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## Broadleaf and Grass Weed Control in Strawberry using Preemergence Herbicides

Dr. Nathan S. Boyd Associate Professor, UF/IFAS Gulf Coast

#### Previously published in Berry Vegetable Times, Summer 2016

Broadleaf and grassy weeds are a serious issue in many strawberry fields. The extent of the problem and the types of weeds present vary with the soil type, topography, weather, management practices, and field history. For example, growers with effective fallow programs generally have far fewer weeds during the strawberry season then those that do not adequately manage their fields during the fallow perriod. In recent years strawberry growers report increased issues with weeds largely due to the loss of methyl bromide. The majority of growers now fumigate with combinations of chloropicrin and 1,3-dichloropropene but weed control with these products tends to be weak. Dimethyl disulfide (Paladin) is another option that can effectively control nutsedge but is generally weak on broadleaf weeds and annual grasses. Metam potassium and metam sodium tend to have more activity on broadleaf weeds and grasses than any of the other products mentioned above

I recommend the use of preemergence herbicides in fields where weeds are an issue. These herbicides are applied following fumigation immediately prior to laying the plastic mulch. Read the herbicide label for application instructions and recommendations. The three most common products used in strawberry include flumioxazin (Chateau), napropamide (Devrinol), and oxyfluorfen (Goal). I have listed trade names as examples but there are many different products with the same active ingredient. Products such as Chateau and Goal are more effective if the soil is not disturbed following application. No herbicide will control all weed species. Table 1 summarizes the general effectiveness of three herbicides on some common weed species. Table 2 lists the effectiveness of the same herbicides on common grasses.

**Table 1:** The effectiveness of some common str awber r yher bicides on common br oadleaf weeds of strawberryfields. The ratings are largely based on the experience ofweed scientists at the University of Florida (Nathan Boyd,Peter Dittmar, and William Stall) as well as researchconducted throughout the state.

	Chateau	Devrinol	Goal
Black Medic	Suppression	Poor	Poor
Carolina Geranium	Suppression	Poor	Poor
Common Purslane	Excellent	Good	Excellent
Common Ragweed	Excellent	Good	Good
Eclipta	Good	Poor	Excellent
Evening Primrose	Excellent	Good	Excellent
Florida Pusley	Good	Good	Good

**Table 2:** The effectiveness of some common str awber r yher bicides on common gr ass weeds of strawberry fields.The ratings are largely based on the experience of weedscientists at the University of Florida (Nathan Boyd, PeterDittmar, and William Stall) as well as research conductedthroughout the state.

	Chateau	Devrinol	Goal
Barnyardgrass	Good	Excellent	Excellent
Broadleaf signalgrass	unknown	Excellent	Fair
Crabgrass	Good	Excellent	Fair
Goosegrass	Good	Excellent	Fair
Panicum spp	Good	Excellent	Poor

In some cases a combination of herbicide products can be applied to increase the number of species controlled. This is recommended in fields with serious weed control problems. Of course, the herbicide cost also plays a role in making any decision. I have listed an approximate price for the most common herbicides applied under the plastic in Table 3 but price will vary between years, dealers, trade names, etc. At best, the prices listed in table 3 can be used as a rough guide.

Table 3: Efficacy of	of some common	her bicide p	r oducts
and estimated cos	t.		

Herbicide	Spectrum	Estimated \$/acre
Chateau	Excellent Broadleaf Good Grass	\$17
Goal	Excellent Broadleaf Fair Grass	\$10
Devrinol	Fair-Good on Broadleaf Excellent on Grass	\$96
Goal + Devrinol	Excellent on Broadleaf Excellent on Grass	\$106

Herbicide selection should be made based on the following information:

- Type and number of weeds historically present in the field
- Crops that will be planted following strawberries
- Cover crops that will be planted following strawberries
- Herbicide products available at your local agrochemical dealer
- Herbicides applied in the past. When possible rotate active ingredients to slow the development of herbicide resistance.
- Cost

In summary, preemergence herbicides are an important weed management tool in strawberries. There are a limited number products registered for use and as such care must be taken to rotate active ingredients when possible. One potential approach is to use different herbicides during the fallow period then the ones you use during the cropping period. The three most common herbicides applied by growers in the state of Florida control different species and the best option will depend on the weeds present in your field. If you have any questions on herbicide use in strawberries contact Dr. Nathan Boyd located at the Gulf Coast Research and Education Center.

# Broad Mites and a Few Other Pests in Blackberries

Dr. Justin Renkema Assistant Professor, UF/IFAS Gulf Coast REC

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During May and June, 5 blackberry fields in central Florida were visited every few weeks to scout for insect and mite pests. Four fields were in Hillsborough County and one in Sumter County. Blackberry plantings at Gulf Coast Research and Education Center (GCREC) were also scouted.

Broad mites – were found at one site in primocane blackberries (PrimeArk®). Broad mites have a wide host range in tropical areas, including many vegetables, fruit trees and ornamental species. Broad mites in blackberries is a recent occurrence, with reports in AR, CA, NC, SC, PA, IL, IN since 2007. Arkansas has been the "hot spot" for damage and research on management.

Broad mites are very small and live primarily on new, expanding leaves. Adults are about 0.2 mm or 1/125" long, and can be seen using a 20X hand lens. Adults are football-shaped, whitish to light yellow to amber colored, with a lighter stipe that runs down the length of the body. Eggs are attached on leaves and appear to have scattered white tufts on the upper surface.



Adult broad mite



Broad mite egg

Broad mites cause the terminal leaves to become malformed, distorted and highly cupped. Leaves turn a brownish, coppery color. Fruit can also be affected, but no damage to fruit was seen in blackberries in Florida. Cupped leaves are evident at about 20 adult broad mites per leaflet. Populations can increase rapidly – at the visited site, few broad mites were observed on May 26, but by June 17 broad mites were numerous and damage was severe.



Broad mite damage on primocane blackberry – June 17, 2016

The only currently registered miticide for blackberries is Zeal (etoxazole). A 2ee recommendation for Agri-Mek SC (abamectin) has been obtained for broad mites in Florida and other affected states. In a trial in Arkansas, both products reduced broad mite numbers 7 daysafter-application to zero or nearly zero. Research in Arkansas is also being conducted on the efficacy of Microthiol Dispress (micronized sulfur), JMS stylet oil, and releases of predatory mites. If feasible, affected branches should be pruned out, removed from the field and destroyed before a miticide application.



Broad mite damage on primocane blackberry - June 17, 2016

Flower beetle - Euphoria sepulcralis, a drab, black and white scarab beetle, was observed in 3 fields, and in relatively high numbers at one field. A few of the beetles were in flowers and covered in pollen, but most were feeding on ripe fruit. There are three beetles on the berry in the picture below, but on some berries we found 6 or 7 beetles. Ripe berries with beetles were mushy and unmarketable, and the beetle may also be responsible for destroying flowers resulting in no berry formation as seen in this picture. Little is known about the biology or management of this beetle. It has a large host range and can be a corn and rose pest, as well as cause damage to mango and avocado in South Florida.



Flower beetles on blackberry

Cane borer - At one field and at GCREC, we observed a few girdled canes, with new shoots that were wilting and dying. This damage is likely caused by raspberry cane borer - Oberea bimaculata or O. affinis - a long-horned beetle, although we have not observed beetles or been able to rear them from affected canes. The adult female beetle creates the two girdles and inserts an egg in the stem between the girdles. The oviposition wound is a D-shaped hole adjacent to one of the girdles.

Cane borer populations can be kept in check by removing the stem an inch below the bottom girdle and burning or destroying it. Chemical controls are



Cane borer damage on blackberry shoots

#### not necessary.

Leafrollers – were common in most fields and were likely strawberry leafroller, Ancylis comptana. Rolled leaves with webbing can be peeled apart to reveal a small caterpillar or worm. The caterpillar is greenish-yellow with a dark colored head. Sometimes the caterpillar has pupated and the adult moth may have emerged - particularly if the entire rolled leaf is brown and dry.

Removing and destroying affected leaves will help reduce leafroller populations. As in strawberries, chemical control is infrequently recommended as plants can withstand some damage without affecting growth or yields. For more information, see: http://entnemdept.ufl.edu/creatures/FRUIT/strawbe rry\_leafroller.htm

# Automated Strawberry Picker: One Step Closer To Reality

Rosemary Gordon

Previously published online in <u>Growing</u> <u>Produce</u>, July 2016

Harvest CROO (Computerized Robotic Optimized Obtainer) Robotics is developing and testing the latest technology for agricultural robotics – an automated strawberry picker to help alleviate the labor shortage facing



The Pitzer Wheel, named after co-founder and inventor Bob Pitzer, is an autonomous and continuous picking wheel on an automated strawberry picker that is being developed by Harvest CROO.

labor shortage facing the industry. Its first U.S. Patent approval marks a milestone accomplishment.

The Pitzer Wheel, named after co-founder and inventor Bob Pitzer, is an autonomous and continuous picking wheel on the apparatus. "Our biggest differentiator has always been that growers will not have to change the way they currently grow strawberries," said Gary Wishnatzki, co-founder of Harvest CROO and owner of Wish Farms based in Plant City, FL. "Now, with the patent of the Pitzer Wheel, what I believe to be the heart of the invention, we have another strong distinguishing factor."

The picking wheel uses conservation of motion as opposed to a "pick and move" motion. It picks the initial berry, then rotates to expose the next claw to pick another berry at a rapid rate. Once a strawberry is picked by one of the six foodgrade silicon claws, it is rotated to the top of the wheel. From there, the berry is carefully placed into a cup that will transfer it to a central location on the machine, where it will be inspected for a second time, before placement in consumer packs. This is all done without human intervention.

Check out the video of the Pitzer Wheel in action.

Since the start of the project, Harvest CROO has filed a total of six patents. Current patentpending applications include GPS navigation techniques, an altitude control system, and leaf manipulation concepts for harvest. The company's vision technology, which is used to identify the perfect ripe berry, is being held as a trade secret.

Harvest CROO is currently fundraising in preparation for the next round of prototypes.

