Small Fruit News

Fall 2021 Edition, Vol. 21 No. 4

www.smallfruits.org

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Impact of Winter Injury and Spring Freeze on Blackberry: Observations from the 2021 Season in Arkansas

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In the late winter and spring of 2021 we experienced two severe cold events in Arkansas that had the potential to impact fruit crops. The first event was arctic air that moved into the state during the week of February 14th, 2021 where low temperatures of to -20°F to 0°F occurred on Feb 16th (Table 1). After the February event we observed symptoms of cold injury and potential crop loss to peaches, blueberry and blackberry across the state. This was a major cold event for us in Arkansas with low temperatures 10-15° F below the low temperatures that are typical for our area and many parts of the state experienced 200+ continuous hours at temperatures below freezing which increases the likelihood for damage.

Unfortunately crops whose floral buds survived the February freeze, were then blooming or setting small fruit during a frost event on April 20th-21st where temperatures dipped into the mid to low 20s F (Table 1).

Major crop reductions to peaches and muscadine occurred in Arkansas during the 2021 season due to these events. Muscadine vines were killed back to the ground in part of the state and fruit loads on peaches in many parts of the state were drastically reduced. Surprisingly blackberry crops in many parts of the state were near normal levels despite the extreme temperatures observed. Blackberry cane damage is expected to occur once temperatures dip below around 0-10F and blooms are damaged below around 27F.

The conditions we experienced in 2021 were expected to result in major reductions in blackberry yields at our University of Arkansas Fruit Research Station, Clarksville (FRS) where lows in Feb achieved -15F and lows in April were 28-30F, however we still had decent crop yields at this location and in locations with similar conditions. Why?

Trellis

In some cases growers using the rotating cross arm trellis were able to lay the trellis down and cover the plants during both cold events and were able to save the crop where growers using traditional static trellising had more significant crop loss.

Hardiness of Canes/Health of Plants

Substantial cane damage was expected at -15F, potentially with canes of most cultivars killed to the ground. It was difficult to believe the lack of cane damage, and for most cultivars, bud damage, after this event. It is believed that a key reason the damage was not worse was the plants had not lost hardiness from their mid-winter hardiness levels. In the South, cold damage to blackberries and other crops is often due to fluctuating temperatures resulting in hardiness loss. For the week prior to the -15F event, 6 of 7 days had highs in the 30s or below, with night temperatures from mid 20s to teens. This likely prepared the blackberries for this unusual event. Another factor could have been plant health. At FRS, there are multiple plots for many cultivars, and these plots have varying levels of care (weed and pest control, irrigation, etc). In general, where the overall care and health of the plants was not as high, there was more winter cane damage. This should be noted since good planting management has many benefits, including potentially higher winter hardiness level.

Cultivar

In other cases we observed major differences in crop loss among cultivars. Following the February freeze we saw high rates (>60%) of cold injury in primary buds (Figure 1) of Prime-Ark Freedom and moderate levels (20-40%) of injury to Natchez, and only very minor damage to Ponca and Ouachita. Cane injury externally and internally was observed on some cultivars but not uniformly. This shows up as withering of the cane on the outside or darkening of the internal portion of the cane just below the surface of the bark (Figures 2,3). More extreme cold injury was observed in less protected locations or low areas of poor cold drainage.

Following this event we saw mostly normal leaf out and flowering at FRS. Some growers at colder locations experienced uneven budbreak and reduced flowering. However, following the April frost growers reported losses of 50-100% to primary buds for certain cultivars and open blooms in the central and northern parts of the state (Figures 4, 5). These observations reinforce the importance of planting multiple cultivars that have different bloom and ripening periods.

Secondary/Basal Buds

Secondary buds are found on some cultivars, while others produce few to no secondaries. The potential of secondary buds is not well known for most cultivars due to their presence not being that commonly seen (if the primary crop is full, the secondaries normally do not develop). It is possible that secondary buds do not develop consistently for a cultivar in different environments also. Secondary buds usually have a much longer flower

cluster/shoot length, and often have fewer flowers per cluster than the normal primary buds (Figure 6). However, secondary buds usually have many large leaves, and produce very good quality berries that ripen later than the primary crop. This year provided a good opportunity to observe secondary bud crop potential, and cultivars or advanced breeding selections varied significantly in this characteristic.

Another potentially important component of yield of blackberries, particularly for local-market growers, is basal buds or inflorescences which emerge from the crown of the plant. Many have seen these produced on the older variety Navaho, which tends to produce basal inflorescences commonly, and more so if winter injury to buds occurs on the upper-portion of the plant canopy. This year there was a significant amount of basal inflorescences produced on some blackberries. These berries also ripen later and are often very large and of high quality due to the large leaves produced.

