



## Fall 2020 Edition, Vol. 20 No. 4 www.smallfruits.org

We are testing out developing a PDF/ printable version of the Small Fruit Newsletter.

If you would like a printable version to always be offered please provide feedback to this survey: <u>https://forms.gle/Rie1147sUmT2pb3X9</u>

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#### Some Vineyard Tasks to Prepare for Winter

*Eric T. Stafne, Extension and Research Professor, Mississippi State University* 

Fall is coming soon, and winter is just around the corner. With the cold temperatures coming, it is important that grapevines are prepared. Irrigation should be stopped in September to allow plants to acclimate to the lower light conditions and cooler temperatures. Vines native to North America tend to do this better than Vitis vinifera types. For example, American grapes, such as 'Concord' or 'Cynthiana' will tend to start responding to shorter daylengths as well as cooler temperatures to prepare for dormancy. European grapes like 'Chardonnay' and 'Merlot' respond primarily to cooler temperatures. Therefore, American grapes get a head start on dormancy, whereas European grapes are at higher risk of being damaged in an early fall freeze event. While this is not usually much of a problem in certain areas of the south, vines in the upper and mid-South regions can be susceptible.

An important task to do is to remove grow tubes from around plants (Photo next page). Many grape growers use these during the growing season to protect plants from herbicide damage and sunscald, but also to speed up the growth of the plant. They work great during the growing season, but if left on during fall they will not allow the plant to acclimate normally. Tubes heat up with the sunlight and creates a small microenvironment that will be warmer than the outside air. However, once night arrives, the temperature inside the tube equals that of the outside air. The extreme changes from day to night temperatures can cause damage. This is also true during the winter.

Another thing that should not be done is fertilizing grapevines too late in the season. Nitrogen fertilizer will induce growth of green, succulent tissue that cannot acclimate quickly enough in the fall and thus will not go fully dormant. Often this growth is damaged or killed during the winter and can predispose the plant to stress and pest infestations.

Ultimately, the best thing to do to prepare grapevines for winter is to keep them healthy and happy throughout the year by planting them on a good site, provide adequate water, control insects and diseases, fertilize when necessary, train and prune appropriately, crop load thin if needed, and clean out debris that may be a source of fungal disease inoculum for future years. Preparing for winter is just as important as managing for a good harvest. Just because the crop is off the vines doesn't mean the vines don't require some attention.





## Provide Feedback on The Southern Fruitcast Podcast Aaron Cato, IPM Specialist University of Arkansas



The Southern Fruitcast is hosted by Aaron Cato and Amanda McWhirt, extension IPM and production specialists for fruits and vegetables at the University of Arkansas. This podcast aims to cover the people, technology and latest developments in small fruit production in the Southeast. These topics are covered each episode by interviewing extension specialists, small fruit growers, or industry representatives to provide relevant information on specific topics. Episodes can be found at <u>www.uaex.edu/</u> southernfruitcast

The overall goal of the podcast format is to provide insight and information that can be accessed while growers are busy doing other things like driving. In addition to making the information easily digestible, we want to be certain that we are covering topics that are of major interest and are relevant to small fruit growers and others that work in that industry.

To assure that we are hitting this mark, we are currently looking for feedback on the episodes we've produced so far. Using the survey link below, please answer the listed questions to help provide feedback and to ensure future episodes are relevant to your needs.

Click here for a short survey relating to the podcast.

Here are short descriptions about the most recent episodes of the Southern Fruitcast:

# Episode 4 – Muscadine and Blackberry Production with Ervin Lineberger

Ervin Lineberger, owner of Kildeer Farms in Kings Mountain, North Carolina, joins us for episode 4. Ervin has been farming in the Southeast since the 1980s and is well known as one of the most influential blackberry and muscadine growers in the region. Ervin shares with us his experience with blackberries and muscadines, provides insight into the future of muscadines as a commodity, and offers advice for growers who are looking to tap into the small fruit market.

#### Episode 5 – Farm-to-school Marketing and Strawberries with Randy Arnold

In episode 5 we are joined by Randy Arnold, owner of Arnold Farms in Alma, AR. Randy and his family have operated a highly diverse farm for over 20 years and are well known in the area for their "strawberry patch" which is an integral part of the community. Randy shares with us his experience with marketing to local schools in farm-to-school programs, as well his yearly on-farm festival called "fun on the farm" that hosts 1,000 students from area schools who visit the farm and learn about agriculture.

#### Episode 6 – Southeast Strawberry Disease Management with Guido Schnabel

Dr. Guido Schnabel, a plant pathologist at Clemson, joins us for Episode 6. Guido has a wealth of experience in strawberry disease management and pro-

Assessment of *Pierce's* Disease Resistant Predominantly European Grape in Alabama

Dr. Elina Coneva , Fruit Crops Extension Specialist and W. A. Jr. & C. Dozier Endowed Professor. Department of Horticulture, Auburn University

Studies to establish the feasibility of growing Pierce's Disease (PD) resistant, predominantly European grape hybrids are ongoing at Auburn University, Alabama since 2010 <u>https://www.asevcatalyst.org/</u> <u>content/early/2020/07/06/catalyst.2020.19008</u>. We have evaluated advanced selections with early-, mid-, and late season of ripening trained to the tradition-al vertical shoot positioning system (VSP) recomvides excellent insight that is highly relevant for Southeast growers. Topics discussed include fungicide selection, common resistance issues, dip applications before planting, when to use soil applied fungicides, options for fumigation, and much more. Also discussed is the MyIPM app, which was developed by Guido and is a great source of information for both growers and agents.



RESEARCH & EXTENSION University of Arkansas System



cate PD resistant predominantly European (*Vitis vinifera*) hybrid grapevines can survive and consistently produce a good quality crop under humid conditions in central Alabama.

The outcomes of this initial study had encouraged us to expand the experiment in 2017 and test another UC Davis developed advanced PD resistant European grape hybrid, namely 'U0502-20'. The major goal of the new study is to evaluate the vine production potential when plants are trained to a highly efficient 'Watson' trellis system. 'Watson' system is a relatively new trellising structure that continues to gain popularity in southeastern viticulture. It features divided canopy training for better air movement and reduced risk of foliar disease development. Also, we aimed to determine the optimal planting distance for 'U0502-20' based on the vine vigor, productivity, and fruit quality evaluations when vines are planted at inrow distance of 6', 7', or 8', and the between-row distance is 12'.



PD resistant predominantly European grape 'U0502-20' trained to the 'Watson' trellis system grown at the CREC, Clanton, AL.

Data is being collected to determine vine phenology, total yield, fruit quality and vigor of 'U0502-20' grape at each planting distance. Fruit cluster production was observed during the second growing season, when clusters were removed before flowering in order to encourage root system establishment of the young vines. Annually, the experimental vines are dormant pruned to 12 spurs per vine (6 spurs/cordon) with two buds per spur retained for a total number of 24 buds per vine. Shoot thinning is conducted during spring to maintain the desirable shoot number. Additionally, cluster thinning is applied to adjust the crop load to one cluster per shoot.



Crop load and fruit quality of PD resistant predominantly European grape 'U0502-20' trained to a 'Watson' trellis system, grown at the CREC, Clanton, AL, 2020.

The 'U0502-20' vines produced the first commercial crop during the 2019 season. Current season results for total yield per vine (Fig. 1, 2) suggest similar cropping level regardless of planting distances with the 6' in-row treatment producing 18.7 lb/vine, and the 7' and 8' in-row distance treatments producing 19.4 lb/vine. No statistical differences were found in cumulative yield per vine during 2019-2020, when the plants produced between 36.2 and 36.8 lb/ vine. Mean cluster weight varied between 367.2 g for vines planted at 6' X 12' to 394.3 g for vines planted at 7' X 12' during the current season, when the number of clusters harvested per vine ranged from 27.7 for plants at 7' X 12' to 31.6 for vines at 8' X 12'. Mean berry weight for all planting distances was slightly above 2.0 g with soluble solids content of 18.4-18.7 %.