# Bird Damage Plagues Most Fruit Growers

Gary Gao

Previously published online in <u>Growing Produce</u>, July 2016



This grower uses overhead bird netting system to protect the fruit at a blueberry farm in northeast Ohio. (Photo credits: Gary Gao, The Ohio State University)

Fruit loss to bird depredation can be a serious challenge to fruit growers whether they grow 1 acre or 1,000 acres. A recent comprehensive survey showed that bird damage to five fruit crops including 'Honeycrisp' apples, winegrapes, blueberries, and sweet and tart cherries in five U.S. states including California, Michigan, New York, Oregon, and Washington was estimated at \$189 million. After many years of trials and tribulations by commercial companies, growers, and researchers, we are still searching for the truly cost effective method of bird damage control in fruit plantings.

Overhead bird netting, though quite costly and difficult to install, is still a better method in preventing fruit loss to hungry birds. Quite a few berry growers who I work with in Ohio have adopted this method. The overhead bird netting looks like a huge bird cage over the entire fruit planting. There are a few companies that carry bird netting systems. One of them is the Crop Protection Netting by Smart Net Systems.

Bird netting may be expensive to install, but many fruit growers found it an essential part of their fruit production. I have seen Ohio growers who covered as little as half an acre and as big as 10 acres. I was told that a blueberry grower in Canada covered 20 acres of blueberries with bird netting. Many different noise-making devices, such as cannons and radios, have been used for years to scare birds away with limited success.

Growers found out that birds quickly get used to these devices. When I was visiting a blueberry farm in Ohio, I found one robin sitting right on a cannon, enjoying the view of that beautiful blueberry farm. The loud noise from the cannon scared the daylights out of me and other pickers, but did not seem to bother that bird at all!

Another idea, according to professor Marvin Pritts of Cornell University, is "an electronic device (Bird-Gard) that emits digitized, speciesspecific bird distress calls. The device can be programmed for certain species, and the calls occur at random intervals to reduce the risk of habituation. It is very difficult for birds to habituate to their own distress calls, so this device can be very effective."

Still, another possible choice is air dancers. Growers have tried this option with mixed results. Steve Beilstein of The Blueberry Patch in Lexington, OH, likes the approach so far. "I attended a presentation on bird damage control at a conference. Air dancer was mentioned as one of the possible options. I bought three of them," Beilstein said.

He said he has had some success with this approach. He also uses it as a marker to direct his customers. Well, killing two birds with one stone.



Andrew (left) and Steve Beilstein use an air dancer, pictured in the background, as a bird-scaring device at The Blueberry Patch in Lexington, OH. (Photo credit: Gary Gao)

Other visual devices, such as fake owls, hawk kites, Mylar tape, scare-eye balloons, and lights may also work somewhat for a limited time. But birds will eventually acclimate to them.

Many fruit growers are looking for that one magic spray that will take care of the problem. Unfortunately, there are few chemical repellents that are available to fruit growers. Quite a bit of research has been done with methyl anthranilate as a chemical repellent. Methyl anthranilate is commercially used as a grape flavor additive in the food industry. There are methyl anthranilate formulations available to blueberry and strawberry growers. I was told that this chemical is supposed to irritate birds by affecting their pain center.

Growers have had varied success with it. Some growers like it a lot while others do not think much of it. I have not done any controlled studies myself. My limited observation has been that the effect of the sprays typically lasts several days. The whole field smells "grapey." Well, you take that for what is worth. Falcons have been used as a bird deterrent on the West Coast with excellent results. Growers with a planting of 50 acres or more may find this approach cost-effective. I have seen these trained falcons at trade shows. They are amazing creatures. Unfortunately, they don't pencil out for small fruit plantings.

Despite many years of research, there isn't one legal chemical spray that solves bird problems for fruit growers. Growers will have to try a combination of many different approaches to prevent bird damage. What works for one year may not work in another year.

Netting is highly effective, provided that the netting is very tight and is put up before birds arrive. If netting is too cost prohibitive, a combination of other measures will need to be tried until an effective method is found for your farm.

# Celebrating the highbush blueberry's centennial

Sharon Durham Agricultural Research Service

Previously published online in <u>Fruit Grower</u> <u>News</u>, June 2016



You probably don't think there's anything special about picking up a tub of fresh blueberries at the store or the farmers market — the quality of the product, the freshness and the convenience of it all. If only you had to go pick the fruit from the wild yourself!

Up until 1911, blueberries had to be picked from the wild, and bushes were dug from the wild that might or might not survive when transplanted elsewhere. True domestication — reproduction at the will of the grower and breeding to improve desirable traits — was beyond reach until USDA botanist Frederick Coville unlocked a longstanding mystery in 1910.

Coville compared plant growth in alkaline, neutral, and acid soil. By 1908, he had pretty much dropped alkaline soil from testing. He had remarkable success with very-low-pH (or acid) soil. While most plants prefer soil at the neutral pH 7, blueberries only thrive at pH 4.5 to 4.8. That blueberry plants require moist, acid soil was a novel concept at the time and one that Coville, in his later years, would consider his greatest discovery.

In 1911 came his landmark first successful crosses between two wild blueberries — one highbush and one lowbush — that had been selected for their superior qualities from a pasture in Greenfield, New Hampshire. These were named Brooks (highbush) and Russell (lowbush). The crosses he made in 1911 and 1913 resulted in 3,000 hybrids. Another cross of Brooks with a wild blueberry named Sooy in 1912 resulted in another 3,000 seedlings. Four years later, in 1916, and exactly a century ago, the first commercial cultivated crop of highbush blueberries was harvested.

Much of Coville's original wild breeding stock came from his partnership with Elizabeth White of Whitesbog, New Jersey, whose family owned a large cranberry farm, and a horticulture enthusiast herself. She acquired high-quality bushes by recruiting blueberry pickers and local residents to locate and tag desirable largefruited bushes for use as parental stock, and then she personally went out and brought them back to Whitesbog and made them available to Coville.

Coville's historical records provide a fascinating look at USDA research efforts that took blueberries from a crop picked from the wild and sold for 14 cents a quart in 1912 all the way to a commercially grown crop of more than 553 million pounds worth more than \$817 million (2014). Worldwide, current blueberry production is greater than 1.9 billion pounds.

His crosses continued to be released for many years after his death in 1937 and included Bluecrop, Blueray and Earliblue—varieties still popular today with gardeners and commercial growers. By 1942, of the 18 blueberry varieties offered by Eastern growers, 14 were the result of Coville's selection efforts or breeding. His varieties remain part of the pedigree of most varieties grown today.

And the USDA research program Coville founded in New Jersey is still carrying out critical research to protect and expand the U.S. blueberry crop. Consumer demand continues to increase at a rapid pace, thanks not only to the blueberry's taste and versatility but also to its health benefits.

Let's wish the highbush blueberry a happy 100th birthday!

# Genetics Key To Keeping Strawberry Growers Out Of The Red?

Paul Rusnak

### Previously published online in <u>Growing Produce</u>, August 2016

According to a <u>recently published study</u>, a team of researchers has found genetic markers they believe can lead them to develop strawberry cultivars that are more resistant to angular leaf spot, a pathogen that can destroy up to 10% of Florida's \$300 million-a-year strawberry crop in years with multiple freezes. Genetic markers are short sequences of DNA used to identify a chromosome or nearby genes in a genetic map.

In two years of field trials, researchers at the UF/IFAS Gulf Coast Research and Education Center – along with colleagues from Oregon, The Netherlands, and Canada – found places in strawberry genes that show promise for developing cultivars that are resistant to this disease.



UF/IFAS Associate Professor Vance Whitaker and a team of researchers found genetic markers they believe can lead them to develop strawberry cultivars that are more resistant to angular leaf spot. Photo courtesy of UF/IFAS

"We got closer to finding the exact gene," said <u>Vance Whitaker</u>, a UF/IFAS strawberry breeder and Extension specialist, who led the study. UF/IFAS scientists developed a genetic marker that can track the resistance to angular leaf spot during the breeding process with about 95% accuracy. They will use this data to predict which seedlings will be resistant to the pathogen and only test those in the field that should be resistant.

The impacts of the researchers' findings could stretch far beyond Florida.

Angular leaf spot, caused by the bacterium Xanthomonas fragariae, is the only major bacterial strawberry pathogen, according to the study. It was first described in Minnesota in 1960 and has since been reported in most major strawberry producing regions worldwide. The pathogen is primarily spread by rain or the use of overhead irrigation.

Currently, some growers treat the disease with chemicals containing copper, Whitaker said. Chemical treatments are mildly effective but may result in as much yield loss as the disease itself, he said. Thus, UF/IFAS researchers are looking for strawberry cultivars resistant to angular leaf spot. Whitaker said it will likely be a few years before scientists can commercialize a strawberry cultivar that is completely resistant to angular leaf spot.

# What U.S. Consumers Think About Florida Blueberries

Tori Bradley

#### Previously published online in <u>Growing Produce</u>, September 2016

Growers of Florida blueberries are fortunate to begin their marketing efforts during a unique window, from March to May, when Florida blueberries are the first and only domestically grown blueberries available to U.S. consumers. In order for Florida growers to receive the benefits of this unique marketing window, consumers must first specifically demand Florida blueberries when they make purchases during this season.

TOP STATES CONSUMERS PREFER TO PURCHASE BLUEBERRIES FROM



Graphic courtesy of UF/IFAS PIE Center

As part of a Specialty Crop Block Grant funded by the Florida Department of Agriculture and Consumer Services, the UF/IFAS Center for Public Issues Education (PIE) in Agriculture and Natural Resources conducted an online survey of consumers in 31 states to determine the demand and knowledge that exists for Florida blueberries.

Consumers reported they would prefer to buy blueberries from Florida more than they would prefer to buy from any other of the Top 10 blueberry-producing states, including Georgia and California. However, almost all of the consumers reported wanting to buy blueberries during the summer months when Florida blueberries are no longer available. When consumers were asked to identify the Florida blueberry season, only 16% believed they could do so correctly. Of this 16%, most did not know to begin looking for Florida blueberries in March. Half of that very small group knew Florida blueberries are available in April and March. Eighty-six percent of the surveyed consumers were unsure of the season overall. These consumers also were unsure if they had ever seen Florida blueberries in stores and many people reported not looking for Florida blueberries at all when making purchasing decisions.