Arkansas Cultivar Observations and Experiences - A Closer Look

A very close look was provided this year among the more important Arkansas varieties, those established in the market or being planted for the first time. Ouachita, the most widely planted Arkansas variety, did not show any obvious cane or bud damage from the February freeze. It was not in bloom on the April 21 frost, but had many large, unopen and exposed flower buds. It was estimated to have 10-20% crop reduction due to bud damage. This was very surprising due to Ouachita is one of the most reliable producers due to later bud break than Natchez or Osage. And, normally this level of bud damage would not be expected at 29-30F that was recorded at the site. Overall, Ouachita produced a good crop for the year, but likely was not at full potential. Noteworthy was that Ouachita produced very few secondary or basal inflorescences, reflecting little “recovery” potential from the frost. Natchez appeared to have some bud damage from the February extreme temperature, and some flower clusters were reduced in number of flowers present (evidence of winter damage), thus Natchez started out the bloom period reduced in crop potential. It was in bloom on the date of the frost, and experienced devastating damage to open flowers and buds. Crop was estimated to be 1% after the frost. Interestingly, Natchez produced a noteworthy number of secondary buds along with some basal inflorescences, and was estimated to have a 5-10% crop due to these later-developing buds. The berries produced were large and of exceptional quality. Osage did not show any cane or bud injury following the February extreme, and was in early bloom at the time of frost, slightly behind Natchez in degree of bloom. It was estimated to have 85% crop reduction due to damage to open flowers and developing buds. Osage produced very few secondary or basal inflorescences.

The newer cultivars Ponca and Caddo had some of their first experiences with cold damage in these challenging events. Ponca ripens early, near or with Natchez, but blooms 8 days after Natchez and 4 days after Osage. Ponca was noted to have a slight amount of damage to buds after the February freeze and some frost damage to exposed flower buds at frost (bloom had not begun), resulting in an estimated 10-20% crop reduction and thought to be a

little more damaged than Ouachita. However, Ponca has a number of secondary buds usually, and these broke as expected. Ponca also produced a substantial basal inflorescence crop, and this was more than observed prior. When the year was complete, it appeared that Ponca provided a full crop. Caddo was not observed to have freeze damage to canes or buds. It was not in bloom at the frost event but did incur damage to unopen buds and was estimated to have 10% crop reduction. Caddo also produced a number of basal inflorescences that had substantial yield potential that extended the fruiting season beyond that of Ouachita.

The primocane-fruiting cultivars suffered much more substantially than floricane-fruiters from the February freeze. A major impact on primocane fruiters and resulting freeze damage is the degree or amount of primocane fruit produced the prior fall. In the fall of 2020, a larger than normal primocane crop was produced at FRS, and this resulted in the canes naturally dying down to a point below the fruiting point. The February freeze appeared to compound the degree of dieback on the canes, so that a major reduction in crop potential occurred. Prime-Ark® 45 had severe cane damage due to the winter freeze plus substantial frost damage resulting in an estimated 90% crop reduction. It produced a limited number of basal inflorescences along with limited secondary buds. However, it was observed in North Carolina, where the severe February freeze was avoided, but the April frost occurred, that Prime-Ark® 45 produced a substantial secondary bud crop that extended ripening almost into the primocane production season. Prime-Ark® Traveler fared a little better than Prime-Ark® 45 at FRS, but still was highly impacted by the winter freeze and spring frost. The damage to Prime-Ark® Freedom was the greatest of all primocane fruiters, with winter freeze bud damage over 95% of the floricane crop. The new Prime-Ark® Horizon fared better than other primocane fruiters as far as survival of canes in the February freeze, but with the combination of winter and frost freeze damage was estimated to have 75% crop reduction.

Table 1: Low Temperatures observed at locations across Arkansas in February and April of 2021.

Location	Recorded Low Temperature on Feb 16th 2021*	Recorded Low Temperature on April 21st, 22nd, 2021*
Fayetteville	-20 to -10 ° F	26, 29° F
Harrison	-6 ° F	31, 30° F
Clarksville	-6 to -15 ° F	28-30, 30° F
Little Rock	-2° F	37, 35° F
Paragould	-3 ° F	33, na ° F
Hope	-7° F	31, 32° F
Pine Bluff	0 ° F	34, 35° F

**Data from NOAA weather stations and local weather stations*

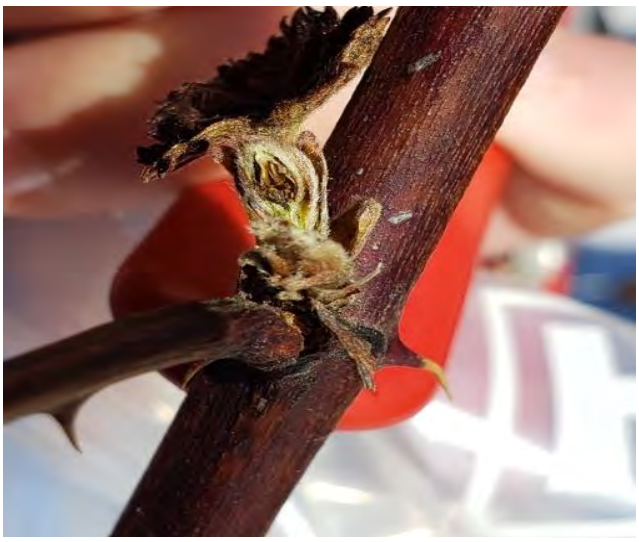


Figure 1: Blackberry buds with cold injury, photo: Amanda McWhirt

Figure 2: Blackberry cane injury, Photo: Dave Freeze

Figure 3: Blackberry cane not showing injury, Photo: Dave Freeze

Figure 4: Blackberry bloom not damaged by cold (left) versus one killed by frost (right), Photo: Sherri Sanders, Lizzy Herrera and Sarah Cato

