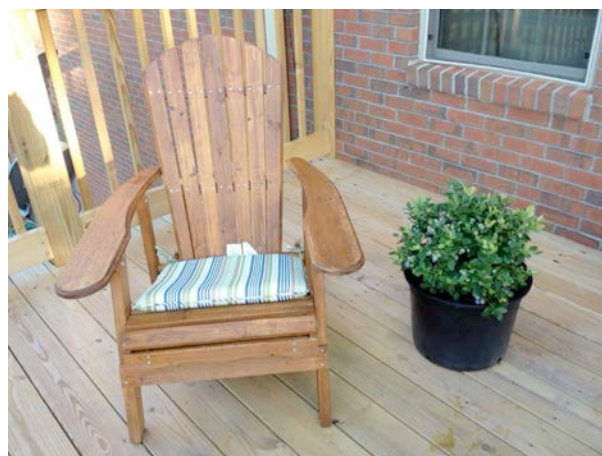


Figure 7: 'TO-1319' is expected to make a great patio blueberry.





Figure 8: New dwarf southern highbush 'TO-1319' during flowering and ripening under field growing conditions.



Figure 9: 'TO-1319' being used to accent a landscape as ground cover (upper photo) and as a hanging basket (lower photo).



Figure 10: Silver-blue foliage of selection T-1223 (center plants upper photo) and its attractive fruit (lower photo).



Figure 11: Compact homeowner blueberry selection TH-1089 with very attractive, highly flavorful fruit that holds well on plant.





Figure 12: Selection TO-1398 with a 'gold rush' of berries before ripening.

Blackberry: Selecting Suitable Cultivars and Improving Management Practices for the Florida Environment

Shinsuke Agehara
Assistant Professor of Horticultural Sciences
Gulf Coast REC, Balm, FL

Reprint from the Berry Vegetable Times 2015

Blackberry is an attractive specialty crop with extremely high nutritional value and antioxidants. Blackberry production in the U.S. has rapidly increased in recent years because of consumer-driven demand and the release of new cultivars with superior fruit quality and adaptability to diverse climates. From 2009 to 2014, the blackberry grower price in the U.S. increased from \$0.56 to \$0.97 per pound, and the production value increased from \$30.8 million to \$43.2 million. However, current blackberry production in Florida is limited primarily to home gardens and small commercial U-pick operations.

To evaluate the potential of blackberry as a new alternative specialty crop in Florida, we initiated blackberry trials in 2013. There are two types of blackberry based on fruiting characteristics of their canes. Primocane-fruited cultivars produce berries on first-year canes in late summer, and the same canes produce berries again in spring of the second year. By contrast, florican-fruited cultivars

produce berries only from buds on second-year canes in spring. Most commercial blackberry cultivars are currently florican-fruited cultivars. In the first season (2013-2014), we tested three florican-fruited cultivars ('Natchez', 'Navaho', and 'Ouachita') that require relatively low chill hours, which is an important trait to grow in Florida. Plants were grown on a standard trellis system for blackberry production constructed under the shading net. We identified 'Natchez', 'Ouachita', and 'Navaho' as high, medium, and low yielding cultivars, respectively (Table 1). In particular, 'Natchez' grown under the optimal cultural practices yielded more than 9,000 lb/acre, which was about 20% higher than the average blackberry yield in the U.S. Fruit Brix was higher for 'Natchez' and 'Ouachita' than 'Navaho', although all cultivars had good sweetness overall.

Cultivar	Fruit set	Fruit wt		Brix
	(#/plant)	(lb/plant)	(lb/acre)	(%)
Natchez	227	2.60	9,145	10.52
Navaho	28	0.24	862	9.23
Ouachita	62	0.50	1,701	10.54

All canes were pruned at the base immediately after the last harvest (July 7, 2014). We are currently collecting the second-season yield data, which appear to be similar to the first season (Figure 1). In this season, we are also growing the same blackberry cultivars in a high tunnel to determine the optimal production system in Florida. Despite high temperature in the high **tunnel**, we are observing excellent fruit set for 'Natchez' (Figure 2). We will continue the trial to fill a gap in our current knowledge and to develop recommendations of blackberry production for Florida growers.

Three Promising New Berries From USDA

Jenna Rymer

*Reprinted from Growing Produce,
May 27, 2015*



Figure 1: Three floricane-fruiting blackberry cultivars grown under the shade net at the Gulf Coast Research and Education Center in Balm (from left: 'Natchez', 'Navaho', and 'Ouachita'). Photos were taken on May 13, 2015.



Photo: Flavorfest (Photo credit: Kim Lewers, USDA-ARS)

USDA breeding programs in Maryland and Oregon have introduced three promising berry cultivars that could work well for growers both East and West. Here's what you need to know about Flavorfest and Sweet Sunrise strawberries and Columbia Star blackberry.

FLAVORFEST

Flavorfest, a new release from the USDA-Agricultural Research Service (ARS) breeding program in Beltsville, MD, led by Kim Lewers, is a mid-season high-yielding strawberry variety with large, firm berries.

Staying true to its name, key features of this variety are its flavor, as well as its resistance to anthracnose fruit rot. The shape of the strawberry is "overfull," according to Lewers.

"It's like each berry is all puffed up trying to get your attention ... as if it's trying to tell you it's bursting with flavor," she says.

Flavorfest is best adapted to growing conditions in the Mid-Atlantic, Northeast, and surrounding areas. The berry performs well in both plasticulture and matted row systems. Shawn Wright of the University of Kentucky



Figure 2: Fruit set of floricane-fruiting 'Natchez' blackberry grown in a high tunnel at the Gulf Coast Research and Education Center in Balm. Photos were taken on May 13, 2015.

said it grew well for him in an annual plasticulture system and perhaps could work well in Ohio or western Virginia.

Flavorfest also does well in cold storage. It will develop some botrytis after a week, but if fungicides are used, very few berries will show symptoms.

“Unlike some varieties, it does not change physiologically in cold storage. Some varieties turn dark and soft in even a day of storage, but Flavorfest does not,” Lewers says.



Photo: Sweet Sunrise (Photo credit: Chad Finn, USDA-ARS)

Flavorfest is widely available to commercial growers. Wright encourages you to try this variety because of the excellent flavor, color, and shape of the berry, and yields that were equivalent to Chandler in his trials.

“I would suggest growers contact their favorite nursery to help them obtain Flavorfest plants,” Lewers adds.

SWEET SUNRISE

Sweet Sunrise is a new strawberry variety from the USDA-ARS Horticultural Crops Research Unit in Corvallis, OR. The unit’s breeding program is led by research geneticist Chad Finn. This cultivar, developed primarily for the process berry market, has a good, intense color internally and externally, as well as a good flavor.

Finn has trialed the variety for the past few years, and says he has seen it produce the highest yields in every trial compared to other varieties. The plants lasted about three years. Although the yields declined a bit over the

years, the size of the berry didn’t drop as dramatically as the others.