Research will continue to more fully assess the vegetative and productive responses of PD resistant predominantly European grape 'U0502-20' and determine the optimal planting distance in Alabama conditions.

Figure 2. Total yield of PD resistant predominantly European hybrid 'U0502-20' grape trained to a 'Watson' system and grown at three planting distances at the CREC, Clanton, AL, 2019-2020.





# Top-Performing Arkansas Blackberry Receives Horticultural Science Group's Outstanding Fruit Cultivar Award

Fred Miller, U of A System Division of Agriculture Arkansas Agricultural Experiment Station

FAYETTEVILLE, Ark. — Ouachita blackberry, a 2003 thornless variety from the University of Arkansas System Division of Agriculture, received the Outstanding Fruit Cultivar Award from the Fruit Breeding Professional Interest Group of the American Society of Horticultural Science.

The Outstanding Fruit Cultivar Award recognizes noteworthy achievements in fruit breeding and highlights a modern fruit introduction that has a significant impact on the industry.

The award was presented July 24 during the ASHS Fruit Breeding Professional Interest Group meeting, which was held virtually this year. The award has been presented since 1987 to noteworthy cultivars, according to information on the ASHS website.



#### **Top seller**

"Ouachita has been the most important variety from our fruit breeding program," said John Clark, Distinguished Professor of Horticulture for the Division of Agriculture, and fruit breeder for the Arkansas Agricultural Experiment Station, the division's research arm.

Clark said almost 5 million plants have been propagated and sold, based on reports from licensed propagators, who sell the plants to nurseries and commercial fruit farms. An earlier award winner, Navaho, had nearly 2 million plants sold. "Plant sales are the strongest reflection of its importance," Clark said.

Sales are a good indicator of popularity with growers and consumers, but Ouachita made significant impacts in other ways, particularly because of its good storage and shipping qualities.

#### Expanding the market

"Ouachita contributed substantially to the establishment of a commercial shipping market blackberry industry in the eastern U.S., especially in the South, in the years following its release in 2003," Clark said. "It has also been planted in other regions of the U.S., including western, midwestern and northeastern states."

"The idea of a shipping industry based largely on southern U.S. production developed because of an increase in imported Mexican blackberries in the 1990s to early 2000s," Clark said. "Shippers wanted to continue marketing blackberries after the Mexican production season ended in late May." Ouachita proved to be adapted to widely different growing conditions, allowing its use in many different states.

The first major plantings of Ouachita began in southern Georgia and central Arkansas, Clark said, and expanded to North Carolina, the Midwest and other states as the shipping industry grew. Advances in production technologies, particularly the rotating cross-arm trellis, allowed expansion of blackberry production into regions where the new technologies allowed growers to protect the plants from winter cold in the upper Midwest. Ouachita has also been planted in western states, particularly in California, he said.

This expansion of the U.S. blackberry shipping markets was possible because of Ouachita's potential for long-distance shipping, Clark said. "The specific traits of importance were retention of berry firmness, low leakage of berries, and reduced reversion (reddening of drupelets after harvest) compared to other cultivar choices at the time," he said. "Ouachita has also been very popular with localmarket growers," Clark said. "This is a substantial use for this variety, especially in Arkansas." Another part of Ouachita's appeal to growers is its proven resistance to double blossom/rosette, a devastating disease that once made commercial blackberry production virtually prohibitive in the South, Clark said.

In its 17th year of production, Ouachita continues to be popular with growers, Clark said. Its thirdstrongest year for sales was the 2018-2019 planting season.

Ouachita has also been licensed for sale in Japan, several South American countries, Australia, South Africa and Europe, bolstering the Division of Agriculture's boast that its blackberries are grown on every continent but Antarctica.



TOP BERRY — Division of Agriculture fruit breeder John Clark shows Ouachita blackberries. The Fruit Breeding Professional Interest Group of the American Society of Horticultural Science presented the 2003 release from the Arkansas Agricultural Experiment Station their 2020 Outstanding Fruit Cultivar Award. (Photo courtesy of John R. Clark)

Join us in congratulating Dr. John Clark on this achievement!



## UGA releases new muscadine cultivar 'RubyCrisp'

#### Patrick Conner

University of Georgia – Tifton Campus

'RubyCrisp' is a new muscadine cultivar released from the University of Georgia muscadine breeding program. 'RubyCrisp' was selected from a cross of 'Supreme' × 'Tara' and was tested as Ga 8-1-338 in replicated trials in Tifton, GA. Single vine replicates were planted in randomized order in 2012. Vines were spaced 3.0 m between plants within the row, and 4.5 m between rows. Vines were trained to a single wire trellis with a single trunk and two cordons per vine. Vines were annually spur pruned by hand and fertilized with 560 kg•ha<sup>-1</sup> of 10N-4.4P -8.3K. Drip irrigation was used and diseases and insects were controlled according to commercial guidelines

'RubyCrisp' vines are self-fertile and do not need a pollinizer. Total yields of 'RubyCrisp' were excellent and consistently ranked among the highest yielding cultivars in all years of the trial (Table 1). Usable yield was reduced by both rot and pedicel scar split, but usable yield remained among the highest of the tested cultivars. Berry rot in 'RubyCrisp' appears higher than typical black cultivars but lower than bronze-colored cultivars (Table 1). Percentage pedicel scar split was higher than the recent commercial cultivar releases Hall and Paulk. Overall percentage of dry scar was lower than 'Hall', 'Paulk', and 'Supreme' (Table 1). Berry firmness was similar to 'Paulk', less than 'Supreme' and more than 'Fry' at harvest (Table 2). However, after 11 d of storage berry firmness was less than both 'Paulk' and 'Supreme' and similar to 'Fry'. The ability to pick berries with a dry scar and firmness in storage are vital traits for a commercial packing berry, and the low percentage of dry scar and softening during storage of 'RubyCrisp' make it unfavorable for this use.

Average first harvest of 'RubyCrisp' was 21 Aug. (Table 1), which was similar to the midseason check cultivars Supreme, Fry, and Paulk. Normal harvest seasons extended into the first week of September. Berry size of 'RubyCrisp' was similar to 'Supreme' and 'Paulk', and larger than the other check cultivars (Table 1). Percent soluble solids was higher than all other cultivars except



Figure 1. RubyCrisp<sup>™</sup> berries on the vine

'Lane' (Table 1) and flavor was sweet with relatively low muscadine aroma. Textural analysis of 'RubyCrisp' indicate that the berries had a very firm flesh (4.5 N maximal force) and tender skins (11.4 mJ berry puncture work). The firm flesh and tender skin of 'RubyCrisp' make it distinctly different from the other tested muscadine cultivars and more similar to texture of *V. vinifera* table grape cultivars. In addition, 'RubyCrisp' berries are non-slipskin and the berry skins have a neutral flavor, favoring the flesh and skins to be eaten together. 'RubyCrisp' berries are attractive with a distinctive red color (Figs. 1, 2) and have a good flavor.