#### **Gain Leverage With Labels**

This research also asked consumers about their preferences surrounding blueberry packaging. Most consumers preferred a one-pint package size, with the two-pint package size being the next preferred size. Very few people preferred the six-ounce package. As for labels, the overwhelming majority said they would choose the package displaying the Fresh from Florida label over any other label that displayed the growing location of the berries, even if that location was in Florida.

IDEAL PACKAGE SIZES CONSUMERS WANT TO BUY



Graphic courtesy of UF/IFAS PIE Center

All of this information shows that, while consumers want to buy their blueberries from Florida, they do not know when to look for them. They also do not actively seek out information about where their blueberries are grown. In order to generate demand for Florida blueberries, consumers need to be made more aware of the season so they can begin asking for them in their local stores and seeking them out in farmers' markets when the season begins. Better labeling of the growing location, along with the Fresh from Florida label, will make it easier for consumers to identify Florida blueberries in stores. More consumer outreach through blueberry organizations in the state will aid in educating consumers about the Florida blueberry season, with the intent of encouraging consumers to specifically seek out Florida blueberries.

#### **A Healthy Perspective**

The study also looked at the knowledge that consumers have about the health benefits of blueberries overall. Most people know blueberries can help ward off heart disease and cancer, but are less aware about benefits like blueberries helping to revert the aging process, improving memory, and strengthening eyesight. This shows that, along with educating consumers about the Florida season, demand for blueberries overall may be increased by educating consumers on the many benefits they receive by eating blueberries.



Graphic courtesy of UF/IFAS PIE Center

Consumers are eager to buy Florida blueberries. Through better education about the Florida blueberry season, making Florida products more visible in stores, and increasing consumer knowledge about blueberry health benefits, consumer demand for Florida blueberries should increase.

This research is part of a larger project that will culminate in a marketing plan for the Florida blueberry season. The marketing plan will address the challenges mentioned in this article and will serve to help producers and marketers reach more consumers with their Florida blueberries. The marketing plan is scheduled to be presented at the <u>Florida Blueberry Growers</u> Association Fall Meeting.

For more information about this research and other Florida blueberry-related research, visit <u>PieCenter.com</u>.

# New Berry Releases Hit Marks For High Yields, Mechanical Harvest

**Christina Herrick** 

Previously published online in <u>Growing Produce</u>, October 2016

Two new berry varieties — a highbush blueberry and thorneless blackberry — developed by USDA <u>Agricultural Research Service</u> (ARS) geneticist Chad Finn and his colleagues at the <u>Horticultural Crops Research Unit</u> in Corvallis, OR, were recently released to the public.



'Baby Blues' is a new ARS blueberry cultivar. (Photo credit: Chad Finn, USDA-ARS)

'Baby Blues,' a cultivar released in cooperation with the Oregon State University Agricultural Experiment Station and the Washington State University Agricultural Research Center, is making its debut during the 100th anniversary of the first cultivated blueberry crop to go to market.

"Baby Blues' is a vigorous, high-yielding, smallfruited, machine-harvestable highbush blueberry with outstanding fruit quality. It's well-suited for those processing markets that require a small fruit size," Finn says. "Baby Blues' should offer growers and processors an alternative to the low-yielding 'Rubel' highbush blueberry, and it may thrive in milder areas where northern highbush blueberries are grown."



'Columbia Giant' is a new ARS blackberry cultivar. (Photo credit: Chad Finn, USDA-ARS)

Finn also developed a new blackberry named 'Columbia Giant.' This thornless, trailing blackberry cultivar came from the same breeding program as 'Baby Blues' and was also released in cooperation with the Oregon State University Agricultural Experiment Station.

"This cultivar is a high-quality, high-yielding, machine-harvestable blackberry with firm, sweet fruit that, when processed, is similar to or better in quality than fruit from the industry standards 'Marion' and 'Black Diamond," Finn says. "Due to its extremely large size, however, 'Columbia Giant' will most commonly be sold in the fresh market."

'Columbia Giant' is adaptable to areas where other trailing blackberries successfully grow.

"Two Tasty New Berries From ARS" was published in the <u>September 2016</u> issue of *AgResearch*Magazine

# 2015-2016 Botrytis Fungicide Resistance Profiles

Mengjun Hu and Guido Schnabel Clemson University

Gray mold, caused by the fungus *Botrytis cinerea*, drives the spray program for strawberry

and grape producers. The disease is most severe during years with rainy and cloudy periods during bloom or during harvest and can cause devastating preharvest and postharvest losses.

The Schnabel lab at Clemson University offers a free service for growers in the Southeastern U.S. to identify ineffective and effective spray materials. Producers send freeze-damaged flowers in early spring to the lab for analysis and within a week will receive a report that details resistance and disease management advice. Producers also may send cotton swabs with spores from infected fruit later in the season. Instructions for sampling and shipment are online at the 'Clemson Schnabel lab' website or can be obtained from the authors (schnabe@clemson.edu). This resistanceprofiling program has been offered to small fruit growers in the Southeast since 2011 and is supported by commodity boards as well as the Southern Region Small Fruit Consortium.

 Table 1: Origin and number of gray mold samples (and corresponding isolates) collected from strawberries and grapes during the 2015-2016 season

	Strawberry	Grape
North Carolina	31 (294)	2 (14)
South Carolina	27 (206)	
Virginia	21 (210)	
Maryland	10 (86)	
Georgia	4 (35)	2 (22)
Louisiana	1 (5)	
Delaware	1 (10)	
Total	101 (846)	4 (36)

During the 2015-2016 season, we received and processed a total of 105 gray mold samples. each represented by 10 isolates. Of the 105 samples, 101 were from strawberry (mostly flower samples but some fruit samples), the other 4 were from grape fruit (**Table 1**). In total, 846 strawberry isolates from 7 states and 36 grape B. cinerea isolates from 2 states were tested (Table 1). We examined sensitivity to thiophanate-methyl (t-methyl; Topsin M), cyprodinil (Scala; one of two components of Switch), fenhexamid (Elevate), iprodione (Rovral), boscalid (major botryticide component of Pristine), fludioxonil (major botryticide component of Switch), penthiopyrad (Fontelis), and fluopyram (major botryticide component in

Luna Sensation and other Luna products). Resistance to t-methyl was found virtually in all strawberry samples, while resistance to fluopyram, penthiopyrad or fludioxonil was rarely detected (**Fig. 1**). Resistance to fludioxonil has been increasing over the last years because Switch has been used a lot. Most of the *B. cinerea* isolates from grape samples also were resistant to t-methyl, but resistance to fludioxonil, penthiopyrad, and boscalid was not detected (**Fig. 1**).



Figure 1: Frequency of isolates resistant to fungicides.

For strawberry producers we recommend to use thiram and captan as the core program especially prior to bloom if sprays are needed. During bloom, growers should alternate other FRAC codes and use each no more than twice per season (for example, if you used Fontelis once and Merivon once you maxed out the 2 applications for FRAC 7 fungicides). Resistance profiles vary from farm-to-farm and year-to-year and it would be in the producer's best interest to sample gray mold populations and request the resistance profile through Clemson University every year. Table 2 shows the active ingredients and FRAC codes of fungicides currently registered for gray mold management on strawberries. Many of them are also registered for grape production. Please use our spray guide at www.smallfruits.org and download our MyIPM smartphone app (MyIPM-SED) for more information.

Table 2: Active ingredients and FRAC codes of fungicides										
used for strawberry	used for strawberry gray moto management									
	Active ingredient(s)	FRAC code(s)								
Elevate	fenhexamid	17								
Captevate	fenhexamid; captan	17; M4								
Ph-D and generics	polyoxin D zinc salt	19								
Rovral and generics	iprodione	2								
Fontelis	penthiopyrad	7								
Kenja and generics	isofetamid	7								
Luna Privilege	fluopyram	7								
Luna Sensation	fluopyram; trifloxystrobin	7; 11								
Merivon	fluxapyroxad;	7; 11								
	pyraclostrobin									
Pristine	boscalid; pyraclostrobin	7; 11								
Luna Tranquility	fluopyram; pyrimethanil	7; 9								
Scala	pyrimethanil	9								
Switch	cyprodinil; fludioxonil	9; 12								
Thiram and generics	thiram	M3								
Captan and generics	captan	M4								

## Fruit Quality Comparisons in Southern Highbush and Rabbiteye Blueberries: Organic Acids

Rachel A. Itle and D. Scott NeSmith

We are measuring fruit quality attributes to assess the differences and similarities between southern highbush (SHB) and rabbiteye (RE) varieties that currently make-up a large part of Georgia's blueberry market. Here we discuss the organic acid profile current results for our research trials.

For our study, fruit of major varieties of SHB and REs grown in Georgia were analyzed using an HPLC (high performance liquid chromatography) system. This system allows us to separate and to characterize the individual chemicals forming part of a product. For example, if we are talking about blueberry sweetness, we normally talk about soluble solid content (°brix) measured using a refractometer. However, if we use an HPLC, the amount of sugars can be also characterized by the individual sugars (profile), glucose, sucrose, and fructose, which constitute the blueberry fruit. This method was also used to characterize and to quantify the different antioxidants present in blueberries. Here, we characterized and quantified the individual acids (profile) constituting the different SHB and RE blueberry varieties. The goal of this experiment was to characterize, to quantify and to compare

the organic acids present in blueberry fruit for the major SHB and RE grown in Georgia.

#### **Fruit Collection**

Fruit were harvested at approximately 50% ripe from SHB varieties and from RE blueberry varieties grown at the UGA Blueberry Research Farm near Alapaha, GA from April to July 2014. Varieties were selected to represent an array of fruit ripening times throughout the harvest season (early, middle and late season ripening). SHB varieties included: 'Camellia', 'Emerald', 'Farthing', 'Legacy', 'Meadowlark', 'Rebel', and 'Star'. Rabbiteye varieties included: 'Alapaha', 'Brightwell', 'Ochlockonee', 'Powderblue', 'Premier', 'Tifblue', and 'Vernon'. Fruit were harvested from three plants (replicates) per variety. Fruit were collected in pint clamshells and packed in open plastic bags in coolers on ice and were transported back to the Griffin campus. Fruit were stored in freezer bags at approximately -15°C (5°F) until processing.