Figure 5: Near total loss of closed blackberry buds due to cold injury (black centers), Photo: Lizzy Herrera and Sarah Cato

Figure 6. Observations of primary vs secondary bud production on blackberry, Photo: Amanda McWhirt

Anaerobic Soil Disinfestation shows potential as a preplant treatment in Plasticulture Strawberry Production

Danyang Liu and Jayesh B. Samtani, Hampton Roads Agricultural Research and Extension Center, Virginia Tech

The southern region is the second-largest strawberry-growing region of the United States. Strawberry plants are susceptible to soil-borne pests, including weeds and diseases. Early season weeds can compete with newly transplanted strawberry plugs for nutrients, light, and other resources. There are limited options of preplant fumigants and herbicides available for use in strawberry plasticulture production making weed control a challenge. Anaerobic soil disinfestation (ASD) may be an effective alternative to preplant chemical fumigation. Anaerobic soil disinfestation involves three steps- applying carbon sources to the soil, covering the bed with an impermeable tarp, and watering the soil to maintain soil moisture to field capacity, generally for 21 days.

There are only a few studies in the U.S. to date, evaluating ASD effects on weed control. Carbon sources local to our region also need to be evaluated for their use in ASD. Our initial study in greenhouse conditions focused on evaluating locally available carbon sources for ASD and showed brewers' spent grain (BSG) to be of promise. This study also explored a new approach of mixing distiller's yeast with solid carbon sources to enhance the ASD weed control effect. Additionally, this study evaluated the effect of ASD using reduced carbon inputs, thus potentially reducing the total cost of ASD. A follow-up, replicated, field study during the 2018-2019 and 2019-2020 growing seasons done at the Hampton Roads Agricultural Research and Extension Center evaluated BSG at full rate with or

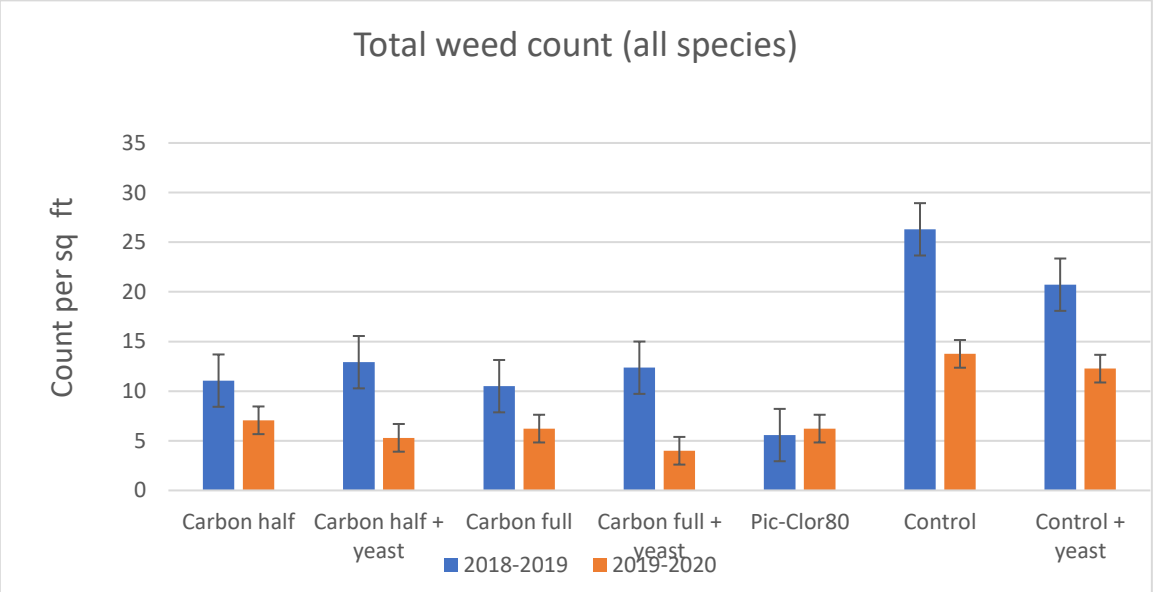


Figure 1. Total weed count of all species by treatments during 2018-2019 and 2019-2020 growing season.

without yeast. However, the total nitrogen from brewer`s spent grain (C: N ratio 14: 1) was much higher than the soil test recommendation for strawberry production. Thus, to reduce the nitrogen coming from the carbon source, the brewer`s spent grain was mixed with pelleted paper mulch (C: N ratio 57:1). Fumigation (Pic-Clor 80 at 175 lb/acre) treatment was used for comparison. We evaluated the effects of these treatments on weed control, plant crop growth, and crop yields for Ruby June strawberry variety.