'RubyCrisp' combines several rare traits for a muscadine cultivar which have led it to be a popular selection at field days and grower events. The red coloration of the berries is very distinguishing and pleasing to most consumers. In addition, the tender skins and crisp flesh of 'RubyCrisp' is similar to a V. vinifera fresh-market grape and adds to the originality of this cultivar. Berries show good sweetness, but muscadine aroma and flavor is low. This is pleasing to some people who dislike muscadine flavor, but unfavorable to others that do like the characteristic flavor of a traditional muscadine. Unfortunately, the tender skin of 'RubyCrisp' berries make it difficult to commercially pick without suffering relatively large losses due to berry split. Heavy rainfall during harvest season can also lead to fruit cracking. However, the unique fruit quality traits of 'RubyCrisp' warrant its release as a home-garden and pick-your-own cultivar. Given the large berry size and high production potential of 'RubyCrisp', growers may need to limit vine fruitfulness,

										Percent
				Total			Percent			soluble
				yield	Usable		dry		Berry	solids of
	Flower	Berry	Avg. day of	Tifton	yield	Percent	pedicel	Berry wt.	diam.	all
Cultivar	type <sup>z</sup>	color	first harvest	(kg)	(kg) <sup>y</sup>	berry rot <sup>x</sup>	scar <sup>w</sup>	(g)	(mm)	harvests
RubyCrisp	Η	Red	Aug. 21 abv	25.2 a	19.6 ab	8.4 bc	48.7 d	15.2 a	30.2 a	16.1 a
Fry	F	Bronze	Aug. 19 b	11.4 c	8.5 d	12.6 ab	49.4 đ	12.2 b	27.9 b	14.5 b
Hall	Н	Bronze	Aug. 2 c	19.3 ab	15.7 bc	16.6 a	90.9 a	10.1 c	26.0 c	14.9b
Lane	Н	Black	Aug. 4 c	15.5 bc	11.7 cd	4.0 c	52.2 cd	9.2 c	25.4 c	15.5 ab
Paulk	Н	Black	Aug. 19 b	22.9 a	21.0 a	4.7 c	84.9 a	15.0 a	30.2 a	14.9 b
Supreme	F	Black	Aug. 24 a	20.7 ab	17.7 ab	3.4 c	59.3 c	15.0 a	30.0 a	14.5 b
Significance			<0.001	< 0.001	< 0.001	<0.001	<0.001	<0.001	< 0.001	0.017

Table 1. Yield, flower and fruit attributes of 'RubyCrisp' and standard muscadine cultivars in Tifton, GA in the third through fifth years of growth (2014-2016).

<sup>z</sup>(**H**) hermaphrodite, (**F**) female

yUsable yield is total yield minus weight of rotted berries and berries with pedicel scar splitting.

\*Percentage of berries with visible signs of decay or fungal pathogens.

"Percentage of berries with no splitting or tearing at the pedicel scar after picking.

<sup>v</sup>Mean separation within columns by Duncan's multiple range test, P<0.05, with n = 4.

especially on young vines, by increasing the distance between fruiting spurs or thinning the crop so that the vine is not weakened by maturing excessive crops. Limited data is available to determine the cold hardiness of 'RubyCrisp' vines, and large plantings should not be made in the northern muscadine regions until more data is available. 'RubyCrisp' has been licensed to Ison's Nursery and Bottom's Nursery.

Table 2. Change in firmness (g•mm<sup>-1</sup>) of 'Paulk' and test cultivars at harvest and after cold

Cultivar	Firmness (g•mm <sup>-1</sup> ) <sup>y</sup>	Firmness (g•mm <sup>-1</sup> ) <sup>y</sup>
	Day 0	Day 10 + 1
RubyCrisp	222 b	176 c
Paulk	240 ab	203 в
Fry	199 c	178 c
Supreme	248 a	222 a
Significance	< 0.001	<0.001

storage (0-1 °C, 90% to 95% relative humidity).<sup>z</sup>

<sup>z</sup>Berries were evaluated at harvest, packaged in ventilated clamshell containers, and placed in cold storage for 10 days. Berries were then brought out of cold storage allowed to warm for 24 h at room temperature (21 °C) and evaluated 1 d post-removal.

<sup>y</sup>Values are means with n=4. Each replication consisted of 25 berries measured for firmness using a Bioworks FirmTech II. Mean separation within columns by Duncan's multiple range test, P<0.05.



# Establishing the Arkansas Quality Wine (AQW) Program

Renee Threlfall, Research Scientist, University of Arkansas

The Arkansas Quality Wine program, or AQW, will set quality standards for Arkansas-made wine, provide professional development for growers and winemakers and entice consumers to taste Arkansas wines. The program will be established in the fall of 2020 as part of a project funded by a specialty crop block grant from the Arkansas Department of Agriculture. Dr. Renee Threlfall, from the University of Arkansas System Division of Agriculture will serve as the AQW Director and work Amanda McWhirt, Extension Horticulture Crops Specialist for the Division of Agriculture and Amanda Fleming, a food science graduate student.

The AQW will include extension outreach, helping grape growers increase crop production, improving techniques for home and commercial, as well as creating marketing materials to raise consumer awareness of Arkansas wines. The program will establish quality standards for commercial wines made mostly from Arkansas-grown grapes. The commercial wines will be submitted and evaluated during an annual wine competition with additional chemical analysis. Wines that earn AQW status can use the AQW seal on each bottle of wine produced as well as receive recognition on AQW marketing materials. The AQW wines will help consumers identify and try Arkansas wines.





Check out the resources, production guides and videos for Small Fruits in the Southeast available at www.Smallfruits.org

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## The IR-4 Project: Quietly Making Pest Management Possible

Tim McCoy, Extension Associate with the Virginia Tech Pesticide Programs, and Virginia State Liaison to the IR-4 Project.

More than 40% of your daily consumption comes from crops that are deemed by the USDA to be "minor" or "specialty" crops. These commodities are only minor in comparison to the major crop groups like corn, soybean, cotton, wheat, etc. These minor crops typically represent the entirety of many growers' portfolios, and for them, are far more than just some "specialty". However, agrochemical manufacturers focus their effort on large acreage crops that offer greater potential for significant sales, and often have little financial incentive to generate the EPA-required data needed to register a pesticide for use on these minor crops.

This is where the IR-4 Project comes in! Created in 1963, through funding from the USDA, the IR-4 Project has become a central force in generating the crucial data needed to register pesticides for use on minor crops. The group's mission is simple and clear: "Facilitate regulatory approval of sustainable pest management technology for specialty crops (fruits, vegetables, nuts, herbs, ornamental and other horticultural crops) and specialty uses to promote public wellbeing"

Despite the fact that few in the public know it exists, the IR-4 Project is now involved in many areas that are key to making pest management possible. While the group's activities include efforts in animal and public health, pollinator protection, and international harmonization of pesticide regulation, its core programs still focus on food crops, environmental horticulture, biopesticides, and organic agriculture support research. All of these projects ultimately flow through the Project Request approval process, a system for nominating and choosing which research priorities each year will be funded for investigation.

The process starts in one of two ways: at the local level, or initiated by agrochemical industry interests as they develop new pesticides. At the local level, growers (or Extension personnel, or university Specialists) may discover a pest, plant disease, or weed



for which there is not a labeled or adequate pesticide solution. This was the case when obliquebanded leafrollers (OBLR), traditionally a pest on apples, became a pest of cherries in the early 2000s. Through work done at Michigan State University, the pesticide emamectin benzoate was identified as a possible management tool. Through research conducted by IR-4 cooperators, the necessary efficacy, crop safety, and residue data, were generated to allow the EPA to expand the label in 2019 to include cherries. As a result, growers now have a new tool to combat both OBLR and spotted-wing drosophila in cherry.

The other common way that new pesticides gain EPA approval for use on specialty crops is when they are brought to the attention of IR-4 by the agrochemical industry during product development. A new chemistry that may show promise for control of a pest in a major crop, may be suggested as a potential fix for the same pest in a specialty crop. The industry has some incentive to expand their registration of products because the federal government offers longer patent protection for a chemistry if minor use crops are added to a pesticide label. The IR-4 group makes decisions about the need and feasibility of conducting the research to generate data through an annual priority-setting meeting. Each year, IR-4 selects approximately 50 pesticide projects to fund in order to generate the necessary data.

The 2020 priority-setting meeting concluded September 17th, where over the course of four days, 422 project requests were whittled down to 59 funded projects for 2021. This process sometimes feels like a "horse trading" session where participants (university researchers, IR-4 state liaisons, grower reps, EPA regulators, and industry reps) advocate for their priorities. You can imagine that it is a challenge balancing the needs and desires of different commodity representatives from around the nation in order to prioritize what pest problems gets the research attention in the coming year. No one gets everything they want, but the process is fair and collegial.