#### **Fruit Quality Chemistry**

Fruit were frozen for approximately seven to eight months before chemical analyses were performed at the UGA Agricultural and Environmental Services Laboratories in Athens. Measurements included total titratable acids (TTA), soluble solids content (°brix), total monomeric anthocyanin concentration (mg/L cyanidin-3-glucoside equivalents), sugar profile, organic acid profile, antioxidant profile, and sugar acid ratio (°brix /TTA and total sugars/total acids). In this article, we will discuss the organic acid profile. We looked at comparisons between SHB and REs overall, and comparisons across all the varieties regardless of type. **Results** 

Organic acids function in the cellular metabolism of the plant and are involved in processes such as photosynthesis. In fruit, some acids are present in large concentrations and many acids are present in trace amounts, and are major components that contribute to a fruit's flavor and aroma (1). We measured six organic acids commonly found in fruits and vegetables (oxalic, citric, tartaric, ascorbic, succinic, and malic acid) and total acids present in each of the varieties. There were statistically significant differences observed across all of the varieties for all of the individual acids measured and for total organic acids.

#### Oxalic Acid

Oxalic acid combines with calcium and iron in the body to form oxalates. Oxalates can be found in urine and feces and the accumulation of calcium oxalates can form large kidney stones. Fruits and vegetables with high concentrations of oxalic acid can be problematic for individuals prone to developing kidney stones (2).

Out of the six organic acid concentrations measured, oxalic acid concentrations were the lowest. When comparing the two blueberry types for oxalic acid content, all SHB varieties had values below the detectable, measurable, limit on the HPLC machine for this compound. However, all RE varieties examined had detectable values. The highest concentration was identified in 'Brightwell' (0.0141mg/g) and the lowest concentration was identified in 'Vernon' (0.0044mg/g).

## Citric Acid

Citric acid occurs naturally in vegetables and in fruits such as citrus fruits, apples pears and peaches (1). It influences the tart, or sour, taste. Citric acid is also commercially produced and is used in a variety of industries including pharmaceutical, chemical, textile, beverage, and food. Some of its uses for food items include a preservative for ciders and wines, a flavor for products such as beverages, an emulsifier for products such as ice cream and cheese, and a pH adjuster for products such as jam and jelly (3). Citric acid also acts as a protective acid which prevents kidney stone formation and splits up stones as they are starting formation. The higher citric acid concentrations in one's urine content, the greater protection the body has against the formation of new kidney stones (5).

It is present in SHB and REs. SHB citric acid concentration was eight times higher than REs citric acid concentration (1.69mg/g vs 0.19mg/g). Overall, citric acid was the most prominent of the identified acids in the SHB varieties, accounting for over 25% of the total acid concentration. Although citric acid constituted a larger percentage in HB fruit in another report, (75%) (5), it was also the most prominent of the acids examined in the SHB. Across all varieties, the highest blueberry cultivar was 'Emerald' ( 4.25mg/g) and the lowest was 'Alapaha' (0.09mg/g). Within SHB cultivars, it is noted that only 'Rebel' contains levels similar to those of all REs evaluated in this test.

## Tartaric Acid

Tartaric acid is one of the predominant acids in grapes (1) and the taste of tartaric acid is a pronounced, sour taste (6). Tartaric, citric, and malic acids are enhancers that affect iron absorption for humans (7). However, the majority of tartaric acid is not absorbed in the human body (6), either undergoes bacterial digestion in the large intestine or it is excreted in the form on an insoluble salt such as calcium tartrate (8).

Tartaric acid was not statistically different across the two types: SHB and REs (0.09mg/g vs 0.06mg/g). The highest variety across both types was 'Legacy' (0.21mg/g) and the lowest was 'Ochlockonee' (0.02mg/g). The only varieties that were not estimable and below the detection limit for tartaric acid were 'Meadowlark' and 'Rebel'.

## Ascorbic Acid (Vitamin C)

Ascorbic acid, commonly known as vitamin C, is found in numerous fruits and vegetables including citrus fruits, leafy greens, and berry fruits. Ascorbic acid is used in the body for repair and for growth. It is used in collagen production which is a protein used to make skin, blood vessels, and ligaments. This acid is also necessary for teeth and bone maintenance and for wound healing. Some studies suggest that vitamin C may also contribute to helping to protect against arterial damage; to lower the rate of skin, breast, and cervical cancer; and to protect against macular degeneration (9).

REs were higher for ascorbic acid (vitamin C) than SHB by 23% (0.16mg/g vs 0.13mg/g). The highest concentration of ascorbic acid in SHB was identified in 'Emerald' (0.18mg/g) and the lowest was in 'Rebel' (0.09mg/g). Similarly, in REs the highest was 'Tifblue' (0.30mg/g), which was also the highest for ascorbic acid concentration across all varieties including SHB. The lowest concentration was identified in 'Alapaha' (0.07mg/g) and this as well was the lowest across all varieties.

### Succinic Acid

Succinic acid is a naturally occurring acid in vegetables such as beets, asparagus, and broccoli; and is also present in meat and cheese. It is also used in condiments and meat products to both control the pH level and to enhance the flavor. Succinic acid is perceived as very bitter. It is also described as having a savory umami taste, which is a Japanese word with the meaning of deliciousness (6).

RE varieties were reported to have over 3.5 times higher concentration than SHB (3.77mg/g vs 1.06mg/g). Overall, succinic acid was the most prominent of the identified acids in the RE varieties, accounting for over 30% of the total acid concentration. Although succinic acid constituted a larger percentage in RE fruit in another report, (50%) (5), it was also the most prominent of the acids examined in the REs. Overall, the variety with the highest concentration of succinic acid in REs, 'Tifblue' (6.48mg/g), was 2.6 times higher than the variety with the highest concentration in SHB, 'Emerald' (2.41mg/g). The variety with the lowest concentration was 'Legacy' (0.22mg/g).

### Malic Acid

Malic acid is predominantly found in apples, pears and peaches (1) and it is perceived to be sour when by itself or in combination with citric acid (6). Malic acid plays a critical role in ATP production in the body. ATP is an energy source that is used to make amino acids in the body, which form proteins. Fibromyalgia is a degenerative disease that is associated with the break-down of muscle proteins. Recent research suggests that a supplement of magnesium and malic acid for patients with this crippling disease shows a reduction of muscle pain (10).

There were no significant differences between the two types of cultivars for malic acid, however, there were some differences between varieties across types. The highest and the lowest concentrations across types were observed for 'Premier' (0.27mg/g) and 'Alapaha' (0.03mg/g) within RE varieties. Overall, varieties within SHB did not show differences.

## Total Acids

RE varieties had approximately double the amount of acids measured as compared to SHB (12.2mg/g vs 6.7mg/g). The highest concentration of total acids was identified in 'Tifblue' (20.31mg/g), which was almost doubled the SHB with the highest concentration of total acids, 'Emerald' (12.5mg/g). Within SHB, varieties concentrations of acids were not statistically different, but in REs it was observed extremes as represented by 'Tifblue' and 'Alapaha' (5.3mg/g).

Variety <sup>C</sup>	Oxa	alic <sup>D</sup>	Cit	ric	Tarta	aric	Asc	orbic	Suco	cinic	M	alic	Tota	I Acids
SHB	_													
'Camellia'	0.0020	E EF	2.36	в	0.10	BA	0.12	CD	0.32	С	0.20	BAC	6.3	DC
'Emerald'	0.0031	ED	4.25	Α	0.15	BA	0.18	BC	2.41	BC	0.16	BAC	12.5	BDC
'Farthing'	0.0025	ED	1.69	CB	0.09	BA	0.15	BCD	1.40	BC	0.08	BAC	6.7	BDC
'Legacy'	0.0017	E	0.95	CD	0.21	Α	0.09	CD	0.22	С	0.05	BC	5.8	D
'Meadowlark'	0.0026	ED	1.11	CBD	0.02	в	0.16	BCD	1.16	BC	0.10	BAC	5.9	D
'Rebel'	0.0014	E	0.25	CD	0.07	BA	0.09	CD	1.26	BC	0.07	BAC	5.0	D
'Star'	0.0018	E	1.22	CBD	0.01	в	0.10	CD	0.74	BC	0.07	BAC	4.4	D
RE	_													
'Alapaha'	0.0047	EDC	0.09	D	0.09	BA	0.07	D	1.51	BC	0.03	С	5.3	D
'Brightwell'	0.0141	Α	0.21	CD	0.08	BA	0.24	BA	2.31	BC	0.13	BAC	15.0	BAC
'Ochlockonee'	0.0083	BDC	0.14	D	0.02	в	0.15	BCD	3.94	BAC	0.16	BAC	13.1	BDAC
'Powderblue'	0.0098	BAC	0.19	CD	0.05	BA	0.13	CD	6.46	Α	0.08	BAC	15.3	BA
'Premier'	0.0065	BEDC	0.10	D	0.03	BA	0.09	CD	1.41	BC	0.27	Α	7.0	BDC
'Tifblue'	0.0115	BA	0.35	CD	0.10	BA	0.30	Α	6.48	Α	0.24	BA	21.3	Α
'Vernon'	0.0044	ED	0.23	CD	0.07	BA	0.12	CD	4.27	BA	0.08	BAC	8.5	BDC
SHB	0.0022	В	1.69	Α	0.09	Α	0.13	В	1.06	В	0.10	Α	6.7	В
RE	0.0085	Α	0.19	В	0.06	Α	0.16	Α	3.77	Α	0.14	Α	12.2	Α

Table 1. Fruit quality chemistry traits of organic acids<sup>A</sup> measured in southern highbush (SHB) and rabbiteye (RE) varieties harvested during the 2014 season<sup>B</sup>.

<sup>A</sup> Values expressed in mg/g fresh weight.