Photo: Columbia Star (Photo credit: Chad Finn, USDA-ARS)

Sweet Sunrise is ready to harvest one week earlier than industry standards like Tillamook and Totem. It is also a large berry which helps make picking more efficient.

Since it does harvest a week early, obtaining labor that early might be an issue.

Finn says there’s no reason it wouldn’t work in the East although an annual plasticulture system is typical in the East while a perennial matted row system is typical in the West. Western growers face a lot of virus pressure and Sweet Sunrise proves to adapt well to those pressures.

This variety is available through distributors in the West and is available to ship to the East.

COLUMBIA STAR

If you’re looking for a strong thornless blackberry variety, Columbia Star — also from the Corvallis program — may be a great option for you. Black Diamond has been the industry standard for the last decade or so with a high yield and good quality, but the consumer market was looking for a thornless variety that

had the same characteristics of Black Diamond. Finn says Columbia Star is equivalent to, if not better than, Black Diamond. The variety produces high yields and is of high quality for processing and short distance fresh buys. In a blind taste test, it scored well with flavor and aroma, as well as a puree.

In its second year of harvest, a major processor said it “fit the bill,” giving confidence to a number of growers to try this variety. Finn says the number of plants sold jumped to more than 400,000, which is about 500 acres.

Finn cautions those in the East to “try it carefully,” as Columbia Star is not very cold hardy. If you’re in an area where the temperature doesn’t get below 10°F, it’s worth a shot, he says.

Georgia Blueberry Growers Suffer Chill Damage

Growing Produce Staff
Reprinted from Growing Produce



Photo Credit: Clint Thompson, University of Georgia

Early southern highbush blueberry varieties in Georgia took a major hit from the Polar Vortex this year.

They felt the chill of deep freezes during January and February, according to University of Georgia blueberry specialist Erick Smith.

“I do know that the flowers that were open

during the freezes, especially with that last long spell, they probably were frozen,” Smith said. “On the early varieties, that may have constituted about 40 to 50%.”

Georgia blueberry producers farm mostly southern highbush and rabbiteye varieties. The southern highbush varieties are the earliest to bloom and the berries were zapped by winter’s cold snap. UGA plant pathologist Phil Brannen cautions that the same fate could fall on rabbiteye blueberries, which are beginning to bloom.

“The next week or two for the rabbiteye varieties will be critical. Even after you have small berries form, you can still have cold weather significant enough to lose berries as well. There’s still a month at least where we have to look at the temperatures before we’ll be out of the woods, as far as cold damage,” Brannen said. “If you look at some of the historical freezes we’ve had, they have been really late and have done significant damage to our blueberry crop.”

Winter freezes are nothing new for Georgia blueberry producers. Many prepare for the cold temperatures with frost protection systems, which apply water through overhead irrigation systems. This practice protects the plant’s bud from being damaged, Smith said.

“As water moves from liquid to solid, it’s 32 degrees and there’s a little bit of energy that’s given off as it moves from a liquid state to a solid state. During that time when water’s freezing, it’s protecting the bud by not allowing it to go any lower than 32 degrees,” Smith said.

Many farmers applied water on their plants for three days straight during the worst cold snaps, Smith said. However, even with frost protection, some farmers saw crop damage. The temperatures were just that low.

“The frost protection really did help in some situations. But given how cold it got and what the dew point was, some of those early

varieties that were producing flower blossoms—no matter what you did, it wouldn't have helped," said Renee Holland, UGA Extension blueberry specialist for the Southeast District.

According to the Georgia Automated Environmental Monitoring Network, low temperatures in Bacon County — the top blueberry-producing county in Georgia — dipped to 25, 23 and 29 degrees from Feb. 19-21. The weekend before, back-to-back nights of low temperatures were recorded at 28 and 28 Feb. 13-14.

Source: University of Georgia College of Agricultural and Environmental Sciences

Building A Better Black Raspberry

Christine Bradish, Chad Finn, Gina Fernandez, Jill M. Bushakra
Reprinted from Growing Produce



Photo Credit: Gina Fernandez, NC State

Black raspberries are a minor crop, even among the berry crops. The majority of the berry-consuming public only knows of them as a processed product, such as jam and juice, and few people have ever had them fresh. However, it has not always been that way.

In the early 1900s, black raspberry production was centered in and around western New York and exceeded the production of red raspberry. By the 1940s, disease problems shifted production to Oregon, where the crop is now

grown and harvested mechanically for processed products.

In the past decade there has been a growing amount of data extolling the health benefits of dark fruits in general, and black raspberries specifically. These discoveries have led to a demand for fresh product and the potential for increased production range.

Despite the potential, there are many challenges for this crop including low yield, poor regional adaptation, and disease and insect susceptibility. In addition, there have been few new cultivars released due to a lack of breeding effort and a lack of genetic diversity in the breeding stock.

Ramping Up Research

In 2011, a group of more than 15 scientists at 11 institutions were awarded a USDA National Institute of Food and Agriculture (NIFA) Specialty Crop Research Initiative (SCRI) grant for \$1.59 million titled, "Developing The Genomic Infrastructure For Breeding Improved Black Raspberries."

At the beginning of this project, two genetically and physically diverse populations of black raspberry plants were propagated and planted in four research stations and six commercial locations representing current, historic, or potential production sites in Oregon, Ohio, New York and North Carolina. Detailed observations for more than 30 fruit and plant traits were taken at each of these sites over three years.

The ambitious project has seven major objectives, including breeding, in-depth genetics, consumer preferences, and educational efforts. Teams of researchers have addressed each of the objectives over the years and they have made significant strides. The scientists report their findings yearly to USDA, funding agencies and grower groups. A comprehensive list of their more technical findings can be found at <http://is.gd/BlackRaspberryResearch>.



Photo: Inoculating seedlings to test for plant resistance or susceptibility. (Photo Credit: Jill Bushakra, USDA-ARS)

Summary Of Findings

- Detailed profiling of plant genetics — Researchers have sequenced the DNA from different parts of the plant — leaves, roots, and fruit — to find genes that are unique to each part. They will use this information to find what makes each plant and plant part behave differently from one another. This in turn can help identify sources of disease and insect resistance as well desirable horticultural traits such as improved fruit size, plant vigor, phenology (e.g. time of flowering), fruit chemistry (sugar and acid levels), and heat tolerance. For plant breeders, this information will reduce the amount of time needed to determine whether early generation seedlings have specific traits of interest, and will reduce the amount of space needed to grow populations since only those with the traits of interest continue on for observation over additional seasons in the breeding program.