For 2021, two herbicide priorities were funded that may be of interest to readers of SFN. One priority was for studying quinclorac for the control of clover and bindweed in grape vineyards. The other was for generating data on the efficacy of using florpyrauxifen-benzyl to control broadleaf annuals in blueberry production. These projects will likely take two to three years of research data in order to justify an EPA registration expansion.

Since its inception, through the priority-setting meetings, and the research that has been conducted as a result, IR-4 has assisted in the registration of nearly 50,000 registered crops uses. These uses have enabled specialty crop growers to produce healthier crops and reduce crop damage and food waste.

If you would like to get involved with the valuable work that IR-4 does, you might consider becoming a member of the Commodity Liaison Committee (CLC). This group of volunteers works to educate policy advisors, industry, and IR-4 personnel, about the specific needs of your commodity group. In the last two years, actions of the CLC have resulted in a potential increase in funding for IR-4, which has remained flat at approximately \$12M annually for the last decade. Competing budget proposals now before Congress will, hopefully add 3 – 7 million dollars per year to the IR-4 budget, which will enable the organization to do more of its valuable work.

If you want to find out more about the vital and diverse work that IR-4 is involved in, a great place to start is the "Food Crop Success Stories" (<u>https://www.ir4project.org/fc/food-crop-successes-stories/</u>), or you can contact your state liaison.



# Post-harvest insect pest management in small fruit crops

Douglas G. Pfeiffer Dept. Entomology, Virginia Tech

When the fruit are in, it is easy to think about putting the sprayer away. But sometimes there are insect issues that can be addressed in post-harvest, fall or winter periods. Let's take up a few now.

#### Grape

In general, it is advisable to maintain healthy foliage as long as possible into the fall. Here are some insect problems that can be addressed to help achieve this goal.

**Grape mealybug** and some related mealybug species can be found feeding on grapevines during much of the year. The phloem-feeding insects are covered with white, waxy material that often is produced into finger-like projections along the sides of the body, and into long white filaments from the hind end (all of these disappear if an impressive looking mealybug is dropped into a vial of alcohol!). Grape mealybug is a pest that can be addressed either early in the year (the recommended timing in our southeastern regional recommendations, <u>https://smallfruits.org/ipm-production-guides/</u>), or in the fall. Traditionally, mealybugs should be controlled if there were high populations in the fall – honeydew and sooty mold can cover foliage and clusters, and high populations can cause clusters to drop. The situation has been made worse by the advent of grapevine leafroll virus which is transmitted by mealybugs. Mealybugs can be targets of natural enemies, but broad-spectrum sprays can induce outbreaks of these insects.

Fig. 1. A young grape mealybug on a Virginia grapevine.

Venom, Assail, Actara (thiamethoxam), Admire Pro (imidacloprid), Be-



lay (clothianidin), Applaud (buprofezin) and Moven-

to (spirotetramat) are good candidates for chemical control of mealybugs. All but the last two are neon-icotinoids.

The question occasionally arises about the utility of oil sprays to grapevines in the dormant period – these have long been used in orchards. A usual target for oil sprays is European red mite, which overwinters as eggs on the bark of fruit trees and grapevines. On the relatively smooth bark of apple and peach branches, a coating of oil acts to suffocate the eggs (especially if applied close to hatch, when oxygen needs are greatest). However, the shaggy bark of grapevine trunks makes it difficult to achieve adequate coverage of the eggs with an oil spray. Another insect that may be targeted by oil sprays is grapevine scale. Vines may develop populations of scales especially if broad spectrum sprays have suppressed populations of parasitoids. On tree fruits, aphids are also the targets of oil sprays since they overwinter as eggs on the bark. But the main aphid on grape uses black haw as its winter host, so aphid management in vineyards does not benefit from oil sprays.



Fig. 2. Grapevine scales on a Virginia grapevine. The large individuals are the scale coverings of mature females, and the small, white individuals are settled crawlers.

General examination of vines. Vines may be examined in the post-harvest period for symptoms of Pierce's disease, including typical leaf discoloration and the presence of matchstick petioles. Unusual pest situations may also be revealed, such as lecanium scales. European fruit lecanium and terrapin scape could occur on grapevines but this is not common.

#### Caneberry

Rednecked cane borer is a member of the flatheaded borer family Buprestidae. The elytra are black or dark grey, and with a distinctive copper-colored pronotum. The adult beetle is about a quarter inch long. Adults are around for a good part of the season, from May to August. Larvae make spiral tunnels under the bark, reducing growth of the plant. When sprays are made for this insect, the target is ovipositing females. During winter pruning, assess the presence of galls. If more than 10% of canes have galls, a chemical control approach is needed in the coming season. But pruning during the dormant period can help reduce populations. Removal via pruning is most effective if wild brambles growing nearby are also removed. Removal of galled canes can be helpful at other times of the season as well.



Photo by James Solomon, USDA Forest Service, Bugwood.org

*Fig. 3. Rednecked cane borer adult and galls. Susan Ellis, James Solomon, Bugwood.org.* 

**Raspberry crown borer** is a clearwing moth (Sesiidae). Moths in this family are often wasp mimics, and this one is a good mimic of a yellowjacket. Crown borers invade the crown of the plant where they can cause girdling. After the eggs hatch, the larvae spend the winter in hibernacula beneath the soil surface. During the first summer, larvae feed within the crown; in the second summer, they tunnel upward into canes. They may be controlled by a soil drench in the fall, while they are preparing for overwintering, or in April, before they tunnel into the plant. Brigade (bifenthrin) or Altacor (chlorantraniliprole) may be used, applied in a minimum of 50 gallons of water per acre. In addition, infested plant may be rogued out.



*Fig. 4. Raspberry crown borer and larvae in its gallery. Univ. Georgia, Bugwood.org.* 

**Rose scale** may occasionally develop on caneberries. Rose scale overwinters as eggs beneath the maternal scale covering. There are 2-3 generations in the north, but more in the south. This scale can be controlled during the dormant or delayed dormant period using Admire Pro (imidacloprid), Brigade (bifenthrin) or a 2% solution of Tri-Tek oil. Sprays should be made when temperatures are above 50 degrees F.



*Fig. 5. Rose scale infestation in a caneberry planting in Blackstone Virginia.* 

If high populations of aphids, mites or leafhoppers are present after harvest, they can be controlled as during the pre-harvest period.

#### Strawberry

Since strawberries are harvested early, for perennial or matted-row crops much of the remaining season is a post-harvest season. Foliar feeding pests can be controlled as normal. A couple of pests bear specific mention.

**Strawberry root weevil** mainly occurs in beds that are in place for several years, but not in beds that have a shorter lifespan. The adults (all females) are flightless, and since they have to walk into the planting, and only have a single generation, populations need some time to build. If root weevils need to be controlled, Brigade (bifenthrin) or malathion may be applied when leaf-feeding by adults appears.

White grubs may be a problem in strawberries, and Admire Pro can be applied at renovation, when it is incorporated into the soil.



Fig. 6. Strawberry root weevil adult. Whitney Cranshaw, Bugwood.org

#### Blueberry

**Blueberry bud mite** is a tiny mite in the rust or blister mite family (Eriophyidae). Mites in this family tend to be highly host specific, and blueberry is the only host. The mite invades flower buds in late summer and fall, where they feed during the winter. Attacked buds fail to expand and bloom, or give rise

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## Our Continuing Search for Better Strawberry Varieties

E. Barclay Poling, Professor Emeritus, NC State & Master Licensee for Lassen Canyon Strawberry Nursery

Whit Jones, Extension Agent (retired), Duplin County & Farm Manager, Cottle Strawberry Nursery

In this paper, we wish to simply report our findings from a strawberry variety and advanced selection trial at a location in Eastern, NC (Cottle Farms, Faison), over the most recent 2019-2020 season. Our primary purpose for doing this testing program is to identify new varieties and/or advanced selections from various public and private breeding programs in the U.S. that could provide strawberry growers in the Carolinas and other states in the mid-South with an opportunity to replace Chandler and/or Camarosa.