<sup>B</sup> Fruit was harvested from UGA Blueberry Research Farm near Alapaha, GA.

<sup>c</sup> For all fruit quality chemistry traits, each variety sample number (n)=3. For Farthing, n =2. For type comparisons, SHB, n=20; for REs, n=21.

<sup>D</sup> The Tukey mean separations do not include all significant comparisons. Additional pairs that are significantly different: 'Ochlockonee' and 'Meadowlark'.

<sup>E</sup> Italicized values indicate variety average concentration was not detected. Concentrations were calculated using the detection limit of 0.1 mg/ml.

<sup>F</sup> Differences examined using Tukey HSD ( $P \le 0.05$ ).

#### **Organic Acids Summary Points:**

- Organic acids are involved in key functions in the plant such as photosynthesis. In fruit some acids are present in large concentrations and many acids are present in trace amounts, and are major components that contribute to a fruit's flavor (constituting the bitter, sour, and tart tastes) and aroma.
- Some acids may have important roles in the human body including prevention of kidney stones (citric acid); repair and growth, maintenance of teeth and bone, healing of wounds (ascorbic acid); and reduction of muscle pain in fibromalyagia (malic acid).
- REs are higher than SHB for 3 of the 6 organic acids measured (oxalic, ascorbic, and succinic) and for total acid concentration. REs had approximately twice the amount of total acid than did SHB.
- 4. The largest difference between the two blueberry types for acid concentrations was for citric acid, with SHB citric acid

concentration eight times higher than REs citric acid concentration. **References** 

- Pussam, H.C., I.C. Karapanos, and A.A. Alexopolos. 2011. The biological basis of fruit quality. p.5-38. In: M.A. Jenks and P.J. Bebeli (eds.) Breeding for Fruit Quality. Wiley-Blackwell, Ames, IA.
- Coe, F. L., A. Evan, and E. Worcester.
   2005. Kidney stone disease. The Journal of clinical investigation. 115(10): 2598-2608.
- Apelblat, A. 2014. Introduction, p.1-6. In: Citric acid. Springer International Publishing, New York, NY.
- Penniston, K. Citric acid and kidney stones. University of Wisconsin Hospital Metabolic Stone Clinic, University of Wisconsin Health Clinical Nutrition. Accessed 28 Sept. 2016 <https://www.uwhealth.org/files/uwhealth/do cs/pdf/kidney\_citric\_acid.pdf >.
- Ehlenfeldt, M. K., F.I. Meredith, and J.R. Ballington. 1994. Unique organic acid profile of rabbiteye vs. highbush blueberries. HortScience, 29(4): 321-323.

- Rubico, S.M. 1993. Perceptual characteristics of selected acidulants by different sensory and multivariate methods. Doctoral dissertation, Oregon State University. 200pp.
- Insel, P., D. Ross, K. McMahon, and M. Bernstein. 2016. Trace Minerals, p.502-541. In: Nutrition, 6<sup>th</sup> ed. Jones & Bartlett Learning, Burlington, MA.
- Garcia-Perez, I., J.M. Posma, E.S. Chambers, J.K. Nicholson, J. C. Mathers, M. Beckmann, J. Draper, E. Holmes, and G.Frost. 2016. An analytical pipeline for quantitative characterization of dietary intake: Application to assess grape intake. Journal of Agricultural and Food Chemistry, 64(11): 2423-2431.
- 2013. Vitamin C (ascorbic acid). University of Maryland Medical Center. Accessed 28 Sept. 2016 < http://umm.edu/health/medical/altmed/suppl ement/vitamin-c-ascorbic-acid>.
- Abraham, G. E., and J.D. Flechas. 1992. Management of fibromyalgia: rationale for the use of magnesium and malic acid. Journal of Nutritional Medicine, 3(1): 49-59.

## **Researchers Unravel Genetic Ancestry Of Cultivated Strawberry**

**Rosemary Gordon** 

### Previously published online in <u>Growing Produce</u>, August 2016

Scientists from the University of New Hampshire have unlocked a major genetic mystery of one of the ancestors of cultivated strawberry. A genetic analysis conducted by New Hampshire Agricultural Experiment Station researchers, which took four years to complete, aims to improve modern cultivation efforts of strawberry growers. The focus of the University of New Hampshire (UNH) research is one of cultivated strawberry's wild ancestors, *Fragaria iinumae*. Strawberry species have seven unique chromosomes. Like humans, this species of strawberry has two sets of chromosomes, as opposed to the cultivated strawberry, which has eight sets chromosomes and is among the most genetically complex plants. The UNH study relied on samples of this strawberry species collected on the Japanese Island of Hokkaido by an American-Japanese expedition in 2004 that included UNH plant geneticist <u>Thomas Davis</u>.



University of New Hampshire scientists constructed a linkage map of the seven chromosomes of the diploid Fragaria iinumae, which allows them to fill in a piece of the genetic puzzle about the eight sets of chromosomes of the cultivated strawberry.

UNH scientists, including Davis and experiment station researcher Lise Mahoney, constructed a linkage map of the seven chromosomes of the diploid *Fragaria iinumae*, which allows them to fill in a piece of the genetic puzzle about the eight sets of chromosomes of the cultivated strawberry. The cultivated strawberry is believed to trace its genetic ancestry to as many as four diploid ancestral strawberries, one of which is *Fragaria iinumae*.

"Many people are trying to understand the ancestry of the cultivated strawberry so that they can better understand traits associated with specific genetic markers, such as fruit quality, flowering habits, and resistance to diseases," Mahoney said. "Defining the genomes of the cultivated strawberry's wild ancestors will ultimately help guide the use of genetic information in breeding for a better cultivated strawberry."

The research on *Fragaria iinumae* is the second time experiment station researchers have mapped the genes of an ancestral diploid strawberry of the cultivated strawberry. In 2011, UNH researchers were part of a team that sequenced *Fragaria vesca*, another diploid ancestor of the cultivated strawberry. This reference sequence immediately became an indispensable resource in strawberry genetic research throughout the world.

"This remarkable genetic map, which is the highest resolution linkage map for any ancestral diploid strawberry species, is a valuable research tool in and of itself. More importantly, it provides a necessary resource for assembly of a *Fragaria iinumae* reference genomic sequence as a much needed complement to the previously published reference genome for ancestral diploid *F. vesca*," Mahoney said.

To create the genetic map of *Fragaria iinumae*, experiment station researchers used the IStraw90 strawberry SNP array, an advanced genomics tool for marker-assisted mapping that the Davis lab helped develop as part of the International RosBREED Consortium. Prior to the advent of the marker-assisted mapping approach, breeders had to rely only on the evaluation of physiological traits such as fruit yield, disease resistance, and flavor for hundreds of plants to identify those with the desired traits, while having little or no knowledge of each plant's underlying genetic composition. The evaluation of traits in very large breeding populations is costly and time-consuming.

"UNH is recognized as one of a very small handful of institutions worldwide working at the forefront of strawberry genomics and its application to strawberry breeding. We are leading a multi-institutional collaboration to assemble a new genomic resource, the *F. iinumae* reference genome. Of particular local interest, we are putting the genomic knowledge, resources, and technologies to work at UNH to develop new strawberry varieties that will be locally adapted and suitable for organic production, to the benefit of regional strawberry growers and consumers," Mahoney said.

The researchers present their findings in the journal *The Plant Genome*.

The U.S. is the world's leading producer of strawberries. In 2012, the U.S. produced more than 3 billion pounds valued at \$2.4 billion, according to USDA. Most strawberries are grown in California. Strawberries are also an important crop in New Hampshire, with estimates of the retail value of New Hampshire's strawberry crops at about \$1.85 million.

This material is based upon work supported by the NH Agricultural Experiment Station, through joint funding of the National Institute of Food and Agriculture.

## An Update on Southern Highbush Blueberry Varieties and Advanced Selections at UGA from 2016

D. Scott NeSmith

The UGA Blueberry Cultivar Development Program generates and evaluates hundreds of selections of southern highbush and rabbiteye blueberries each year. The UGA Blueberry Research Farm near Alapaha is the primary field site for evaluating new selections and replicated advanced selections. The following is a brief progress report for some Advanced Selection Trials of southern highbush at Alapaha during 2016.

#### General Season Overview

The 2016 chill hour (hours < 45 F) accumulation from Oct. 1 thru Jan. 1 were some of the lowest ever recorded for the Alapaha site during the early part of the season (Fig. 1).



*Figure 1:* Chill hour accumulation 2013-2016 at the Alapaha site.

This is especially in extreme contrast to the high early chill hour accumulation observed during 2015. This "delay" in chilling had a tremendous affect on flowering and ripening times for the year. However, the abnormally slow chill hour accumulation did provide a unique opportunity in 2016 to reevaluate chill hour requirements of many of our varieties and advanced selections, which we will show later. There was some early season freeze damage experienced in 2016 that primarily affected the earliest flowering selections. Notable minimum temperatures at Alapaha and dates were: 26.5 F on Jan. 12; 24.0 F on Jan. 19; 25.8 F on Jan. 24; and 25.8 F on Feb. 10. Comprehensive flowering notes, cropping notes and fruit characteristic evaluations were taken for several advanced selections of southern highbush blueberries, along with data for standard cultivars.

In the past 7 to 8 years, we have established several Advanced Selection replicated trials at the Alapaha site. These trials have multiple replications of 10 to 15 plants for the Advanced Selections, along with cultivar standards. These trials are a culmination of advanced material from earlier selections trials, and offer a more comprehensive look at performance. This report contains data on trials that are 4 to 6 years old. All trials were started from 1 gallon plants, were grown in soil amended with pine bark, and were irrigated using a single line of drip tape. Overhead irrigation for frost protection is not available. Data presented are a numerical scale, where values range from 1 to 10, with a value of 6.0 or less being considered not commercially acceptable (with the exception of cropping score).