Over both seasons, plots treated with all ASD treatments consistently and significantly had a lower density of most of the broadleaf weed species and total weed density compared to non-treated plots (Figure 1). In both growing seasons, the dominant broadleaf weeds species observed in the study were carpetweed, Carolina geranium, cudweed, henbit, and white clover. The dominant grass weed species were bermudagrass and crabgrass. Shepherd's purse and yellow nutsedge were dominant species only in the 2018-19 growing season but not the latter growing season. Compared to Pic-Clor 80, ASD treatments had similar control on cudweed, henbit, and white clover, but better control of Carolina geranium. Pic-Clor 80 had better control of carpetweed than ASD.

Strawberry marketable and total yield in the 2018-19 growing season was not significantly different among all ASD treatments and non-treated control, but all ASD treated plots had a higher marketable and total yield than non-treated control in 2019/20. In the 2019-20 growing season, yeast addition enhanced the crop yield of the ASD treatments compared to ASD treatments without yeast (Figure 2). Compared to plots treated with Pic-Clor 80, ASD treated plots in the 2018-19 growing season had lower total yield. However, in the 2019-20 growing season, plots with ASD at both rates with yeast had similar yield

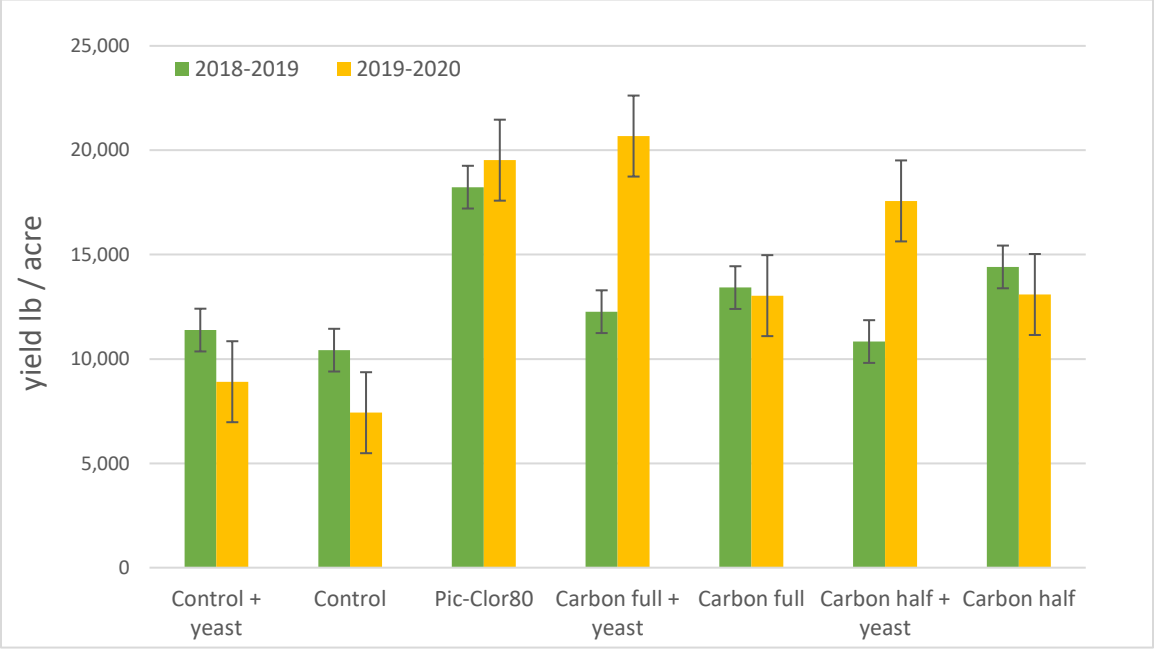


Figure 2. Total yields for the 2018-19 and 2019-20 growing season. Yields are estimated based on 12,500 plants per acre.

compared to Pic-Clor 80 treated plots. Therefore, the yeast amendment had the potential to enhance ASD using brewer's spent grain and paper mulch as carbon sources for weed control and improvement of strawberry yield. Half carbon rate of ASD with yeast could be a potential strategy to reduce the cost of ASD.

This study was funded in part by the Southern Region Small Fruit Consortium and North American Strawberry Growers Association.

Raspberry Crown Borer Management

Dr. Jackie Lee, University of Arkansas, Fruit Research Station Director

My first research project was funded through IR-4 and entailed finding management options for raspberry crown borer (RCB). I began that work in 2003 at the University of Arkansas Fruit Research Station as an MS student, under the direction of my advisor Dr. Donn Johnson, who retired recently and was also instrumental in these recommendations and research. In 2019, I took the role of Director at the University of Arkansas Fruit Research Station so I am sitting at my desk 18 years later writing this article from where it all began, which brings back a lot of good memories and hard work! There is a reason why RCB was not well studied, since it entailed working in thorny blackberries, digging blackberry plants, and cutting every inch of them by quarter inch pieces with hand pruners. Glad we have mostly thornless varieties on the station nowadays! It was all worth it in the end because we were successful in pinpointing important life history characteristics of RCB that were monumental in learning how to effectively manage it. We were also able to provide data to support adding chemicals to our toolbox. A few new chemicals have been added since then but for the most part recommendations have not changed much since I published my work in 2005. Raspberry crown borer, *Pennisetia marginata*, is a diurnal moth that flies during the day and mimics a wasp (Figure 1). They are so convincing that to the untrained eye they are mistaken for a common yellow jacket. These cryptic insects are devastating to blackberry and raspberry plantings. The larvae tunnel into canes and the crown of the plant to feed. This reduces yield, kills canes, reduces plant vigor and ultimately can kill the plant.