<u>Background</u>. Historically, the University of California public strawberry breeding program, founded in the 1930s, has been the leading source of commercially useful strawberry varieties for the midto malformed, roughened fruit. The biology of this pest is not well known. Treatments may be considered in blocks of susceptible varieties with a history of infestation. High volume and high-pressure applications of horticultural oil may be made. Summer topping and hedging right after harvest helps remove older, infested tissue and can help in blueberry bud mite management.

**Scale insects**, while not usually a problem on blueberries, may be exacerbated by broad spectrum sprays for SWD or blueberry bud mite. They can be managed with applications of Sivanto Prime (flupyradifurone) or Movento (spirotetramat).

So, after harvest, look through your plantings and assess insect populations, and determine whether any action is needed. This may be a valuable time to take care of issues!

South over the last four decades. Chandler, released by the University of California in early 1980's, became the standard variety of the North Carolina strawberry industry from the mid-1980s through mid-1990s. Camarosa, a 1992 UC release, replaced Chandler to become North Carolina's dominant variety from the mid-1990s until the present. In more recent years, Albion, a day-neutral introduced in 2006, has been gaining some popularity in North Carolina and the Southeast. Also, a short day UC variety 'Merced' with excellent heat tolerance and large berries is showing some promise in our region.

Beginning in the fall of 2015, Cottle Farms of Faison, NC, in cooperation with Dr. Barclay Poling, former Small Fruit Extension Specialist, NC State (1980 -2010), began testing a number of newer strawberry varieties (including Ruby June, Sweet Ann, Lucia and Scarlet), and advanced selections coming out of the private breeding program of Lassen Canyon Strawberry Nursery, Redding, CA. Of this group, Ruby June has shown the best adaptation to growing conditions in Eastern NC (Figure 1), as well as on several commercial farms in the piedmont. Ruby June is very high in fruit quality, and its marketable yields have compared favorably with Chandler and Camarosa in four (4) seasons of testing at Cottle Farm. In 2019, the University of California strawberry breeding program released four (4) new varieties (Royal Royce, Valiant, Victor and Warrior), which were included in our 2019-2020 trial (Figure 2).

<u>Varieties Tested and Nursery Sources</u>. We evaluated fifteen (15) varieties, including ten (10) from the University of California: Albion, Camarosa, Camino Real, Chandler, Merced, Royal Royce, San Andreas,





Fig. 1. Ruby June is a new short day strawberry from Lassen Canyon Breeding program (Redding, CA). Fig. 2. A new variety and advanced selection trial was planted in mid-October 2019 at Cottle Farms, and it consisted of 128 plots (20 plant plots) with newer varieties and advanced selections from several breeding programs, including Lassen Canyon Nursery, University of California and NC State University.

Valiant, Victor and Warrior (Figs. 3 & 4). The four (4) newly released UC varieties were grown as cutoff plants, and were sourced from Norcal Nursery, Turlock, CA. All other cutoff plants utilized in the trial were furnished by either Lassen Canyon Nursery (LCN), Redding, CA, or Westech Agriculture LTD, Al-

berton, PEI, Canada. Westech LTD also furnished runner tips for plugs that were propagated in either Buffalo Junction, VA (PEI-1), or Faison, NC (PEI-2). All plant material from Lassen Canyon Nursery, is designated 'LCN' in Table 1.





Fig. 3. (left) Royal Royce – a new day-neutral from the UC-Davis Strawberry Breeding Program that has shown in California trials significant marketable fruit yield advantage over commercial checks (Cabrillo, Monterey and San Andreas). Apparently, it produces significantly fewer runners during the berry season (a very serious problem in Monterey), and has excellent postharvest and fruit quality characteristics (photo provided by UC-Davis). Fig. 4 (right) Valiant – a day-neutral that has shown excellent yields in the early season, and the plant has also performed well in organic culture (photo provided by UC- Davis).

We also tested two NC State releases, Rocco (NC10-156) and Liz (NC10-038). The plugs of both Rocco and Liz were grown by Aaron's Creek Farms, Buffalo Jct., VA. Rocco was described at the Varieties Breakout at the November 2019 Southeast Strawberry Expo by the panelists leading this discussion (Mark Hoffmann, Gina Fernandez and Rocco Schiavone) as follows:

 Rocco – short-day. Early season. Medium-large, medium soft berry, excellent flavor! Very high

Rank	CLONE/Plant	Mkt_lbs/plant	Tot lbs/plant	Percent cull	Ave berry weight (g)	<sup>0</sup> Brix	Flavor <sup>z</sup>
1	74X4 Cutoff LCN	2.83	3.38	16%	24.8	6.8	2.2
2	73X41 Cutoff LCN	2.62	3.23	19%	22.4	6.9	2.0
3	81X18 Cutoff LCN	2.60	3.03	14%	20.7	8.3	1.8
4	89T2 Cutoff LCN	2.48	2.90	14%	28.8	7.3	2.1
5	57U55 Cutoff LCN	2.47	2.79	12%	24.7	6.3	2.0
6	86U59 Cutoff LCN	2.45	2.88	15%	25.0	6.5	1.9
7	Camar. Cutoff LCN	2.39	2.75	13%	18.4	6.6	2.3
8	Camila Cutoff LCN	2.37	2.83	16%	24.5	7.4	2.2
9	Liz Plug NCSU	2.37	2.81	16%	16.9	7.8	2.3
10	12X40 Cutoff	2.30	2.89	20%	17.8	8.5	2.6
11	Camino Real plug	2.29	2.60	12%	21.1	7.5	1.9
12	UC Royce Cutoff	2.25	2.68	16%	27.9	6.7	1.5
13	152X15 Cutoff	2.23	2.56	13%	26.6	8.5	2.8
14	Ruby J Plug (PEI-1)	2.19	2.43	10%	20.0	8.4	3.3
15	Ruby J Cutoff (LCN)	2.17	2.45	12%	20.2	9.2	3.6
16	146T54 Cutoff LCN	2.16	2.36	9%	23.0	7.7	2.5
17	Camar. Plug (PEI-2)	2.11	2.59	19%	18.5	7.8	1.9
18	85U40 Cutoff LCN	2.08	2.62	21%	24.0	6.9	2.5
19	UC Valiant Cutoff	2.05	2.63	22%	28.6	6.0	1.7
20	84X27 Cutoff LCN	1.96	2.35	17%	21.7	7.6	2.7
21	Ruby J Plug (PEI-2)	1.92	2.17	11%	21.3	8.2	3.2
22	UC Victor Cutoff	1.85	2.73	32%	24.2	5.7	1.8
23	Chandler Plug (PEI)	1.85	2.15	14%	14.5	7.2	2.8
24	Gamar, Cutoff (PEI)	1.84	2.16	15%	17.8	7.5	2.2
25	122X8 Cutoff LCN	1.84	2.26	18%	29.2	8.9	2.9
26	Rocco Plug NCSU	1.79	2.33	24%	13.4	8.4	2.5
27	Ruby J Cutoff (PEI)	1.73	1.95	12%	21.0	8.8	3.4
28	95X5 Cutoff LCN	1.71	2.18	21%	24.0	8.3	2.7
29	53X53 Cutoff LCN	1.63	1.98	18%	23.3	6.6	1.0
30	Merced Cutoff LCN	1.61	1.94	17%	23.2	6.0	2.2
31	Chand Cutoff (PEI)	1.58	1.91	17%	13.0	8	2.8
32	Merced Plug (PEI)	1.54	1.87	18%	19.7	6.9	2.6
33	143T35 Cutoff LCN	1.53	1.83	17%	20.9	9.9	4.0
34	UC Warrior Cutoff	1.43	1.97	27%	23.0	6.2	1.7
35	San Andreas plug	1.35	1.60	16%	18.3	5.9	2.0

Table 1. The top thirty-five (35) Advanced Selections and Variety Treatments for marketable yield, 2020.