Table 1 shows data for several popular varieties and some UGA Advanced Selections for the 6vear-old trial at the Alapaha Farm. 'Rebel' remains one of the earlier ripening varieties, but the accompanying early flowering time requires that the variety be frost protected to maximize production. Also, we are seeing some decline in plant vigor in some of our older 'Rebel' plantings, likely due to bacterial leaf scorch (Xylella fastidiosa) susceptibility. Note that our updated chill hour estimate for 'Rebel' puts it in a 250-300 hour class, which is a lower chill requirement than the 400-450 chill hour range we estimated years ago. 'Meadowlark' ripened early, but crop load was very light for this variety as is typical from year to year with the very early flowering. We estimate 'Meadowlark' to have a 100-150 chill hour requirement. Selection 02-28 was the earliest of all in this trial, and it too had a reduced crop load due to its early flowering. This selection has a very low chill requirement of 100 hours or less, which is similar to 'Emerald'. However, this selection has very good fruit guality, and will continue to be looked at for possible utility in the early market. 'Suziblue' continues to look good, although, ripening was a little later than 'Rebel' even though the new estimated chill hour requirement is similar (200-300 hours). But, 'Suziblue' crop load and flavor were better than 'Rebel', and overall plant vigor continues to be better as well.

'Farthing' crop load was among the highest in this trial in 2016, and this variety ripened 5 to 8 days earlier than in past years. It appears to have a chill hour requirement more similar to 'Rebel' than to 'Star'. However, 'Farthing' berry color (red backs) continues to be of some concern. One of our newest releases, 'Miss Alice Mae<sup>™</sup>', had a very good crop load, good overall berry quality, and very good flavor. It ripened a little later than 'Star' this year, and has an estimated chill hour requirement of 450-500 hours. For later season southern highbush, 'Camellia' continues to perform well, with overall very good berry quality. 'Camellia' remains one of the most vigorous southern highbush we have released, and it performs very well year in and out at the Alapaha site. It is estimated to have a 450-550 chill hour requirement. TH-896 is a

later season selection with large, high quality fruit. However, plants of TH-896 do grow slowly and further evaluations are needed to determine long-term performance and stability. It has an estimated chill hour requirement of 300-350 hours.

Table 1:	Ratings	of some	fruit and	plant char	acteristi	cs of 6-	year-old	Advance	d Selecti	ons of	
southern	highbus	h blueber	ry along	with stand	ard culti	vars. D	Data are	from Alap	aha duri	ng 2016	j.
Plants we	ere estat	olished in	Fall 2010	).							
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Selection or Variety	Date of 50% Flower	Date of 50% Ripe	Est. Chill hours	Berry Size	Berry Scar	Berry Color	Berry Firm.	Berry Flav.	Crop Load	Plant vigor
Camellia	Mar. 12	May 8	450-550	8.8	7.0	8.0	7.5	8.0	6.0	9.8
Rebel	Feb. 26	April 26	250-300	7.5	7.5	7.2	7.5	6.8	3.5	6.5
Star	Mar. 10	May 3	400-450	7.5	6.8	7.2	7.5	7.2	6.0	8.0
Suziblue	Feb. 24	April 30	200-300	8.5	7.5	7.0	8.0	7.5	7.5	8.0
Farthing	Mar. 8	May 3	300-350	7.5	7.5	6.8	7.5	7.0	8.0	8.5
Sweetcrisp	Jan. 27	May 3	100-150	8.0	8.0	7.2	8.5	8.5	1.5	9.0
Meadowlark	Feb. 8	April 28	100-150	8.5	8.0	7.0	8.5	8.0	1.3	8.5
Emerald	Jan. 25	May 2	< 100	8.5	7.5	8.0	8.0	6.8	2.5	8.5
Miss Alice Mae™	Mar. 12	May 6	450-500	7.5	7.5	7.5	7.5	8.0	7.5	8.0
02-28	Jan. 23	April 24	< 100	8.0	8.0	7.5	7.5	8.0	2.0	9.8
TH-710	Feb. 26	May 5	200-250	7.0	6.8	7.5	7.5	7.5	8.0	9.0
TH-828B	Mar. 20	May 6	550-600	8.2	7.5	8.2	7.0	7.5	3.0	6.5
TH-896	Mar. 5	May 6	300-350	8.0	8.2	8.0	8.5	8.0	7.0	7.2
TH-909	Mar. 6	May 4	300-350	7.5	6.8	7.2	8.2	6.8	6.0	8.5

 Table 2: Ratings of some fruit and plant characteristics of 5-year-old Advanced Selections of southern highbush blueberry along with standard cultivars. Data are from Alapaha during 2016.

 Plants were established in Fall 2011.

Selection or Variety	Date of 50% Flower	Date of 50% Ripe	Est. Chill hours	Berry Size	Berry Scar	Berry Color	Berry Firm.	Berry Flav.	Crop Load	Plant vigor
Camellia	Mar. 11	May 10	450-550	9.2	7.0	8.0	7.5	7.5	6.0	9.5
Rebel	Feb. 24	April 24	250-300	7.5	7.0	7.5	7.2	6.5	3.5	6.0
Star	Mar. 10	May 8	400-450	7.5	7.0	7.0	7.2	7.2	7.2	8.0
Suziblue	Feb. 24	May 3	200-300	8.0	7.5	7.0	7.5	7.5	7.0	8.2
Miss Jackie™	Mar. 12	May 18	450-550	7.5	7.5	7.5	7.5	7.5	9.0	9.2
Miss Lilly™	Mar. 24	May 14	500-600	8.5	7.5	7.5	7.5	7.5	6.0	9.8
TH-889	Mar. 18	May 14	550-600	8.2	7.2	8.5	7.5	7.5	4.0	7.0
TH-931	Mar. 12	May 12	450-500	9.2	7.5	8.5	7.5	7.5	5.5	8.0
TH-1008	Feb. 28	May 8	250-300	9.0	7.5	8.5	7.5	8.0	4.5	8.5

In a separate Advanced Selection Trial of 5year-old plants, similar performance was observed for cultivar standards (Table 2), with 'Rebel' and 'Suziblue' being the earliest ripening. 'Star' was later ripening, but it had a very good crop load. Two new UGA releases from the "Southern Misses" series are in this trial, those being 'Miss Jackie™' and 'Miss Lilly™'. 'Miss Jackie™' had the highest crop load of all selections this year and it ripened a week later than 'Camellia'. This new variety has a chill hour requirement of 450-550 hours, and would be a good candidate for later season production without frost protection. 'Miss Lilly™' is also a candidate for growing without frost protection, as this variety flowers 3 weeks after 'Rebel'. It has an estimated chill requirement of 500-600 hours. The plant is narrow and very upright, likely being suitable for machine harvesting with proper pruning. 'Miss Lilly™' fruit are large and flavorful, and the plant is the most vigorous in the trial.

Results from the 4-year-old Advanced Selection Trial (Table 3) show several early ripening, lowchill selections. 'Georgia Dawn™' was released in 2012, and it continues to be very early ripening. In this 2016 trial, 'Georgia Dawn<sup>™</sup>' ripened only 4 days earlier than 'Rebel', but it also flowered earlier as well. Much of the 'Georgia Dawn<sup>™</sup>' early crop was lost to freezes during flowering, and it has an estimated chill requirement of 100-150 hours. Frost protection is absolutely essential for production of this variety. But, if frost protection is successful, 'Georgia Dawn<sup>™</sup>' offers the potential for very early fruit production. Advanced Selections TH-944, TH-1091, and TH-1125 all had fruit that ripened around the time of 'Rebel', but 'Rebel' long term plant vigor continues to show problems. These selections are all on the lower chill hour requirement side and would also require frost protection for successful production. These Advanced Selections need further observations to see how they progress as plants mature.

**Table 3:** Ratings of some fruit and plant characteristics of 4-year-old Advanced Selections ofsouthern highbush blueberry along with standard cultivars. Data are from Alapaha during 2016.Plants were established in Fall 2012.

Selection or Variety	Date of 50% Flower	Date of 50% Ripe	Est. Chill hours	Berry Size	Berry Scar	Berry Color	Berry Firm.	Berry Flav.	Crop Load	Plant vigor
Georgia Dawn™	Feb. 9	April 22	100-150	7.0	7.2	7.0	7.0	8.0	1.5	6.5
Rebel	Feb. 24	April 26	250-350	8.0	7.5	7.2	7.5	6.5	5.0	5.5
Star	Mar. 12	May 9	400-500	7.0	7.0	7.5	6.8	6.8	6.0	6.0
Suziblue	Feb. 28	May 5	200-300	7.5	7.0	7.0	7.5	7.5	7.0	7.5
TH-831	Mar. 9	May 11	350-400	7.5	7.0	7.5	7.0	7.0	5.0	7.5
TH-938	Mar. 5	May 8	300-350	7.2	7.0	8.0	7.0	8.0	5.5	7.0
TH-939	Mar. 12	May 11	400-500	8.0	6.8	8.0	6.5	7.5	6.2	8.5
TH-944	Feb. 19	April 27	150-250	8.2	7.5	7.0	7.2	7.2	4.5	8.0
TH-1091	Feb. 15	April 29	150-200	7.5	7.0	7.0	7.0	7.0	5.0	8.0
TH-1111	Mar. 9	April 29	300-400	7.2	7.0	7.0	7.5	8.0	5.5	7.0
TH-1125	Feb. 27	April 28	250-300	9.0	7.5	7.5	8.5	7.8	3.0	7.2

## New Peach-Sized Strawberry Big On Flavor

Paul Rusnak

Previously published online in <u>Growing Produce</u>, September 2016



'Archer,' the latest creation from Cornell University, is comparable in size to a plum or small peach. Photo courtesy of Cornell University

According to plant breeders at Cornell University, the newest strawberry variety coming out of its program is big enough to fill the palm of your hand.

Topping out at more than 50 grams, 'Archer' is the latest creation from <u>Cornell University berry</u> <u>breeder Courtney Weber</u>.

"Archer' is an extraordinarily high-flavored berry," says Weber, Associate Professor in the Horticulture Section of the School of Integrative Plant Science. "It has an intense aroma, so when you bite into it you get a strong strawberry smell. And it's very sweet, so you get a strong strawberry flavor that really makes an impact." Weber says the combination of large fruit and strong flavor hits the sweet spot for local growers who sell in farmers' markets, have Upick operations, and/or roadside stands.