Figure. 1. Adult raspberry crown borer male and female. Blackberry field with first 4 rows showing decreased vigor due to RCB infestation. Photos courtesy Dr. Donn Johnson, University of Arkansas emeritus.

The adults emerge from the crown of plants in mid-September, take flight, mate, and lay eggs on the undersides of blackberry leaves. During this time, you can estimate your current infestation by examining the crowns

for exit holes that contain a protruding pupal skin (Figure 2) or look for the eggs on the underside of leaves around the margin (Figure 3). You can also examine spent floricanes this time of year. If you notice many are hollow, could be RCB. A good sign to look for in spring and harvest season is a shepherd's hook appearance at the tip of floricanes (Figure 4). This is due to the larva feeding up into the pith/middle of the cane and shutting off nutrient and water flow to the tip of the cane, which causes it to wilt. This will cause the floricane to produce less fruit, no fruit, or even die back. If you find a lot of floricanes that are hollow after harvest season during pruning, then you likely have an infestation.

Figure 2. RCB pupal skin protruding from cane base after adult emergence.

Figure 3. Raspberry crown borer female laying egg and egg on leaf margin

Figure 4. Shepherds hook appearance of RCB infested blackberry cane.

If you identify that you indeed have RCB then treatment is advised. There is not a derived threshold and I recommend treatment if any are discovered. The timing of treatment is critical due to the life history. I spent hours observing RCB in the field and the lab. Adult emergence and egg lay occurs in September in Arkansas and likely similar timing for much of the southeast. Emergence could be earlier in more southern locations. Once the larvae hatch in early to mid- October, larvae will crawl down the canes, or fall to the ground on a silken thread and make their way to the crown of the plant or first 2-4 inches of the cane. They burrow into the crown/canes and overwinter in the cambium just under the bark usually in a crevice, in October/November. They will overwinter and feed here under the cambium for a short time of their life cycle. In spring, they will bore in deeper and begin

feeding on the pith of the plant (Figure 5). It is critical to apply pesticides before this time. Once they bore into the plant, they become more difficult, almost impossible to control. Early spring is often advised as a good spray timing but the efficacy drops by 2/3 per my research, utilizing bifenthrin (Table 1). The best timing for chemical management we found is mid-late October.

Figure 5. Raspberry crown borer larva in crown of plant.

I recommend using flood nozzles to deliver a soil application but make sure to direct the spray to include the bottom 2-4 inches of the canes. I also recommend 50 gallons of water per acre. We compared multiple rates of water to deliver chemical and found that 50 gallons of water per acre was comparable in efficacy to 100 gallons for RCB. As for chemicals to use, there are not many options. When I first started this research in 2003, guthion was the only labeled chemical but was soon removed for use. We were able to get an RCB crown drench added to the bifenthrin label in 2005. Esfenvalerate and chlorantraniliprole were also labeled long after this research and have proven to also offer good control in more recent studies. We looked at nematodes as well for control and found them inferior to chemical management but they did offer 31-46% reduction in RCB larvae. I know these data are old but they still tell a powerful story on how timing is critical for RCB control and that an early spring timing may be too late (Table 1). It also shows how effective bifenthrin can be as a management tool.

Treatments	Rate	No. larvae per 5-plant plot			
Compounds	Amt form./ha	23 Oct. 2003	% Reduced	6 May 2004	% Reduced
Untreated Control		27.8 ± 4.05 a		19.6 ± 3.54 a	
GF-968	105.1 g/ha	-		18.4 ± 3.09 a	6
S. feltiae[1]	60,000 IJ/crown[1]	19.2 ± 5.62 ab	31	16.2 ± 3.05 a	17
S.feltia	1 cadaver/crown[1]	15.0 ± 2.23 b	46	-	
Novaluron 10 EC	1022.9 ml/ha	11.4 ± 4.77 bc	59	17.8 ± 2.08 a	9
Guthion Solupak	560.4 g ai/ha	3.0 ± 1.79 cd	89	11.8 ± 1.39 a	40
Lorsban 4 E	1186.1 g ai/ha	1.4 ± 1.40 cd	95	16.8 ± 1.66 a	14
Brigade WSB	112.1 g ai/ha	0.2 ± 0.20 d	99	13.2 ± 2.62 a	33

Table 1. Please note the only currently labeled chemical for use against RCB in this table is bifenthrin (Brigade WSB). Other chemicals used were for research purposes only. This table depicts chemical applications for raspberry crown borer in blackberry plots at two different timings, October and May. Reduction of larvae is given as a percent. ALL fall applications were superior. Brigade WSB (bifenthrin) provided excellent control.