<sup>z</sup> Flavor rating: 4=excellent flavor; 3=good flavor; 2=fair flavor; and, 1=poor flavor

yielder. Biggest observed problem: Seeds on surface at times, very early. Best for pick your own and on farm sales. Consider as Sweet Charlie alternative.

 Liz – short-day. Mid-season. Medium-large, firm berry, good flavor. High yielder. Biggest observed problem: large canopy can make it hard to pick. Best for pick your own and short distance shipping. Consider as Camarosa alternative.

Lassen Canyon Nursery furnished cutoffs of two (2) varieties: Camila and Ruby June – these are both short day (SD) varieties. Fresh Forward of the Netherlands furnished the SD variety Calinda.

<u>Planting dates, plot size and replication</u>. The trial was transplanted on October 15, 2019. The only exceptions to this planting date were for Royal Royce, Valiant, Victor and Warrior – these were delayed in digging, and were not transplanted until October 24, 2019. Each plot consisted of twenty (20) plant plots and there were two (2) replications for all the varie-ty/plant type treatments shown in Table 1, except for the new UC varieties (Royal Royce, Valiant, Victor and Warrior), which had four (4) replications. First year LCN Advanced Selections were planted in single replicates. Second year LCN Advanced Selections (repeaters) had from two (2) to four (4) reps.

#### <u>Results</u>.

The marketable yield (per plant), total yield (per plant), percentage cull fruit, average berry weight (grams per berry), <sup>o</sup> Brix, and Flavor (flavor rating: 4=excellent flavor; 3=good flavor; 2=fair flavor; and, 1=poor flavor) of the top thirty-five (35) advanced selections and variety treatments are shown in Table 1.

Marketable yield (MY). The relatively cool weather conditions that prevailed in April and May 2020 made conditions favorable for an exceptionally long harvest season, and seventeen (17) harvests were conducted from March 26 – June 8, 2020. The LCN Advanced Selection 74X4 (cutoff) had the highest marketable yield (MY) in the study of 2.83 lbs. per plant (see No. 1 Rank, Table 1), and Camarosa grown as a cutoff (see No. 7 Rank) had the highest MY of any named variety with 2.39 lbs. per plant, or approximately 35,550 lbs. per acre (assuming 15,000 plants per acre). Camila, Liz, Camino Real, and UC's new variety, Royal Royce, all had marketable yields of more than 2.25 lbs. per plant. With Ruby June plugs, the MY was in the range of 1.92 to 2.19 lbs. per plant, depending on treatment (Table 1). Ruby June cutoffs ranged from 1.73 to 2.19 lbs. per acre (Nos. 27, and 15, respectively). Chandler had MY's in the range of 1.54 to 1.85 lbs. per plant (Nos. 31 and 23, respectively).

Figure 5 shows the relatively "even" distribution of the entire crop over the first two (2) months of picking (March 26 to May 25), for Ruby June and the LCN Advanced Selection 146T54. Chandler had a much more variable yield pattern during this same two (2) month period (Figure 5). Having a more even production level each week during the season can be beneficial for planning harvest labor requirements throughout the season. Having a relatively consistent level of production each week of the season also lessens the likelihood of more catastrophic crop loss in the event heavy rains should coincide with a variety's peak production period. In Figure 5 you can see that Chandler had twin production peaks - one in early April, and another in late Aprilearly May. Ruby June did not have any 'spikes' in production comparable to Chandler; and, 146T54 had a single production peak around May 11, 2020.



Fig. 5. The Lassen Canyon variety Ruby June (light blue line), and the LCN Advance Selection, 146T54 (light green line), stay in a narrower band of production from one harvest to the next by comparison to the industry standard Chandler.

*Cull fruit.* It is important to note that the spring 2020 strawberry season was characterized by very rainy conditions -- we only had two (2) of the seventeen (17) harvests that were unaffected by rainy conditions. Cull fruit data in this trial essentially reflect losses due to rain. The UC variety Victor had the worst rain tolerance with cull losses of 32% (No. 22), followed by UC's Warrior with 27% cull fruit (No. 34), and Valiant with 22% cull fruit (No. 19). Royal Royce had the best rain tolerance of the four (4) new UC varieties, with 16% cull fruit (No. 12). The industry standard in the mid-South for rain tolerance is Camino Real, and in this trial Camino Real had cull fruit losses of 12% (No. 11). For the full season, Ruby June had cull fruit losses in the range of 10 to 12% (see Nos. 14,15, 21 and 27). For the first fourteen (14) harvests of the 2020 season (from March 26 to May 25), Ruby June had only 5% cull losses, and the LCN Advanced Selection 146T54 had only 4% cull losses (Fig. 6). Because of 146T54's relatively low rain losses, Lassen Canyon Nursery is moving forward with naming 146T54 in 2021. This selection will also be tested in the 2020-2021 season by university researchers in Arkansas (Dr. Amanda McWhirt, Univ. of Arkansas), North Carolina (Dr. Gina Fernandez, NC State), and Virginia (Dr. Jayesh Samtani, Virginia Tech).

Brix Readings and Flavor Scores. We did a minimum of three (3) Brix readings during the harvest season for each variety and advanced selection, and the Brix numbers and flavor scores shown in Table 1 represent the full season averages. Essentially, we found that all of the new UC varieties tested low for sugars. Royal Royce (No. 12),



Fig. 6. The Lassen Canyon variety Ruby June had only 5% cull fruit losses for the fourteen (14) harvests from March 26 to May 25, 2020; Lassen will soon be naming 146T54 because of its excellent rain tolerance and overall good production characteristics.

for example, had an average Brix of 6.7. By comparison, Ruby June treatments had average Brix readings in the range of 8.2 (No. 12) to 9.2 (No. 15).

Flavor scoring was subjective (done by Barclay Poling), and the average flavor score was only 1.5 for Royal Royce (4=excellent flavor; 3=good flavor; 2=fair flavor; and, 1=poor flavor). Flavor scores for Ruby June ranged from 3.2 (No. 21) to 3.6 (No. 15). Camarosa flavor scores typically fell into the range of 1.9 (No. 17) to 2.3 (No. 7). The average flavor score of for 146T54 (No. 16) was comparable to Camarosa (Nos. 7, 24). Table 2 shows a comparison of Brix and flavor scores for Camarosa and Ruby June for three (3) harvest dates. We were impressed not only by the higher seasonal Brix readings and flavor scores for Ruby June treatments

Table 2. Soluble Solids	(Brix	) and Flavor Ratings, Faison, NC, 2020
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	Marc	h 31	April	15	May	12
	<u>Brix° Fl</u>	avor <sup>y</sup>	Brix	Flavory	Brix <sup>o</sup>	Flavor <sup>y</sup>
Camarosa	7.5	2.3	6.8	2.3	7.8	2.4
Ruby June	9.0	4.0	8.4	3.5	10.8	3.5

Y Flavor rating: 4=excellent flavor; 3=good flavor; 2=fair flavor; and, 1=poor flavor

shown in Table 1 relative to the industry standard Camarosa, but we were also able to observe how consistently Ruby June maintained its flavor throughout the season (Table 2).

Because of the heavy emphasis we place in this testing program on flavor, the top seven (7) Advance Selections shown in Table 1 were eliminated from further testing consideration due to their flavor scores below a minimum level of 2.3. On a more positive note, we did identify an advanced selection (No. 33, 143T35), with a seasonal Brix reading of 9.9 and an excellent flavor score of 4.0. Its main drawback is lower productivity in comparison to Camarosa or Ruby June, and in the 2020-2021 season it is being tested as a plug plant to see if this might boost its yield.