'Archer' ripens in June and holds its large size through multiple harvests for two to three weeks.

In addition, 'Archer' is cold-hardy, making it suitable for growing in diverse climates

throughout New York as well as in places like Michigan and Minnesota and along the Mid-Atlantic from Maryland into the Northeast. Sporting a durable root system, 'Archer' is tolerant to root rots and other common diseases, Weber notes.

'Archer' has been licensed to <u>Krohne Plant</u> <u>Farms</u> in Hartford, MI, through the <u>Center for</u> <u>Technology Licensing at Cornell University</u>, and plants can be obtained for spring 2017 planting.

## It Behooves Blueberry Growers To Protect Pollinators

Jeanette Klopchin

Previously published online in <u>Growing Produce</u>, September 2016



Place managed hives adjacent to a blooming blueberry crop. Photo by Jason Deering

Blueberry production is on the rise in Florida, from the number of acres in production to the number of new operations and increased popularity in specialty operations like organic and U-Pick farms.

Like many crops in Florida, blueberries are dependent on bee-pollination to set fruit. It is really very simple — the more bees that visit a flower, the more pollen grains that will be transferred from the male stamen to the female, resulting in more fertilized ovules. This equals a larger, more even ripening fruit and demonstrates why pollination is so critical for the grower to understand and manage. Blueberries (Vaccinium spp.) are more adept to buzz pollination, a vibrating act performed by bumble bee species and other native pollinators that literally shakes the pollen from the flower. However, the availability and abundance of these native pollinators are often not enough to support pollination needs for larger or commercial operations. This is where managed pollinators come into the picture.

#### **Management Matters**

Most growers rent managed honey bee colonies for pollination services during the bloom period. The recommended stocking rate is two to five hives per acre, and with upwards of 50,000 bees per hive, it is no question that honey bees can get the job done. The bloom window is relatively short, with abundant flowers that require pollination within approximately three days after opening. However, it is important that honey bees be placed onto the site only after target crop reaches 5% to 10% bloom.

Honey bees forage on the closest, most abundant forage source until it is exhausted. Placing honey bees before the target bloom will leave the bees foraging on the next best source and not the blueberries, even if they are open. Communication between the grower and the beekeeper is crucial to ensure sure hives are ready and placed on site at the correct time relative to bloom.

The time period that honey bees are on site for pollination can pose a number of other challenges beyond timing of hive placement for both the beekeeper and the grower. Blueberry growers face the challenges of pollination itself: bad weather, wind, rain, and sudden blooms can all interfere with bees being available during that crucial bloom time. This is on top of fluctuating market prices and the need to manage pest pressures from insects, mites, and diseases that are often controlled using pesticides, which can pose risks to honey bees and other pollinators. Because both bee pollination and insect control are essential to the success of blueberry production, it is important that both beekeepers and growers work together to reduce these risks.

### Safety First

A 2016 survey from the Florida Department of Agriculture and Consumer Services (FDACS) shows many growers are proactively taking steps to ensure honey bees on site are safe. That's good news for native pollinators, too, as there are up to 20 different species assist with blueberry pollination in Florida. There are many things that can be done to reduce the risk of pesticides to bees while on crop. Many growers adjust the timing of pesticide applications to when bees are not foraging, i.e. after dusk; even when not indicated by label language. Growers can choose products that have less toxic active ingredients or have less bee-restrictive language on the label. Other practices include reducing the overall number of sprays during bloom or performing certain treatments prior to bloom where possible.

These practices, and more importantly their communication and agreement between the beekeeper and the grower, are really what ensures a safe pollination season for bees and blueberries. Many of these operations are utilizing pollination contracts or agreements. These may include details like hive strength, timing of hive placement, pesticide use, and method of contact if any emergency applications may become necessary (liabilities, costs, feeding etc.).

#### **Food For Thought**

Although counterintuitive to some, honey bees can and should be supplemented with sugar syrup (a nectar substitute) during pollination. Bees collect an insignificant amount of nectar from blueberries as they mainly gather pollen. Honey bee hives need both nectar and pollen to keep producing more bees, and more bees equals more pollination. Therefore, it is perfectly acceptable to discuss feeding supplements with contracted beekeepers.

Other factors to consider may include where within the field the hives are placed; it is

important to keep them away from irrigation nozzles, out of the way of turning equipment, clear from roadways and foot traffic, clearly marked for all farmworkers, in areas not subject to drift, and not in the middle of the rows. Honey bee foraging behavior allows the hives to be placed adjacent to the blooming crop, up to 500 yards away.

Lastly, it has become more and more common to see growers reserve, plant, or install some type of native forage on their property. Supplying abundant and diverse forage will not only supplement honey bees and build stronger colonies, but it supports the nesting of native bees year after year.

Florida has a wealth of knowledgeable blueberry growers, beekeepers, <u>UF/IFAS researchers</u>, FDACS staff, and programs like Integrated Crop Pollination that are working together to build a stronger blueberry industry. From communicating information and interpreting pollination needs to reducing pesticide risks and providing diverse native forage, there are many ways Florida growers are taking the lead to ensure that both the bees and the blueberries are getting the protection they need.

## Florida Blueberry Growers Keen On Two New Cultivars

James W. Olmstead

### Previously published online in <u>Growing Produce</u>, September 2016

To help meet the demand for lower-chill, machine harvestable blueberry varieties, research continues to come up with possible solutions for growers to pick from. The latest selections coming out of the <u>UF/IFAS Blueberry</u> <u>Breeding Program</u> ('Keecrisp' and 'Patrecia') aim to please.

#### 'Keecrisp'

'Keecrisp' resulted from a cross made between 'Sweetcrisp' and 'Indigocrisp' made in 2003, and was tested as 'FL06-556.' The selection was released earlier this year and a U.S. Plant Patent was applied for in March.



'Keecrisp' features large berries with a small stem scar. Photo by James Olmstead

'Keecrisp' is the latest release in the series of "crisp" varieties from the UF/IFAS breeding program. This crisp fruit texture has been shown in trials conducted at the University of Florida and the University of Georgia to be important for machine harvest for fresh marketing potential of a variety.

In postharvest storage and quality trials conducted with Dr. Anne Plotto at <u>USDA's</u> <u>Horticulture Research Lab</u> in Ft. Pierce, 'Keecrisp' and the similar crisp texture variety 'Indigocrisp' had the highest firmness ratings at harvest and after two weeks storage compared to standard texture varieties such as 'Emerald.'

Crisp fruit texture also allows fruit to be held on the bush longer between harvests before quality degrades, which is an important management tool to make machine harvest more efficient.

'Keecrisp' is a vigorous, upright-growing bush with long, somewhat whippy canes when grown under the summer hedging management used in southeastern southern highbush blueberry production. The estimated chill requirement for 'Keecrisp' is 300 or more hours below 45°F. This is based on inconsistent cropping and vegetative budbreak in areas south of Gainesville, FL, that receive less than an average of 300 chill hours in a season. 'Keecrisp' does respond favorably to hydrogen cyanamide application with a condensed bloom period and earlier prolific leafing, but appears to be sensitive to rate and timing similar to its parent 'Sweetcrisp.'

The average 50% bloom date of 'Keecrisp' near Gainesville, is February 14, similar to 'Farthing' and 'Star,' and approximately a week later than 'Emerald' and 'Meadowlark.' Like most southern highbush blueberries, planting additional varieties for cross pollination is recommended to achieve the best fruit set on 'Keecrisp.'

'Keecrisp' ripens mid- to late-season, with an average 50% ripening date of May 5. As the majority of the harvestable crop comes after the high-value period in Florida, the greatest potential for 'Keecrisp' will likely be as a machine-harvestable variety that can be freshmarketed in the more northern production areas of Florida.

'Keecrisp' berry size is large with a small, dry stem scar. 'Keecrisp' berries have high soluble solids and consistently low titratable acidity in laboratory trials that result in a mild, very sweet flavor.

#### 'Patrecia'

Also available first in 2016 is the early-season southern highbush variety named 'Patrecia.' This variety was initially developed by Straughn Farms, but is being commercialized by UF/IFAS in cooperation with Straughn Farms. 'Patrecia' resulted from a cross between 'Star' and 'Springhigh,' and retained some of the most desirable characteristics from both parents early season production and short bloom to ripe period. 'Patrecia' has a spreading growth habit, with high yields of large fruit in clusters that are quite easy to hand-harvest. 'Patrecia' has not been trialed in Central and South-Central Florida, so adaptation to these areas is unknown. 'Patrecia' has responded well to hydrogen cyanamide applications, with condensed bloom periods and rapid, prolific vegetative budbreak.

Initial budwood distribution of both 'Keecrisp' and 'Patrecia' is limited, so licensed propagators are strongly encouraged to establish a mother block that can be maintained as a source of cutting material for future propagation. 'Keecrisp' and 'Patrecia are protected varieties and a license must be obtained for propagation and sale of plants. License information can be obtained from Florida Foundation Seed Producers (FFSP).



'Patrecia' was developed by Florida blueberry pioneer Alto Straughn. Photo by James Olmstead

## New Mechanical Strawberry Transplanter Wows

#### Surendra Dara

Previously published online in <u>Growing Produce</u>, September 2016

California strawberries just got sweeter with a new tool developed by a collaborative effort from Driscoll's, Plantel Nurseries, and Solex.

Strawberries are one of those crops with high input costs, and labor is one of the major expenses in strawberry production. Both nursery and fruit production operations require a high volume of manual labor for planting, tending to the plants, processing of transplants, or harvesting fruits.

Shortages of skilled farmworkers is a major challenge the strawberry industry is currently facing and it is an even bigger problem for summer planting, when help is needed for fruit harvesting from the previous fall's plantings. The new mechanical strawberry transplanter developed by the three companies is a significant advancement in the mechanization of transplanting, one of the two major manual operations in the strawberry production.