Photo: These aphids vector numerous raspberry viruses. (Photo Credit: Stephen Ausmus, USDA-ARS)

- Aphid resistance — An exciting example of how these discoveries work is that the labs in Oregon and North Carolina have identified regions on the linkage maps — genetic maps of chromosomes — that are associated with aphid resistance. This information will allow breeders to select parents with aphid resistance and develop cultivars that are less susceptible to viruses, thereby increasing the longevity of black raspberry plantings.
- Heat tolerance — Scientists in North Carolina, the warmest site in this project, have screened the plants in their field site and found there is a wide range of tolerance to heat stress in the individual plants. The data collected were very similar to data collected previously on red raspberry in the same location. They are now further comparing the genetic data between red raspberry and black raspberry to see if the trait for heat tolerance may be found in the same gene region in both species. In the future, they will use these traits for identifying individuals that are better suited for production in regions with hot summers.
- Usefulness of black raspberry for studying red raspberry and blackberry — One of the goals of this project is to be able to use the information developed in black raspberry to aid in red raspberry and blackberry breeding and research. Because black raspberry has such low genetic variation, anything that is different in black raspberry will be more easily identified in red raspberry and blackberry. This means that in the future, the black raspberry DNA sequence information will also be useful for identifying genes for disease and insect resistance, fruit quality, stress tolerance, and a host of other traits in red raspberry and blackberry as well.
- Consumer preferences — Ohio State University organized two different blind

tasting panels of seedless puree made from the fruit of eight black raspberry breeding selections, which took place in Oregon and Ohio. The untrained consumer panel in Oregon showed definite preferences and dislikes in the puree flavor, aroma, texture and color. A trained sensory panel in Ohio had similar overall results, indicating that preferences are common across the U.S.

- Training and outreach — Over the past four years, the researchers on this project have given presentations at local field days in each of the four states, at annual meetings of the North American Raspberry and Blackberry Association, Pacific Northwest grower meetings, and international meetings. The researchers have trained many undergraduate and high school students in everything from simple care of plants and identification of visual traits in the field to complex molecular technology in the lab. At the American Society for Horticultural Science meetings in New Orleans this August, researchers working on the project will be presenting a training session in plant breeding for graduate students and others who are interested to learn how to use genetic tools for their breeding programs.



Photo: Christine Bradish explains her research at a field day at the Sandhills Research Station in Jackson Springs, NC.

(Photo Credit: Gina Fernandez, NC State)

By fully integrating genetics, plant breeding, and an in-depth exploration of consumer perspectives, this research will be immediately useful to breeders engaged in developing tomorrow's superior black raspberry cultivars that will drive increased production and industry growth.

UPDATE 3-U.S. EPA proposing temporary pesticide-free zones for honeybees

Carey Gillam

Reprinted from Fruit Growers News June 2015

May 28 (Reuters) - U.S. environmental regulators on Thursday proposed a rule that would create temporary pesticide-free zones to protect commercial honeybees, which are critical to food production and have been dying off at alarming rates.

The restrictions are aimed at protecting bees from "pesticides that are acutely toxic" to them, and would cover foliar applications when certain plants are in bloom and when commercial honeybees are being used to pollinate crops, the Environmental Protection Agency said in an 18-page outline of the rule. In foliar applications, the pesticide is put on the plant.

Honeybees pollinate plants that produce roughly a quarter of the food consumed by Americans, and beekeepers travel around the country with managed hives to help the process.

The rule, due to be published in the Federal Register on Friday, would apply to pesticide applications to blooming crops where bees have been contracted to pollinate and would cover 76 active ingredients used in pesticides, including a popular class of insecticide known as neonicotinoids.

Earlier this month, the U.S. Department of Agriculture said that honeybees had disappeared at a staggering rate over the last year. Losses of managed honeybee colonies hit 42.1 percent from April 2014 through April 2015, up from 34.2 percent for 2013-2014, and the second-highest annual loss to date, according to the USDA.

Commercial beekeepers reported adverse effects from pesticide applications to roughly 20,000 bee colonies pollinating almonds and roughly 2,000 colonies contracted to pollinate blueberries in 2014, and there are claims of tens of thousands more colonies similarly affected, the EPA said.

Beekeepers, environmental groups and some scientists say neonicotinoids, or neonics - used on crops such as corn as well as on plants used in lawns and gardens - are harming the bees.

But Bayer, Syngenta and other agrichemical companies that sell neonic products say mite infestations and other factors are the cause.

The White House has formed a task force to study the issue, and the EPA said Thursday it continues to conduct "chemical-specific risk assessments for bees" and will consider additional product-specific mitigation efforts.

Critics said the plan falls short because it does nothing about neonics used in seed treatments, applied before the seed is planted. The seed treatments have long-term damaging effects on bees as the neonics persist in the environment, critics say.

"EPA needs to take the next step and ban these poisoned seeds," said Lori Ann Burd, environmental health director for the Center for Biological Diversity. (Reporting by Carey Gillam; editing by Peter Galloway and Jonathan Oatis)

CHASING JUICE-STABLE PIGMENTS IN MUSCADINE

P. Perkins-Veazie, NCSU

Muscadine (*Vitus rotundifolia*) grapes are high in ellagic acid and other phenolic compounds with human health related bioactives (Lee and Talcott, 2004). Their pigments were characterized some years ago and in black or purple fruit consist primarily of 3,5 diglucosides of delphinidum, malvidin, cyanidin, petunidin, and peonidin, mostly located in the peel (Conner and MacLean, 2013). While the 3,5 sugar linkage helps with thermal resistance, the linkage interferes with formation of stable polymeric pigments and increases the ability of the pigments in juices or wines to brown. Malvidin and peonidin are more stable than petunidin, cyanidin, or delphinidin, and many muscadine cultivars are low in malvidin compared to *V. vinifera* cultivars 'Noble' grape was found to have less of this browning, and it has been speculated that this could be due to the higher content of malvidin 3,5 diglucoside as a percent of total pigments, and/or the ratio of malvidin to delphinidin or malvidin to delphinidum, peonidin, and cyanidin. Goldy et al. (1986) characterized the anthocyanins found in muscadines, *V. vinifera*, and crosses of *V. rotundifolia* and *V. vinifera*. Pigments found in the crosses included monoglucosides of peonidin, cyanidin, delphinidin, malvidin, and petunidin. The stability of muscadine juice appears to depend on the relative amount of malvidin glucosides and possibly that of peonidin (Goldy et al., 1989; Conner and MacLean. 2013). The general biosynthesis pathway for these pigments showing relationships of the anthocyanins is given in Figure 1.

Integration of other species, such as *V. munsoniana* or *V. popenoei*, into *V. rotundifolia* has been done to increase malvidin content and acylated pigments to provide color stability (Conner et al., 2013; Goldy et al. 1986). Detection of these individual pigments

can only be made using chromatography, and not by total monomeric anthocyanin analysis by spectrophotometer. This poses a serious problem for breeders who need to screen large populations of fruit, and for those doing analysis, where there may only be a few berries from a seedling, and only peels can be used to best concentrate pigments.