Summary

How to identify RCB infestation.

1. Shepherds hook at the top of floricanes during early spring and harvest season
2. Dieback of canes that resembles winter injury during season
3. Exit holes at the base of the plant with a pupal skin protruding in early fall
4. Brown eggs on undersides of leaves
5. Hollow floricanes at the end of harvest season
6. Low plant vigor
7. Cut into canes and crowns of low vigor plants to look for larvae*

* If you notice cane dieback, low plant vigor, or a shepherd's hook, investigate further and cut through the cane in question to see if it is hollow. If it is hollow, cut it lengthwise and split it down the middle to expose the larvae. They tunnel from the crown, up the canes.

How to treat an RCB infestation.

1) Make chemical applications in the fall.
2) Apply a registered pesticide with flood nozzles delivered in at least 50 gallons of water per acre. Make sure to direct at the bottom of the canes as well.
3) Rogueing may be used as a cultural control method by removing any infested canes before adult emergence and burning them. Some larvae only feed in the crown so this method may not be highly effective unless the entire plant is removed.

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness	REI	PHI
Raspberry crown borer	**chlorantraniliprole** (Altacor 35WG)	3 to 4.5 oz	VG	4 hrs	3 days
	bifenthrin (Brigade 2EC and Sniper 2EC)	6.4 fl oz (soil drench)	VG	12 hrs	3 days
	(Brigade 10WSB)	8 to 16 oz (foliar) 16 oz (soil drench)	VG	12 hrs	3 days
	esfenvalerate (Asana XL)	9.6 fl oz	G	12 hrs	7 days

Table 2. Current labeled chemicals. Please note to check your state registry and read the pesticide label. Approved chemicals can vary from state to state and pesticide labels can change quickly.

Crush It Arkansas! Wine Quality Workshop

Join us for The Crush It Arkansas! Wine Quality Workshop Virtual on October 26, 2021 from 2:00 to 4:00 pm (CST). The workshop will overview keys to producing quality wine for amateur and commercial winemakers. The workshop will be held as a Zoom meeting and led by Dr. Renee Threlfall, Research Scientist, and Amanda Fleming, graduate student, from the Food Science Department, UA System. We will have two speakers from Scott Laboratories, Michael Jones, Fermentation Specialist, and Alicen Rouse, Field Sales Representative – Southwest Territory.

Meeting Agenda
2:00-2:05 Welcome and Introduction (Threlfall)

2:05-2:30 pm Essential Lab Equipment for Wine Production (Fleming)
2:30-3:00 pm Healthy Wine Fermentations (Jones)
3:00-3:20 pm Science of Wine Sensory (Threlfall)
3:20-3:50 pm Wine Faults and How to Avoid Them (Rouse)
3:50-4:00 pm Follow-up Questions

Registration for the workshop is complimentary, but registration is required.

The recording for the workshop will be available after the event. **Register link is https://bit.ly/Registration-Crush-It-Arkansas-Wine-Quality-Workshop**

Neopestalotiopsis disease in strawberry: what do we know?

By: Juliana S. Baggio and Natalia A. Peres, UF/IFAS-Gulf Coast Research and Education Center

If you grow strawberry or are somehow related to the strawberry industry, you must have heard about a new emerging disease, Pestalotia leaf spot and fruit rot, caused by the fungus *Neopestalotiopsis* sp. The taxonomy of this pathogen is confusing because it has gone through multiple reclassifications over the years, and it requires genetic (DNA) characterization. Researchers in Florida and Israel first reported a strawberry fruit rot caused by *Pestalotia longisetula*, subsequently reclassified as *Pestalotiopsis longisetula*. According to recent studies, isolates previously reported as *Pestalotiopsis longisetula* should be identified as *Neopestalotiopsis rosae.* This fungus has always been considered a weak or secondary pathogen and was most

commonly found causing symptoms on roots and crowns during plant establishment. In some cases, it was isolated along with other root pathogens, such as *Colletotrichum acutatum*, and crown rot pathogens, such as *Colletotrichum gloeosporioides*, *Phytophthora* spp., and *Macrophomina phaseolina*. Thus, it was never a major concern in the strawberry industry, until recently.

Fig. 1. Pestalotia leaf spot and fruit rot outbreak in Florida strawberry fields: A) overall field symptoms; B) light to dark brown spots on the leaves; C) fruit rot symptoms showing black structures of the fungus.