Berry size. With harvest labor becoming more expensive each year, it is that much more important for growers to select varieties with good "picking performance" characteristics. In this program we eliminate from further consideration any variety or advanced selection that does not meet a minimum berry size of 18 grams. The names of varieties and advanced selections that did not meet this minimum size requirement are italicized in Table 1. Chandler had an average berry size of 13.0 grams, which was the lowest of any variety or advanced selection tested (Table 1). Most of the Camarosa treatments were slightly above 18 grams in average berry size, with the exception of No. 24 (cutoff, PEI, 17.8 g). Contrary to the suggestion that Ruby June may only be good for "pick your own and short distance shipping" (SE Strawberry Expo, Variety Breakout Session, Nov. 2019), this variety does have more than acceptable average berry size for commercial harvest (see Nos. 14,15,21 and 27). Ruby June clamshell berry counts were in the range of 21-23 berries (1 lb. clamshell). By contrast, Camarosa had clamshell berry counts of approximately 25 berries. Ruby June also has very good shelf-life and is exceptionally easy to pick.

#### Summary.

In our testing in Faison, NC (Coastal Plain) over the last five (5) strawberry seasons, we have not seen much difference in the overall performance of cutoff vs. plug plants. In 2019-2020, Ruby June, for example, produced an average of 2.05 lbs. per plant as a plug (average of two sources), and 1.95 lbs. per plant as a cutoff (average of two sources). In colder growing areas, however, the yield difference between plugs and cutoffs can be much greater, and plugs are generally recommended for regions with shorter fall growing seasons. The chief problem with cutoffs in colder growing regions is related to availability - typically this type of transplant is not available until early to mid-October from nurseries in California and Canada. In reference to transplant choice in colder growing areas, it is helpful to note that in a first year trial conducted in Maryland in the 2019-2020 season (Shlagel Farms, Waldorf, MD), that Ruby June plugs produced an average of 1.4 lbs. per plant and cutoffs had 1.3 lbs. per plant in marketable yield (https:// www.flavorfirst.com/preliminary-reports ).

In looking forward to the 2020-2021 season, we are carrying forward two (2) LCN Advanced Selections: 152X15 (No. 13), and 122X8 (No. 25). These selections had good flavor (range of 2.8-2.9), and 152X15 is a very attractive berry with excellent size (26.6 g). We are also excited about our growing network of research collaborators in AR, NC, and VA who will be evaluating 146T54 (rain tolerant) and 143T35 (high flavor) in the coming season. We also wish to acknowledge the special assistance we received in the 2019-2020 from Dr. Mark Hoffmann, NC State, and his research assistant, Emma Volk.



# Fall Cold Injury: Impact on Strawberry Crowns and Spring Yield

Amanda McWhirt, Horticulture Specialist University of Arkansas

In early November of 2019 a cold front moved across the Southeast on Veterans day, and brought drops in temperature of 40-50°F across the state of Arkansas. (See Twitter post from NWS). Low temperatures dipped to 13-14 °F statewide on Tuesday November 12<sup>th</sup>, 2019 and in some cases set new low temperature records for that day. The temperatures remained cool throughout that day and into the next day.

Once properly acclimated to cold temperatures strawberry crowns are cold hardy to around 10°F and leaves are hardy to around 22° F. The process of cold acclimation in plants generally starts as the day length shortens and colder temperatures near freezing occur. These events signal to the plant to start the process of acclimating for cold temperatures and preparing for dormancy. However, the Veterans day freeze was the first time during the fall of 2019 that temperatures dropped near or below freezing for many places in the state, so recently planted strawberry plants and many other plants had not yet acclimated to cold temperatures.

The early occurrence of the cold weather also meant not all growers had their row covers ready or could only cover parts of their fields. Additionally, initial forecasts of rain occurring around the event meant there was a risk of applying a row cover and having it freeze to the plants which provides no protection and can damage the plants.

Due to these factors we suspected that strawberry crowns had suffered cold injury. Starting a week after the deep freeze occurred in November 2019 we cut strawberry crowns at five locations in AR to assess if any damage occurred.

Here are the locations where we assessed strawber-

ry crowns for cold injury:

- Fayetteville (13°F on 11/12/19) (Zone 7a)
- **Clarksville** (16° F on 11/12/19) (Zone 7b)
- Hope (14° F on 11/12/19) (Zone 8a)
- White County (No recorded low at location for 11/12/19) (Zone 7b)
- Kibler, AR (13-14°F on 11/12/19) (Zone 7b) (Variety Trial Location)

Cold injury appears in strawberry crowns as a darkening of the internal tissues or pith. Often the cold injury will start at the top of the crown and move



# **NWS Little Rock**

Here's a look at the temperature change across the state in the last 24 hours. Some locations across the northwest have dropped almost 40 to 50 degrees! #arwx



PROTOTYPE image generated by the Weather Prediction Center at 0049Z Tue Nov 12 2019

downward. Image 1: Screen shot of NWS Twitter post on November 12th, 2019. We developed a system to rate the severity of cold injury we observed:

#### 0-No injury

- **1-Minor Injury**, light brown discoloration in less than 50% of the crown
- **2-Moderate injury**, medium brown discoloration in more than 50% of the crown
- **3-Severe injury**, dark brown discoloration in more than 50% of the crown and some necrosis of the tissue

# Factors that impact the occurrence of cold damage on strawberry crowns

able levels of cold injury, in some cases severe, likely due in part to plant size, which was small in some locations

- Fronteras and Albion showed severe cold damage when left un-covered (average rating of 2.0)
- Weak plants with small crown size showed more damage than plants of the same cultivar with larger diameter crowns. This was particularly noticeable on late plantings where plants had small crowns.

From our evaluations across the state there were several factors that were determined to impact the occurrence of cold injury to strawberry crowns:

- Plants that had row covers *did not* show signs of cold damage during this event
- Plants that were left uncovered showed varying levels of cold damage, some significant
- The amount and severity of damage varied based on plant vigor, plant size, location within the field and variety
- The north side of the rows tended to show more damage than the south sides of the row
- We observed a large amount of variability within fields, likely due to lows spots where cold air pooled in the field.

Differences between varieties

- Rocco, Chandler and Camarosa showed very low to no cold damage (average rating of ≤ 1)
- Ruby June showed vari-

Strawberry Crown showing no signs of cold damage, notice how the entire crown is a clear ivory white color. (Fayetteville, AR)











Photos: Amanda McWhirt

#### Impacts on Crop Development and Yield

Strawberry plants in the fall are building crowns and initiating floral buds in the crown for the next spring. Damage to the crown therefore means a likely reduction in the crown growth, floral bud initiation and ultimately yield. *The extent to which yield is impacted depends on where in the crown the damage is observed and the severity of damage.* 

- Typically, if damage occurs it starts at the top of the crown where the crown is more exposed and then moves downward through the pith into deeper parts of the tissues. The pith is the middle part of the crown where the plant develops its floral buds and runners.
- Damage can be more severe if the vascular tissue (cambium) (AKA the plumbing for the plant) is damaged. In the pictures of the cold damage ratings the cambium can be seen as the two clear white lines on either side of the crown. If this part of the crown is damaged the effect is more likely to result in severe reductions in yield and even plant death.

#### **Potential for Crown Recovery**

In order to determine the potential for strawberry crowns to recover from cold injury in March of 2020 we re-cut crowns and examined for symptoms of cold injury at the Kibler location. This location is where we were conducting a variety trial and the site was not able to be covered during the November 2019 freeze. Overall the location had an average cold damage rating of 2.19 across all cultivars after the November freeze. Our results show that some cultivars are more susceptible to cold injury, while others are better able to recover from cold injury.