As the first part of this SFRC funded grant, we screened available 2014 material from Georgia and North Carolina. Grape peels were freeze dried and pulverized using a GenoGrinder. The GenoGrinder is similar to a miniature ball mill and samples of 30 g to as little as 0.2 g can be powdered and recovered quickly, with 20 samples run in 2 minutes. Powder was extracted with acidified methanol (1% HCl) and run by HPLC equipped with photodiode array using a solvent system of methanol.

Muscadine cultivars and numbered lines showed the classic 6 digit chromatogram (Fig 2A), consisting of 3,5 diglucosides of delphinidin, cyanidin, malvidin, peonidin, and petunidin. Of these, malvidin is considered most stable and delphinidin least stable. Then we ran material from musconia and popenoei backgrounds. These profiles were slightly more complex. However, the *V. rotundifolia* x *V. vinifera* crosses showed a much more complex pattern of anthocyanins (Figure 2B). Here, the 3,5 glucosides are at the right side, and malvidin monoglucosides are on the left. Several of the malvidin monoglucosides show acylation, most likely with p-coumaric acid. When compared to the anthocyanin peaks published by Goldy et al. 1986, most of the peaks were similar. However, at least six peaks need mass spectrophotometry to better determine likely anthocyanins, especially those that may be acylated. We were able to verify the presence of monoglucoside anthocyanins in ten genotypes/selections (Table 1). Fennel's 3 way (50% *V. popenoei*) contained 56% malvidin 3,5 diglucoside while DVIT 2970 (100% *V. popenoei*) contained 74% peonidin 3,5 diglucoside.

Browning/loss of anthocyanin

In the 1970's, a series of experiments were done as a chromatography alternative for screening muscadines for anti-browning properties. With this method, muscadine peels were homogenized, a subset heated at 76 to 90 °C and the heated and unheated samples extracted with acidified methanol (Flora, 1978). The ratio of absorbance at 520/420 was determined, with the ratio decreasing with heat treatment and with instability of pigment. While a spectrophotometer and water bath is needed for this system, it does provide a means to screen material for potential stable anthocyanins.

Utilizing Flora's technique, frozen Cowart muscadine grape juice from a local grower was heated at 80 or 90 °C for 0 to 3 h in a water bath, extracted with acidified methanol, and absorbance determined at 520 and 420. The same extracts were also run using the monomeric anthocyanin pH differential method (Giusti and Wrolstad, 2001), a widely used method for evaluation of pigment content in many small fruit. Loss of pigment occurred in as little as 30 min at 80 °C; a 1 h heat treatment usually resulted in a 20% loss of anthocyanin and was reasonably well correlated with the 520/420 ratio (Figure 3). We then tested the browning method with purees from purple/black selections and found loss with heating was similar to that of the Cowart juice. Further, color changes in the extracts were visually apparent even before running on spectrophotometer. What was particularly interesting was that purees from selections/genotypes that contained monoglucosides of malvidin or peonidin usually lost less than 15% pigment (UCO 6-38 gained pigment with heating), and the total amount of anthocyanin was not correlated with anthocyanin stability. More extensive heating may be needed for these genotypes to further determine relative anthocyanin stability. In summary, the pH differential method combined with 1 h heat at 80 °C was very effective in detecting anthocyanin loss in

muscadine grapes high in delphinidin and low in malvidin. Pigment loss was less than expected in selections with high amounts of malvidin and low amounts of delphinidin. Additionally, it is clear through HPLC analysis and with heating tests that anthocyanin monoglucosides that help with color stability have been successfully moved into muscadine crosses with other *Vitis* species.

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Table 1: Anthocyanin loss (% of total) and relative amount of primary pigments as % of total anthocyanin in muscadine selections of different % *Vitis* species.

Genotype/cultigen	<i>V. vinifera</i>	<i>V. munsoniana</i>	<i>V. popei</i>	% pigment loss after heating	Total Anthocyanin	delphinidin 3,5 DG	malvidin 3,5 DG	peonidin 3,5 DG	peonidin 3-G	malvidin 3-G
					mg/100g dwt		%			
UCD 6-38	50	0	0	-13	1052	6	20	17	5	7.5
NC CH11-25:64	50	0	0	1	5127	44	17	2	0	0.3
Marsh	0	100?	0	5	1527	29	10	4	0.9	2
NC 74 CO 49-10	62	0	0	8	2775	24	31	12	0.1	1
Fennel's 3 way	0	25	50	11	1010	12	56	8	0	0.2
DVIT 2970	0	0	100	na	4446	0.2	24	74	0.2	0.4
DRX 60-40	12	0	0	16	1676	24	8	0.5	0.5	2
FL-66	0	50	0	28	2209	66	3	2	0	0.1
NC CH11-26:45	50	0	0	37	2822	49	13	3	0	0.1
NC CH 11-26:116	50	0	0	39	4188	51	10	1	0.1	0.5
Olmo U67-2	0	100	0	56	3510	60	5	2	0	0.03
Majesty	0	0	0	26	1185	68	3	1	0	0
NC 1066	0	0	0	26	1120	64	4	3	0	0

G and DG are glucoside (mono) and diglucoside, respectively.

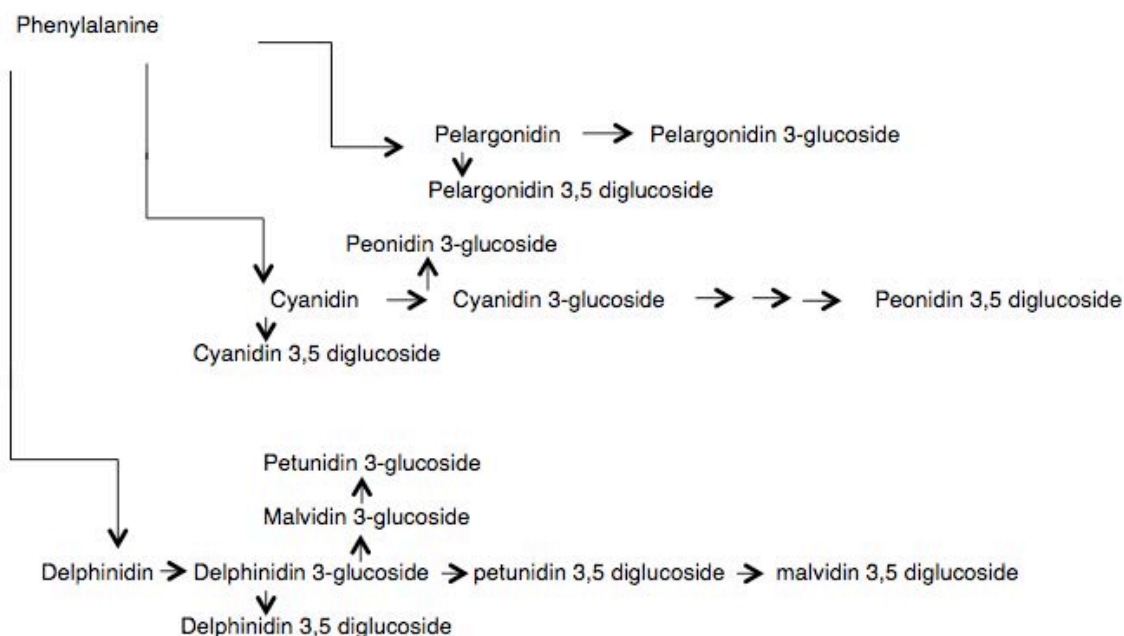


Figure 1: Formation of anthocyanins (cyanidin, peonidin, delphinidin, malvidin, and petunidin 3,5-diglucosides found in muscadine grapes and of monoglucosides found in other *Vitis* species.