Three years ago, a severe outbreak was reported in a single commercial field in Florida and, for the first time in the U.S., massive spotting symptoms were observed on leaves and fruit (**Fig. 1**). During the subsequent seasons, the number of commercial farms reporting problems with this disease has increased. Yield was severely affected, and in many cases, entire fields were rendered uneconomical to harvest and were destroyed. The common linkage among the initial outbreaks was the nursery sources from which transplants originated. However, the pathogen spread very quickly to other fields, particularly after rain storms. Studies performed by researchers at the Unviersity of Florida IFAS-Gulf Coast Research and Education Center (GCREC) confirmed that this is a more aggressive form of this fungus that may belong to a new *Neopestalotiopsis* species. Although leaf spots and fruit rots can also be caused by *Neopestalotiopsis rosae*, most isolates recovered during the recent outbreaks belong to this new species. Thus, isolates must be correctly identified before panicking! Currently, the pathogen can be found in most fields in Florida, and it has been confirmed in some farms in North Carolina, Georgia, Texas, Indiana, and Pennsylvania. For the rapid and accurate differentiation of *Neopestalotiopsis* species, the Strawberry Pathology Lab group at UF/IFAS GCREC has developed a molecular diagnostic tool (HRM) that is already being employed at the GCREC plant diagnostic clinic.

Management of this disease depends on understanding the pathogen's biology and epidemiology and using integrated control approaches. Therefore, the Strawberry Pathology Lab at the UF/IFAS GCREC is currently working on several trials trying to answer growers' most frequently asked questions.

Where did it come from? How does it spread?

Isolates from the 'old' *Neopestalotiopsis* population (a.k.a. *Neopestalotiopsis rosae*) and from the new population were selected for complete genome sequencing. Comparative genomic analysis to identify genetic clues to the recent outbreaks are

currently being performed. Results are expected to generate insights into the origin and aggressiveness of the emerging population.

Since the disease was observed in fields where it was observed the previous season, field surveys in strawberry nursery and fruit production fields were conducted, and *Neopestalotiopsis* was able to be recoved from soil, crop residue, some asymptomatic weeds, and a few alternative hosts around strawberry fields. *However*, many other *Neopestalotiopsis* species found on those other hosts were *not* the new aggressive strawberry species and do not cause disease on strawberry. It is hypothesized that crop residue within strawberry fields serves as the main source of inoculum for disease outbreaks during the following season. However, more studies need to be performed to clarify this hypothesis and to provide a greater understanding of the pathogen's ability to survive under different conditions and the main factors influencing disease spread within strawberry fields.

Within the season, *Neopestalotiopsis* is easily spread in the fields by wind, water (overhead irrigation and rain), farm equipment, and field workers during harvesting and cleaning operations. The most favorable temperature for disease development is 68°F (20°C); however, disease symptoms can be observed even at 41°F (5°C) after 48 hours of leaf wetness (water on the surface of the leaves). It seems that leaf wetness, plays a more important role in pathogen infection and disease development than temperature.

How can it be managed?

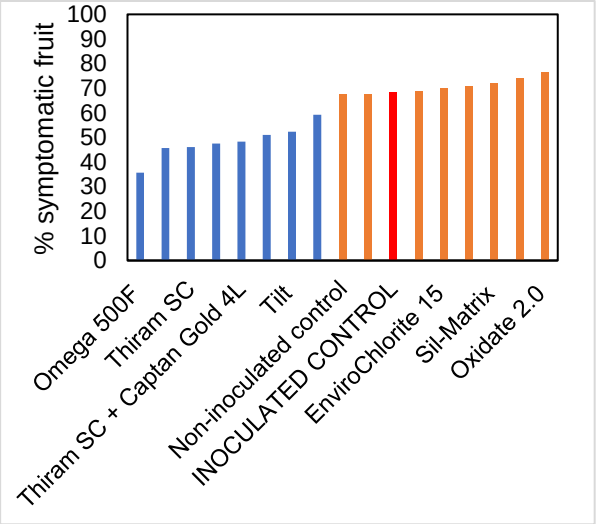
Researchers in the UF/IFAS Strawberry Pathology Lab have been testing different management approaches to control this disease. When possible, acquiring disease-free transplants is the first step to avoid the introduction of the pathogen in a field and escape or delay the occurrence of the disease. However, symptoms are not always easily recognized and can be confused with other leaf spot diseases of strawberry (https://edis.ifas.ufl.edu/publication/PP359). Thus, routine inspections and sample submissions to a diagnostic clinic for accurate identification are crucial.

Limiting field operations, such as harvesting and spraying, when plants are wet is important to minimize spread within and between fields. Dispersal can be minimized by hand sanitation, cleaning and disinfestation of equipment, and performing farm operations in affected fields when plants are dry.

The efficacy of fungicides in controlling *Neopestalotiopsis* has been tested in laboratory and field experiments. Products with the most promising results in the laboratory were selected for evaluation in field trials. During the 2020-21 Florida strawberry season, Omega 500F, Bravo Weather Stik, Thiram SC, Switch 62.5WG rotated with Thiram SC, Thiram SC + Captan Gold 4L, Rhyme, Tilt, and Inspire reduced fruit disease compared to the non-treated, inoculated control **(Fig. 2)**. These same treatments also increased yield over the non-treated control. Omega 500F and Bravo Weather Stik are not registered for strawberry production fields but could be considered for strawberry nursery production (Omega is in the process of registration for nursery use). Unfortunately, our industry already relies greatly on Switch for control of Botrytis fruit rot (BFR). The overuse of this product can lead to

increased selection for fungicide resistance; thus, applications need to be limited to the maximum recommended on the label, and the need to continue seeking alternatives persists.