'Mechanical strawberry transplanter, the first of its kind in California, developed from collaboration among Driscoll's, Plantel, and Solex. (Photo credit: Surendra Dara)

#### The Demo

The team from Driscoll's demonstrated their 3bed transplanter to some growers in an organic strawberry field this past summer in the Santa Maria area. Chris Jenkins, Product Specialist at Driscoll's, conceived the idea and worked with Chris Waldron at Plantel Nurseries and Matt Phillips at Solex in developing the first mechanical strawberry transplanter. Tim McDonald at Guadalupe Hardware also helped in this development.

They experimented first with their 1-bed transplanter in February using celery transplants, which were grown to represent the strawberry transplants that would be available in June. In the meantime, they developed a 3-bed transplanter in the next few months. In June, Driscoll's planted 10 acres of strawberries using their new 3-bed transplanter. The bulk of the misted tips are being propagated locally in standard nursery greenhouses.

"We took an Italian machine (manufactured by Checchi e Magli) used for transplanting peppers and other crops in mulch and modified it for strawberries," said Chris Waldron. "It costs about \$46,000 for the transplanter units that cover three beds. With the tractor, racks, seating, and other equipment, the total cost could be about \$120,000 for the entire unit." It is estimated that when planting a traditional bare-root transplant, 10 farmworkers (including a plant distributor, a forklift driver, and a crew boss) are required to work an 8-hour day to transplant 1 acre of acre of strawberries, which typically has 28,000 plants in a 4-row/bed configuration.

#### 19 Workers - Not 100

The mechanical transplanter can plant 10 acres in a day with the help of a 19-member crew, which includes the tractor driver, a plant handler/loader, 12 planters (one per each plant line loading the transplants into the planting slots), and five people checking the transplanted plants on the bed. What used to take 100 people to manually transplant 10 acres can now be done with just 19 people.

"Harvesting crew members get about \$30/hour and putting them on a transplanting job with about \$10/hour is not ideal," Jenkins says. "With the help of this machine, we can now engage the farmworkers in high-paying jobs. It is socially, economically, and ergonomically a big improvement and helps our field crew tremendously.

"As the transplanter does most of the work, it will allow the available labor to focus on harvesting fresh market strawberries that fetch a higher price than processing strawberries," Jenkins continues. "But one point I would like to highlight is that we are not displacing jobs with the machine. Generally, no one wants to do the transplanting job when harvesting is obviously the preferred job."

Development of the strawberry transplanter is a major improvement to the production technology of the fifth most important commodity in California, with an annual value of \$2.5 billion, as it can address labor shortage issues.

**Benefits At-A-Glance**Advantages of the mechanical transplanter include:

- Efficient and uniform transplanting that requires less time and manpower.
- Avoidance of human errors in planting depth, j-roots, and other such issues in manual

planting of bare root transplants, rather than misted tip transplants.

- Using misted tip transplants are an advantage because they are actively growing and are not dormant like bare root transplants. They are also in an advanced growth stage compared to bare root transplants, and will likely start fruit production 2-3 weeks earlier than the latter.
- Once separated from the mother plants, it takes about 6 weeks for the misted tip transplants to be productive, while several months of field production and refrigeration are required for bare root transplants.
- Local production of misted tip transplants is more likely to adjust to grower needs and probably allows for better control over producing uniform and good quality transplants that can be easily supplied without long distance transportation.
- It is less likely to have soilborne diseases from misted tip transplants compared to the bare root transplants from a traditional infield nursery.

# Blueberry and Cranberry Survey Seeks Industry Input

Profitability and sustainability of the United States' blueberry and cranberry industries require an understanding of production and processing challenges, market changes, and consumer preferences. Breeders and supporting programs must acquire this understanding so that they can develop new cultivars to support industry growth.

A national team of 25 blueberry and cranberry scientists from eleven institutions around the country are working together for the first time to establish a coordinated approach and define research objectives that will ultimately accelerate the development of improved cultivars by selecting for traits that are relevant to stakeholders.

The team will determine the most desirable traits for future cranberry and blueberry breeding by

distributing a survey to blueberry and cranberry stakeholders, including growers, nurseries and processing/packing operations. The survey results will lead the discussion among the leading cranberry and blueberry researchers when they convene in 2017 to discuss the latest genomic approaches to breeding.

While breeding can't address some issues, such as weed control or food safety, there are many production and postharvest priorities that can be addressed through genetics, using the latest genomic tools to improve the targeted efforts of breeders.

This is a unique opportunity to share with breeders *your* challenges. The research team has identified several priorities as potential target attributes for breeders to consider. These include, but are not limited to: fruit quality, insect and disease resistance, plant and fruit characteristics to improve machine harvest, frost tolerance and heat resistance While these generalities were easy to identify, input from the *blueberry and cranberry* community is essential to help bring the specific areas of concern into focus, such as which diseases are most devastating, or what fruit quality attributes are most desirable?

The survey will be distributed at blueberry and cranberry association meetings through the fall and winter. Thank you, in advance, for completing the survey and playing a vital role in the future breeding efforts of blueberry and cranberry. We look forward to working together to advance the industry through targeted breeding efforts that can help solve industry problems.

This project is funded by a USDA Specialty Crop Research Initiative Planning Grant, and led by Dr. Massimo Iorizzo, with N.C. State University's Department of Horticulture Science and <u>Plants</u> for Human Health Institute. USDA planning grants are a precursor to larger, Coordinated Agricultural Projects, or CAP grants that can ultimately empower research toward development of advanced breeding-genomic approaches to meet industry and consumer needs. Efforts supported by the USDA-NIFA in other crops, including apple, strawberry, potato and tomato, that coordinate breeding and genomics-based approaches have been highly successful.

If you have any questions, contact Dr. lorizzo at miorizz@ncsu.edu, or 704-250-5469.

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## Blackberry and Raspberry Seasonal Checklist Fall 2016

Gina Fernandez, Small Fruit Specialist, North Carolina State University

Many of us are recovering from the wrath of Hurricane Matthew. I posted some information on the Team Rubus Blog prior to the storm. In parts of eastern NC, soils are saturated and there is still a threat of additional flooding as the rivers continue to fill with water from the tributaries. There is some information in the blog post on how to dealing with flooded berry fields. http://teamrubus.blogspot.com/2016/10/hurrican e-matthew-preparation-for.html

The NC State University Extension has a new look to their portals. Check out the Blackberry and Raspberry Portal here. https://rubus.ces.ncsu.edu

The Northwest Berry Foundation has a great newsletter that focuses on production issues in the Pacific Northwest. However, they pull information from a range of sources, and many of the articles are relevant for all berry growers. It comes out on a weekly basis during the production season and less often during the offseason. Here is a link to the most current newsletter. therea are a couple of articles on labor situations on the west coast. http://www.nwberryfoundation.org/sfu.html

# FALL

Plant growth and development

- Primocanes continue to grow but growth rate is slower
- Flower buds start to form in leaf axils on summer-fruiting types
- Carbohydrates and nutrients in canes begin to move into the roots
- Primocane fruiting types begin to flower in late summer/early fall and fruit matures until frost in fall
- ✓ Primocane leaves senesce late fall Harvest
- ✓ Primocane-fruiting raspberry harvest
- Primocane-fruiting blackberry harvest
- Pruning, trellising and tunnels
- Spent floricanes should be removed as soon as possible
- Optimal time to prune is after the coldest part of the season is over. However pruning can start in late fall if plantings are large (late winter for smaller plantings).
- Start trellis repairs after plants have defoliated

✓ Remove covers on three-season tunnels Weed management

Many summer weed problems can be best managed in the fall and winter using preemergent herbicides. Determine what weeds have been or could be a problem in your area. Check with your states agricultural chemical manual and local extension agent for the best-labeled chemicals to control these weeds

Insect and disease scouting

- ✓ Continue scouting for insects and diseases
- Remove damaged canes as soon as possible to lessen the impact of the pest
- Check the Southern Regional Bramble integrated Management Guide for recommendations <u>http://www.smallfruits.org</u>

## Planting

 Growers in warmer areas (e.g. extreme southeastern NC) can plant into early December. Preparations for winter planting should have already been made. If you have questions about winter planting please contact your local county extension agent  In cooler areas, prepare list of -cultivars for next spring's new plantings. Find a commercial small fruit nursery list at <u>http://www.fruit.cornell.edu/berry/nurseries/</u>

### Fertilizer

- Take soil tests to determine fertility needs for spring plantings.
- Non-nitrogenous fertilizers are best applied in the fall to established plantings.
- If soil is bare, plant an overwintering cover crop (e.g. rye) to build organic matter and slow soil erosion.

Marketing and miscellaneous

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

### Make plans to attend Grower meetings! Blackberries and raspberries are part or all of these programs.

- North American Berry Conference, Grand Rapids MI
  - December 4-6, 2016. Because the Great Lakes Expo is held in December, we actually have TWO conferences in one calendar year — this December meeting will replace our Winter 2017 conference, which would typically be held in January or February.
  - This year NARBA is meeting jointly with the North American Strawberry Association (NADSGA), in association with the Great Lakes Fruit, Vegetable, and Farm Market Expo in Grand Rapids, Michigan.
  - This is a highly regarded regional meeting that attracts more than 4000 participants and 450 exhibitors. It is one of the largest trade shows for fruit and vegetable growers, greenhouse growers and farm marketers in North America!
  - <u>http://www.raspberryblackberry.com/2016</u> -north-american-berry-conference/

- Southeast Regional Conference and Tradeshow, Savannah, GA
  - Sessions on blackberry and strawberery, blueberry, muscadines and more!
  - January 5-8, 2017, at the Savannah International Trade and Convention Center
  - Registration and program information can be found at
    - http://www.seregionalconference.com
  - Video of past conference
    - https://vimeo.com/174265440

#### **Key Resources:**

Southern Region Integrated Bramble Management Guide: http://www.smallfruits.org/SmallFruitsRegGuide/ Guides/2016/2016BrambleSprayGuide.pdf

Southeast Regional Bramble Production Guide: <u>http://www.smallfruits.org/SmallFruitsRegGuide/index.htm</u>

Blackberry and Raspberry Grower Information Portal:

http://rubus.ces.ncsu.edu

Social Media links: Twitter: @NCTeamRubus Facebook : Team Rubus Blogs: http://teamrubus.blogspot.com/ Small Fruit News

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