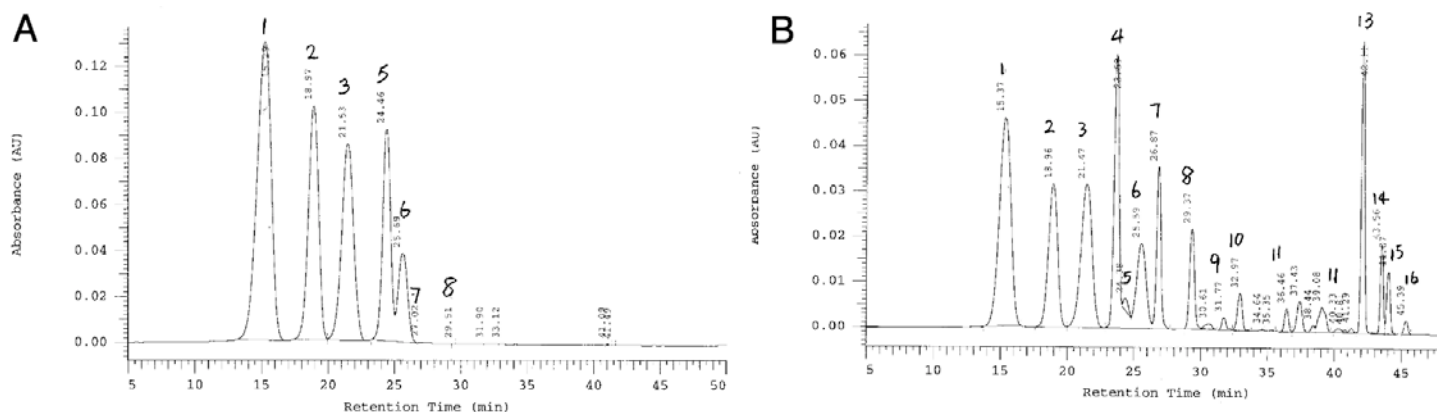


Figure 2: Chromatogram (HPLC) showing classic anthocyanin peaks for muscadine peel (in this case, from 'Noble') (A). Peaks 1,2,3,5,6,7 are delphinidin 3,5 diglucoside, cyanidin 3,5 diglucoside, petunidin 3,5 diglucoside, peonidin 3,5 diglucoside, malvidin 3,5 diglucoside, cyanidin 3 glucoside, respectively. Peak 8 is most likely petunidin 3-glucoside (Goldy, 1989). (B) Anthocyanin peaks for DRX 60-40, a *V. rotundifolia* x *V. vinifera* cross. Note the extra peaks (9-16) to the right side. Peak 9 is peonidin 3- glucoside and peak 10 is malvidin 3 glucoside (Goldy, 1989); peaks 13-16 are most likely acylated pigments, commonly found in red *V. vinifera* grapes.

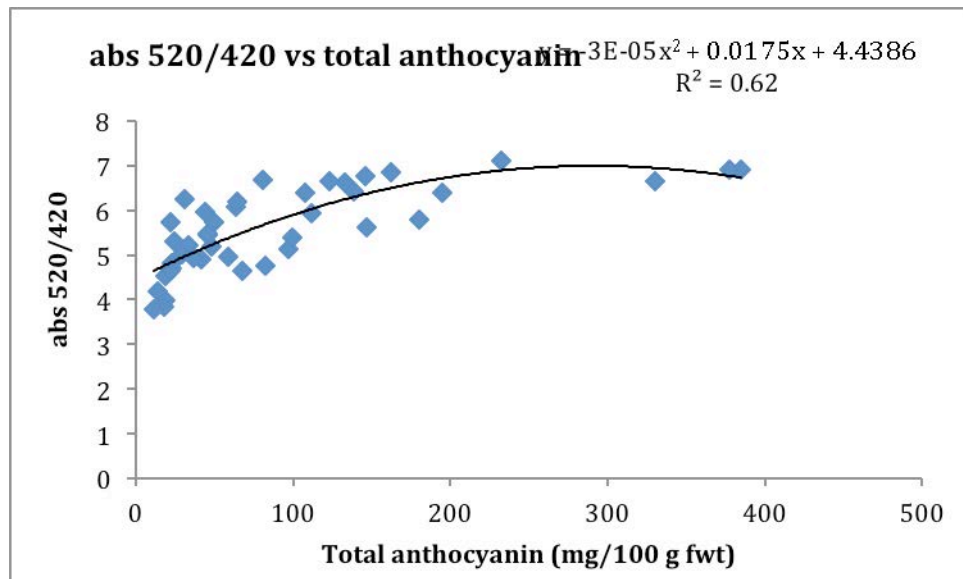


Figure 3: Relationship of browning methods abs 520/420 vs total monomeric anthocyanin pH differential method in grape purees subjected to none or 1 hour heating at 80 C.

Monitoring Flower-to-Fruit Development of Blackberries

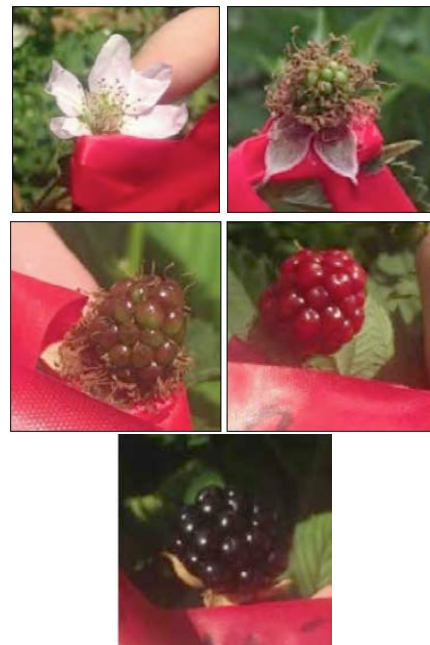
Gina Fernandez

Previous published in The Bramble: Newsletter of the North American Raspberry & Blackberry Association, Spring 2015

Last summer, Dr. Gina Fernandez at NCSU, NC Extension agent Daniel Shires, and an intern set up a demonstration at Killdeer Farm in Kings Mountain, NC to track flower-to-fruit development. They collected data and posted weekly updates on the Team Rubus blog (<http://teamrubus.blogspot.com/>).