During assessments made in the spring at the Kibler location it was observed that:

Strawberry crowns with a fall cold injury rating of 0 - 2 in general showed recovery in the crown tissues (showed less damage or no damage) upon being examined in the spring.

Example: Rocco, Camino Real and Sweet Charlie showed recovery of the crown tissue from cold injury in the spring and had lower ratings of cold damage compared to their averages in the fall. Strawberry crowns with a fall cold injury rating of 2 -3 generally did not show recovery of the crown tissue from cold damage and often cold damage symptoms were worse in the spring.

Example: Fronteras and Albion had the highest ratings of cold damage in the fall and still showed major symptoms of cold injury in the spring.

Because we weren't able to compare our yields to plants with no cold injury we cannot make assumptions about how cold injury impacted yields. However, it is assumed that the damage did negatively impact yields at some level. There may be some evidence of this as Abion and Fronteras were among the lowest yielding cultivars at this site in 2019-2020.

### Marketable Strawberry Yields at University of Arkansas Vegetable Research Station, 2019-2020

Cultivar	Average marketable yield (lbs./ per plant)	Average spring cold dam- age rating
Albion	0.60	2.3 (Moderate)
Fronteras	0.85	3.0 (Severe)
All other cultivars	1.12	1.0 (Minor)

\*There were high rates of rain and hail damaged berries in this trial, which resulted in lower marketable yields

From these assessments we recommend growers have row covers on-site and ready early in the fall.

Also it is important to be aware of differences in cold damage susceptibility between varieties and locations in the field when making decisions about which plants to cover.



# Digital Diagnosis for Disease and Insect Problems

Rebecca A. Melanson, Extension Plant Pathologist, Mississippi State University,

Aaron Cato, IPM Specialist, University of Arkansas

Diagnosis is the first step in pest management. It is first necessary to know the cause of a problem before appropriate management methods can be implemented. Management methods that do not accurately address the problem at hand can add to production costs and delay implementation of effective management methods, which can lead to an increase in yield losses due to the ongoing problem. Oftentimes, physical samples are submitted for disease or insect diagnosis. However, in the digital age of smartphones and email, county agents, diagnosticians, and Extension specialists increasingly receive emails and/or texts with digital images (photos) of plants or insects asking for assistance in identification and management. Travel and other restrictions brought on by the COVID-19 pandemic have further popularized the use of virtual diagnostics. In some cases, such requests are made through an online system used by the state university diagnostic laboratory or clinic. While digital images can be informative, it is not always possible to diagnose a problem from images alone. This is particularly true with plant diseases as many produce symptoms that are similar and cannot be distinguished without examination of a physical sample. In addition, it is sometimes necessary to to isolate a pathogen or perform laboratory tests to detect and identify a pathogen present in a sample. The following tips and guidelines for taking digital images and getting assistance with digital diagnostics are intended to help you make the most of your efforts and help us better serve you:

⇒ Get to know your local county agents and specialists and become familiar with the capabilities and guidelines of your local state university diagnostic facilities! This will allow you to act quickly when time is of the essence.



**Photo 1.** Taking photos that focus on small plant parts can be difficult. A piece of paper was used to help focus on this blackberry cane. The paper creates a solid barrier and can help keep your camera

University diagnostic facility websites: <u>Alabama</u>, <u>Arkansas</u>, <u>Florida</u>, <u>Georgia</u>, <u>Kentucky</u>, <u>Louisiana</u>, <u>Mississippi</u>, <u>North Carolina</u>, <u>Tennessee</u>, <u>South Carolina</u>, <u>Virginia</u>

⇒ Provide relevant information with submitted images. This includes the date the image was taken, the date symptoms first appeared, information about the crop in question (host/ species, cultivar/variety, plant age, etc.), the crop stage, field distribution, field history, and any other relevant events, such as recent weather conditions prior to symptom development or pesticide applications that recently occurred in the affected planting. Information such as planting location (field or enclosed structure), production type (commercial vs. home garden), and pesticide usage preferences (conventional vs organic) can also help when developing management recommendations. When sending images, it is also a good idea to describe the observed symptoms and how they may have changed over time. Much of this information is requested on the sample submission forms for the various university diagnostic labs (examples: Arkansas, Georgia,

Louisiana, Mississippi, North Carolina, Tennessee, South Carolina).

- ⇒ Make sure images focus on the correct target. Clear images can be hard to take within a crop canopy where there are many focal points. Be sure to center the photo on the symptom or insect in question, adjust the focus, and take multiple photos. It may help to use a sheet of white paper to provide a solid background to help with focusing images (Photo 1). Images should be reviewed and checked for clarity before submission.
- ⇒ Take multiple high-quality photos that capture the various symptoms and different views of the affected plant. Depending on the cause of the problems, symptoms may be present on multiple plant tissues or may occur on particular areas of a plant (upper or lower leaves) or in certain patterns in a field (random or clustered). Taking images that show each of the different symptoms on various plant tissues, the entire plant (a "plant view"), and the landscape where the symptomatic plants occur (a "field view") can provide relevant information to assist in diagnosis. Examples and explanations of these situations are provided in **Photos 2, 3 and 4**.
- ⇒ When sending photos of insects, if possible, include images of the suspected damage or the plant part that was being fed upon. Insect pest diagnosis in specific crops can often be achieved with damage symptomology alone (Photo 5), and many times the insect pictured is not related to specific damage symptomology (Photo 6).
- Hint: Taking clear photos of live insects can be incredibly difficult if they are actively moving. Capture insects and place them in a freezer for 10-20 minutes. This will slow the insects down and allow for a clear and focused image.
- ⇒ Include something of known size in the image. This can often be achieved by including plant parts with photos of insects. However, zoomed in images of disease symptomology or insects can be hard to discern. Consider including a ruler or coin or other small item of known size in the image when possible (Photo 7).

More information and examples of images for plant disease assistance are available in the MSU Extension factsheet "<u>Taking Photos of Plant Disease Prob-</u> <u>lems</u>."



**Photo 2.** This photo shows the importance of taking multiple photographs from different angles. This is an example of leaf rust on blackberry, which is easily identifiable by the orange pustules on the underside of the leaf (B). If only viewed from above (A), these diagnostic pustules may not be visible. Credit: A. Cato, University of Arkansas.





**Photo 4.** A "field view" of spider mite damage in strawberry. Pictures of the field view can be important because many pests have distinct patterns to their damage within a field. Credit: N. Hummel, LSU AgCenter, Bugwood.org.



**Photo 3.** A "plant view" of a blueberry plant with crown gall (A) and a close up of the galls (signs) at the base of the plant (B). The galls are the result of infection with the crown gall bacterium. "Plant views" can show where on the plant symptoms or signs occur and the appearance of the various portions of the entire plant. Credit: M. A. Hansen, Virginia Tech, Bugwood.org.

**Photo 5.** The damage to this blackberry plant is caused by microscopic mites that can only be seen and photographed with a microscope. This picture along with information about the planting and time of year is sufficient to suggest a broad mite issue. Credit: A. Cato, University of Arkansas.



**Photo 6.** This picture indicates multiple issues that are not related. The damage to the leaf (cupping) was caused by herbicide drift multiple weeks before the photo was taken. The insect pictured is a green stink bug which can damage the developing fruit of the plant. This exemplifies the importance of picturing both the suspected damage and pest, as the two may occur together but not be related. Credit: A. Cato, University of Arkansas.



**Photo 7.** A ruler included in the image with this grape tissue with anthracnose lesions on the branches and petioles gives the viewer a sense of size of both the leaves and lesions. Credit: P. Bachi, University of Kentucky Research and Education Center, Bugwood.org.

# Next issue of the Small Fruit News: January 2021 Small Fruit News Editorial Team Editor at Large/Weed Science: <u>Amanda McWhirt</u>, Entomology: <u>Doug Pfeiffer</u> Horticulture/Production: <u>Jayesh Samtani</u>, Plant Pathology: <u>Rebecca Melanson</u>