Having this kind of information can be helpful for growers in estimating when berries will be ripening, and then scheduling pickers and markets – though weather is obviously a huge and unpredictable factor, and growing degree days/heat units will impact the number of days that are needed for each cultivar. Relative days-to-ripe between varieties may be much more reliable than absolute dates.

To study flower-to-fruit at your farm, all you need is some flagging tape, a permanent marker, and some simple record keeping. *If you plan to collect data at your farm in 2015 and may want to participate in online multi-farm data collection, please contact gina_fernandez@ncsu.edu.*



The photos show some of the stages of fruit development. From top left: Full Bloom, Green, Red-green, Red, Shiny Black

How to Monitor Flower-to-Fruit

Step 1. When you think the field is in full bloom, find a flower that is on the outside upper

portion of the canopy. This fruit will most likely continue to be easy to spot if not buried too far into the canopy.

Step 2. Cut a 12" piece of flagging tape and put the date on one end of the flag (we used numbers for our trials instead of dates as you can see below)

Step 3. Tie the flagging tape around the base of the flower. Do at least 3 flowers from the same variety at the same time. As the demonstration showed, it is easy to lose fruit to various mishaps along the way.

Step 4. Return to the flower on a weekly basis and monitor. Record stage of plant development. The photos show examples of stages.

Step 5. Keep the records so you can compare how long it takes each year. After a few years, you will have a good idea how long it should take a variety to ripen at your location once it is in full bloom. If you don't want to keep track of all of the stages, make sure at the least that you have a date for full bloom and shiny/dull black.

Also be sure to let your pickers know that they should NOT pick this fruit.

Looking at Data

In the NC demonstration in 2014, the number of days from flower to fruit were: Natchez 51; Osage 44; Ouachita 51; Navajo 51; Von 58.

Data collected in John Clark's research fields in Clarksville, AR shows the following multiple-year averages for peak bloom to peak harvest:

1997-1999: Ouachita 43; Apache 56; Arapaho 38; Navajo 55.

2000-2002: Ouachita 53; Apache 60; Arapaho 45.

2008, 2009, 20011: Osage 54; Apache 59; Natchez 49.

Sample Chart for Data Collection

Variety:				
Field location flower 1:				
Field location flower 2:				
Field location flower 3:				
Stage	flower 1	flower 2	flower 3	Comments
Full bloom				
Petal Fall				
Green				
Green-Red				
Red-Green				
Red				
Shiny black				
Dull black				

How about Raspberries?

Raspberry breeder Courtney Weber from Cornell says, "As far as I know there is no comparable data for raspberries available." He notes that bloom period of summer varieties is very compressed, and that temperature plays such a large role and is so variable across the many varieties and growing locations. However, raspberry growers may also want to give this a try, and certainly may want to record first bloom, peak bloom, first harvest, and peak harvest over a period of years to help manage their harvest and markets.

Much of this article is taken from <http://teamrubus.blogspot.com/> and a presentation by Daniel Shires at the SE Regional Fruit and Vegetable Conference, January 2015.

2015 NARBA Berry Pricing Survey

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Over the last few weeks, NARBA has been conducting an online survey of grower's berry

prices, concentrating on prices for Pick-Your-Own and direct market retail sales. Thank you to all who participated! Below is some analysis of the responses, and on the next two pages is a chart of the responses organized by state and region, somewhat edited and standardized. Responses for black raspberries and red raspberries were combined, as there were not major differences.

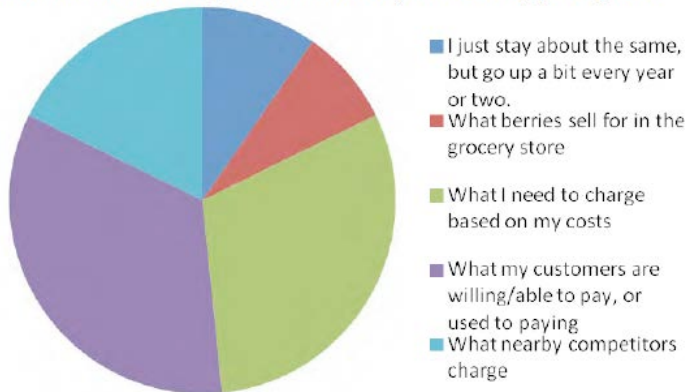
Who took part in the survey? Along with current NARBA members, we invited past members and others on our email lists to participate. About 70 growers responded, of whom 65% were current members. Most respondents were experienced growers: 45% had been growing more than 10 years, 13% for 6-10 years, 21% for 3-5 years, and 9% for less than 3 years.

What were overall pricing strategies? As the pie chart below shows, most respondents did

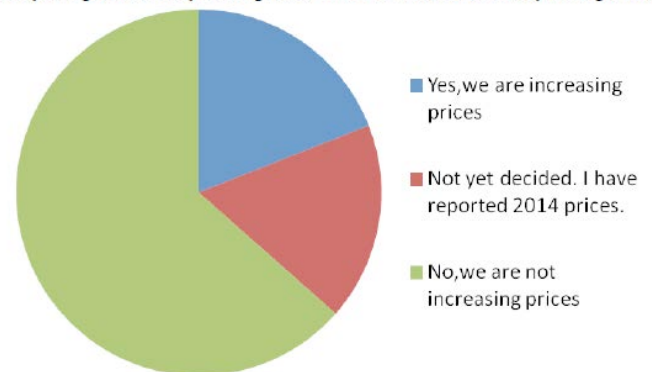
not plan to increase prices this year. The most important considerations in setting prices reported were about equally divided between what customers are willing/able to pay and what the grower needed to charge based on cost. When growers indicated second or third choices, these two were also the predominant choices.

What is customers' buying power? For the question asking growers to describe their customer base as upper income, middle income, lower income, or mixed. 48% said "middle income," and 37% said "mixed," with only 5% reporting "high income" and 10% "low income." (A few others just getting started couldn't yet say.) The sample size in the survey was not large enough to tease out pricing differences based on this factor.

What is the most important factor for you in setting your prices?



Do your prices this year represent an increase over last year's prices?



2015 NARBA Berry Pricing Survey

This chart summarizes responses received 5/25-6/8. Duplicate responses or those lacking prices have been removed. Format of units and prices has been standardized, and some additional info provided by some growers, e.g. on wholesale pricing or reduced prices for larger purchases, has been omitted. They are roughly grouped by region. There were some difficulties creating this table, so apologies if any errors have crept in. When black raspberry prices differ from red raspberries, or are the only raspberries reported, they are indicated as BR.

State	PYO Raspberries	Pre-picked Raspberries	PYO Blackberries	Pre-picked Blackberries
SOUTH AND SOUTHEAST				
AL			\$18/gal	\$25/gal or \$4.00/pt
AR	\$3.00/pt	\$4.00/pt	\$14/gal	\$18/gal
GA		\$4.50/1/2 pt		\$4.00/1/2 pt,
GA			\$10/gal	\$4.00/qt, \$15/gal
GA				Premium: \$22/gal, Culled: \$12/gal
MS			\$14/gal	\$16/gal
NC				\$4.00/pt, \$8.00/qt
NC	\$3.00/1/2 pt, \$2.50/lb	\$3.50/½ pt.	\$4.00/pt, \$5.00/lb	\$5.00/pt
NC		\$4.00/pt BR		\$4.00/pt
NC	\$3.00/lb	\$5.00/lb	\$2.00/lb	\$2.50/lb
OK			\$4.00/lb	\$5.00/lb
OK		\$10.00/lb	\$2.00/lb	\$4.00/lb
OK			\$3.00/lb	\$3.00/pt
SC			\$4.00/lb	\$6.40/lb
SC			\$2.50/lb	\$6.50/qt, \$24/gal
TN	\$5.00/lb	\$6.00/lb	\$4.00/lb	\$5.00/lb
TN		\$5.00/pt	\$20/gal	\$25/gal
TN				\$10/gal
TX			\$10/gal	
TX			\$2.75/lb	\$5.00/lb
MIDWEST				
IA	6.50/lb	7.00/pt	6.50/lb	7.00/pt
IL		\$5.00/pt, \$8.00/qt		
IL	\$5.00/pt			
IL		\$4.25/pt, \$5.25/pt BR		
IN			\$5.00/lb	\$6.00/lb
IN	\$8.00/lb BR	16.00/lb BR		
IN	\$3.00/lb	\$6.00/qt, \$3.50/pt		
KS			\$2.50/lb	\$3.99/lb
KY		BR: \$4.00/½ pt \$14.00/qt, \$45.00/gal		
MI	\$4.00/lb.	\$5.00/lb		
MI	\$1.75/pt	\$3.00/pt		
MI	\$3.00/pt, \$3.50/pt BR		\$3.00/pt	
MN	\$12/gal	\$3.50/pt	\$12/gal	\$3.50/pt
MN	\$3.95/pt	\$5.50/pt		
MO				\$4.50/lb
MO			\$2.75/lb	\$3.25/lb
MO	\$4.00/pt	\$5.00/pt	\$3.00/lb	\$4.50/lb
MO			\$4.00/lb	\$6.00/lb
OH	\$5.00 lb	\$6.00/lb	\$5.00/lb	\$6.00/lb
OH		\$5.00/½ pt (organic)		
OH	\$4.00/lb BR	\$5.00/lb		
OH	\$3.95/lb	\$9.50/qt		
OH	\$3.25/lb	\$3.50/pt	\$3.25/lb	\$5.00/pt
OH	\$2.95/pt or lb	\$4.75 - \$5.00/pt	\$2.95/lb	\$4.25 - \$5.00 (2013)

State	PYO Raspberries	Pre-picked Raspberries	PYO Blackberries	Pre-picked Blackberries
WI	\$4.00/½ pt, \$5.00/½ pt BR			
WI		\$4.00/pt		
WI	\$4.00/pt	\$5.00/pt		
MID-ATLANTIC				
MD		BR: \$4/pt wholesale		2.75/½ pt, \$3.75/pt wholesale
MD	\$4.79/lb	\$5.09/pt, \$6.09/pt BR	\$2.79/lb	\$4.10/pt
PA	\$4.99/lb, \$4.50/lb >10 lbs	\$3.99/½ pt, \$5.99 pt	\$3.99/lb	\$4.99/pt
PA		\$5.00/½ pt \$5.00 - \$6.00/½ pt BR		\$4.00/½-pt \$6.00/pt when plentiful
VA		\$5.00/6-oz clamshell \$10.00/16-oz clamshell \$6.00/6-oz clamshell BR		\$4.00/6-ounce clamshell \$7.00/16-ounce clamshell
VA		\$5.50/½-pt		\$5.50/½-pt early, \$6.00/pt peak season
NORTHEASTERN STATES AND CANADA				
CT	\$4.50/lb	\$3.75/½-pt		
ME	\$4.00/pt	\$5.00/pt		
ME	\$3.25/pt	\$4.50/pt		
ON	\$3.00/lb		\$3.00/lb	
ON		\$3.75/pt		
WEST				
CO	\$6.00/lb, \$6.50/lb BR (org.)			
NV		\$8.00/pt, \$9.00/pt BR		\$8.00/pt
OR		\$3.00/1/2 pt. \$30/flat		
UT	\$3.00/lb	\$30.00/6-lb flat	\$3.00/lb	

What are growers charging? There are many factors involved in pricing, and this survey sample size is pretty small, so it is hard to use it to compare to your own prices. Growers who are at the low end of the scale, however, especially within their own region, may want to take a look at their prices to see if they are undercharging and undervaluing their berries!

For PYO raspberries: The most commonly used unit was by the pound. The average price was \$4.02/lb, the highest price was \$6.00/lb, and the lowest was \$2.50/lb. For those who charged by the pint, the average price was \$4.07.

For pre-picked raspberries: The most common unit was the pint, with an average price of \$4.78/pint. The average price of those selling per pound was \$4.92/lb.

For PYO blackberries: The pound was the most common unit, with a high price of \$6.50/lb, a low price of \$2.00/lb and an average price of \$3.48/lb.

For pre-pick blackberries: Most people charge by the pound. The average price was \$4.80/lb, with a high of \$7.00 lb and a low of \$2.50/lb. For

those who charged by the pint, the average price was \$5.44/pint, with a high of \$8.00 and a low of \$3.00. A number of growers also charge by the gallon, especially in southern states.

Growers' Comments

There was no way to fit these comments into the chart on the next page, though they might have been even more insightful if still associated with the growers prices and location. They still make fascinating reading and a source of ideas and insights.

- There is a segment of our customer base that is quite affluent and usually aghast at how relatively low our prices are. However, they are often not local and when they come back, they bring friends and family from some distance.
- So far pricing has not been a problem until we have a glut. May do a sale or something to sell more a certain times.
- Black raspberries are such a rarity in this area. Once the restaurant owners sample a free half-pint of berries they often buy

all I have. Could probably demand more, and may do so next year.

Pricing Comments

- This is a hobby for me. I recall a grower at the NARBA meeting in February stating you can't make money growing these. I come close to breaking even and have lots of fun with my berries.
- Since I am the only organic grown farmer in the area, I can charge and get higher prices than the few competitors. I try to have double the price that my competitors list and I always sell out.
- We have so many we are trying a bulk rate to get rid of more berries. This is our first year trying this. I check grocery store prices for a close number to charge.
- We also sell blueberries, and usually run out of market before product on all. Very little local competition for the blueberries or raspberries, but much on the blackberries. On good years, we can run out of market on them, then must adjust price down and/or take some to auction.
- Cost of maintaining, replacing and/or adding variety has gone up therefore the price increase. We also monitor what our customers are willing and able to pay.
- I price at whatever I would pay, and check what other markets charge. The economy has been hard for people in our area.
- Our crops look very good for this year and since our most important factor on setting price is covering costs, we do not feel a need to increase.
- Since we have been one of the higher priced operations in our area and our second highest factor is what customers are willing to pay, we felt it wise to not increase this year.
- I explain with regards to price increase labor is up, inputs are up, and invasive species increase pest management costs and grading labor.
- We are going back to the CSA model next year so this year we are improving our fields and adding a lot of plants. The pricing we're doing is just to get product off the plants while they develop.
- We try to retain consistent pricing so customers know what to expect.
- Since I don't know what my true productions costs are, I simply attempt to maximize product quality and charge high prices. I sell small packages to people who see selectivity in that. Customer allegiance and high praise for my berries tells me I'm doing something right.
- We have a limited amount of berries and have all the customers that we need and sell all we grow. We provide extra services and have very nice quality berries. Price has not been a factor. The grocery stores in the area have specials that are cheap but our customers like our berries due to their quality and the opportunity to come out to the farm and pick with their children.
- Most of our berries are sold wholesale, so if we remove inventory from our whole- sale for a retail customer, we expect to receive a better price. We anticipate about \$4.00- 4.50/lb for our wholesale berries.
- Prices for all berries increase by \$1.00/lb for farmer markets or other off-farm sales.
- I try to be the highest-price product because I think I have the highest quality product.
- We are the only organic raspberry U-pick in our area, but even so we find that it makes business sense to price competitively with local conventional

growers. We don't yet have commercial pack/processing options for excess crop, so we make up for that with a consistently high local U-pick base. We also supply berries to small organic CSAs at a discount, but we have not yet gotten a very good handle on what that price point should be.

- We do a PYO club membership – cost is \$5 per customer. This covers all PYO crops and entitles them to 10% off. We find this very effective in bringing people back often.
- We provide buckets and ties for the pickers, a playground, sandbox, and general childcare. We also have a picnic area and flowers for the ladies when they leave. Our prices are higher than our competitors because of our berry quality and the customer service we provide.
- We package pre-picked [blackberries] in 1 and 2 lb clamshells with our label on them.
- Pricing by the pound is absolutely necessary. We find that a pound is an indisputable quantity whereas a quart or other means of measurement is somewhat subjective.
- Our customer base is almost exclusively high-end restaurants in Bowling Green, KY and Nashville, TN These restaurants really pursue the “farm-to-table” concept and actually post our farm name as their source.
- I deliver large quantities of berries to farm marketers located near Washington, DC. I have the cost of hauling, but they take care of retail sales.
- My berries are grown using organic methods. Most of my customers seem pleased with the price and some leave a tip as my farm stand is self-serve.
- I price U-pick at 1/2 Walmart price and retail at 80% of Walmart.

- Early and late season we pick blackberries in half pints and sell at the same prices as red raspberries. But in peak summer- time harvest we pick in 1 pint containers and sell at the same price. We try our darnedest not to prepack

Caneberry Chores Seasonal Checklist Summer 2015

This list was developed by Dr. Gina Fernandez, Small Fruit Specialist at NC State University. Chores and timing may be somewhat different in your area or for your cropping system.

Plant growth and development

- Fruit development for floricanes fruiting types
- Rapid primocane growth
- Flower bud development for primocane fruiting types later in summer
- Floricanes senesce

Pruning and trellising

Floricanes-fruiting raspberries:

- May need to adjust primocane numbers if canes are too thick (i.e. remove less vigorous primocanes at their base)
- Train primocanes to the trellis
- Pinch black raspberry primocanes at 2 to 3 ft. to promote lateral growth

Primocane-fruiting raspberries:

- Train primocanes within a trellis to hold canes erect

Erect floricanes -fruiting blackberries

- Tip the new primocanes when they are about 6” to 12” below the top wire of the trellis to encourage lateral branching

- Continue tipping at monthly intervals to maintain desired branching and height of canopy (laterals should reach top wire)
- Prune out spent floricanes after they have produced fruit, do not thin out primocanes until mid-to late winter
- Train primocanes to trellis to minimize interference with harvest. Shift trellises or V trellises make this relatively easy

Trailing floricanes-fruiting blackberries

- Train new primocanes to middle of trellis, on the ground in a weed-free area, or temporarily to trellis outside of fruiting area (depends on trellis type)
- Cut back side shoots to 18" (after dormancy in cold climates)
- Remove spent floricanes after harvest

Primocane-fruiting blackberries

- Tip canes at 3-4 ft to increase branching and fruiting potential.

Weed management

- Mow along side of row to maintain the width of the bed to 3 to 4 ft.
- Weed growth can be very vigorous at the same time as the bramble crop peaks.
- Weed control is best done earlier in the season before harvest commences.
- Mow middles regularly to allow pickers to move through rows easily.

Insect and disease scouting

- Scout and treat for these pests:
 - Spotted winged drosophila
 - Raspberry crown and cane borers (canes girdled and wilt)
 - Psyllid
 - Two-spotted spider mite
 - June beetle
 - Japanese beetles
 - Stink bugs
 - Fire ants
- Scout for diseases

- Botrytis
- Rusts
- Orange felt (orange cane blotch) (blackberry)
- Sooty blotch (blackberry)
- Orange rust
- Powdery mildew
- Double blossom (blackberry)
- Cane blight (blackberry)
- Powdery mildew

Water management

- Raspberry and blackberry plants need about 1-2 inches of water/week; this amount is especially critical during harvest.
- Give plants a deep irrigation after harvest.

Nutrient management

- Take leaf samples after harvest and send to a clinic for nutrient analysis
- Blackberry growers should give plants additional nitrogen after harvest, check with your local recommendations.

Harvest and marketing

- The busiest time of the year for a blackberry or raspberry grower is the harvest season. Each plant needs to be harvested every 2-3 days. For larger plantings, that means fruit is picked from some part of the field every day of the week.
- Pick blackberries when shiny black for shipping. Those that are dull black are fully ripe and suitable for PYO only.
- Pick directly into clamshells with absorbent pads, or for PYO use clean cardboard flats, take-home baskets, or sanitized re-usable containers.
- Keep harvested fruit in shade and move into coolers as soon as possible to lengthen the shelf life of the fruit.
- Use forced-air precoolers for best removal of field heat.

- Store at 32 to 34°F and 95% relative humidity.
- Freeze excess fruit for jam, juice, or wine.
- Keep good records of what cultivars are picked, what fields are picked and when they are picked. Good record keeping will help you predict harvest potential in the future.
- Keep your customers informed with social media.

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