Fig. 2. Disease incidence (%) on fruit of strawberry plants inoculated with *Neopestalotiopsis* sp. and treated with different fungicide products.



As part of the integrated management program for this disease, the Strawberry Pathology Lab team has been collaborating with the Strawberry Breeding Lab at UF/GCREC to investigate potential sources of resistance in commercial and wild strawberry. Screening for host plant resistance is valuable in case the disease cannot be contained, and strawberry nurseries and fruit growers will need to manage the problem every season. All of the Florida cultivars evaluated were susceptible to the disease. The commercial cultivars Florida Beauty and Florida Brilliance were significantly more affected than Sensation™ 'Florida127', 'Florida Radiance', and the new 'Florida Medallion', which showed intermediate susceptibility to the disease. Older cultivars such as Strawberry Festival and Treasure and the new white cultivar Florida Pearl were less susceptible, but none were found to be completely resistant.

Other trials testing the efficacy of fumigants in reducing *Neopestalotiopsis* inoculum in the soil and crop debris at the UF/IFAS GCREC facility and commercial production fields during the 2021-22 strawberry season are on-going.

This new disease is difficult to control, and the UF/IFAS strawberry researchers are working hard to develop an integrated disease management approach involving the needs of the strawberry nursery and production industries. For more information on this disease, please see the UF/IFAS EDIS publication at https://edis.ifas.ufl.edu/publication/PP357 and do not hesitate to contact Juliana Baggio, jbaggio@ufl.edu, or Natalia Peres, nperes@ufl.edu.

Optimization of a Rooting Protocol for Hardwood Cuttings of Muscadine Grapes

Kenneth Buck (University of Arkansas), Margaret Worthington (University of Arkansas), and Patrick Conner (University of Georgia)

Rooting muscadines from hardwood cuttings is generally viewed as a difficult, if not impossible, task. The majority of the literature on the topic is from the first half of the 20th century, and even the more recent studies from the 80s and 90s had

very little success using hardwood cuttings. Therefore, most muscadine breeders, nurseries, and germplasm repositories propagate muscadines by layering or rooting softwood cuttings under mist. In a breeding program, the selection of muscadine seedlings occurs at the end of the growing season in September. A reliance on softwood cuttings requires the postponement of propagation of selected seedlings until the next growing season, generally in June or July. This propagation schedule falls into the busiest time of the year for fruit breeding programs and delays the establishment of plots and evaluation of new selections by a full season. This yearlong delay adds considerable time to the already lengthy process of releasing a variety. The development of a reliable protocol for muscadine propagation by hardwood cuttings would allow propagation work to be conducted after the conclusion of the growing season at a time when work in the field is beginning to slow and would increase the speed of cultivar development. Despite all the literature claiming that muscadine propagation with hardwood cuttings is ineffective, the University of Arkansas System Division of Agriculture Fruit Research Station (UA-FRS) has been using hardwood cuttings to meet its modest muscadine propagation needs for the past 15 years. The methods used at the Fruit Research Station were adapted from the protocol used for hardwood propagation of bunch grapes. Using these methods, success rates are highly variable, depending on both cultivar and year, ranging from 10-70%. The goal of this SRSFC-funded study was to test the efficacy of the FRS propagation protocol and the impact of multiple factors frequently mentioned in previous studies that may affect rooting success.

There were five factors tested in this study:

- Location- Vineyards in Clarksville, AR, Fayetteville, AR, and Ocilla, GA.
- Cultivar- 'Fry', 'Carlos', and 'Supreme.'
- Collection Date- Cuttings were taken once at the beginning of November, December, January, and February during the winters of 2019/2020 and 2020/2021.
- Storage- Half of all cuttings were given a month-long cold storage treatment at 4 °C prior to the rooting treatment.
- Bottom Heat- Half of all cuttings were given continuous bottom heat at 26 °C.

Data on cutting length, cutting diameter, and number nodes per cutting were also collected 90 days after the cuttings were treated with rooting hormone and placed in perlite media under a mist system in a heated greenhouse.

Generally, cuttings taken in November outperformed cuttings taken at other dates. This trend is most notable at the Ocilla, GA vineyard, where rooting percentages were over 40% (Figure 1). We hypothesize that this is due to the incomplete dormancy of those vines. Located in southern Georgia, Ocilla had not experienced its first frost by the time cuttings were taken in November. However, cuttings taken in November also performed well in the other study locations. Supplying bottom heat early in the dormant season appears to have helped stimulate rooting, but did not seem to have an effect on cuttings taken in January or February. In addition, increased cutting diameter and cutting length positively affected rooting success.

The rooting percentages found in this study were not high enough to justify commercial propagation of muscadines by hardwood cuttings.

However, breeding programs, germplasm repositories, or growers with modest needs may find that transitioning to an off-season propagation protocol saves time and money.

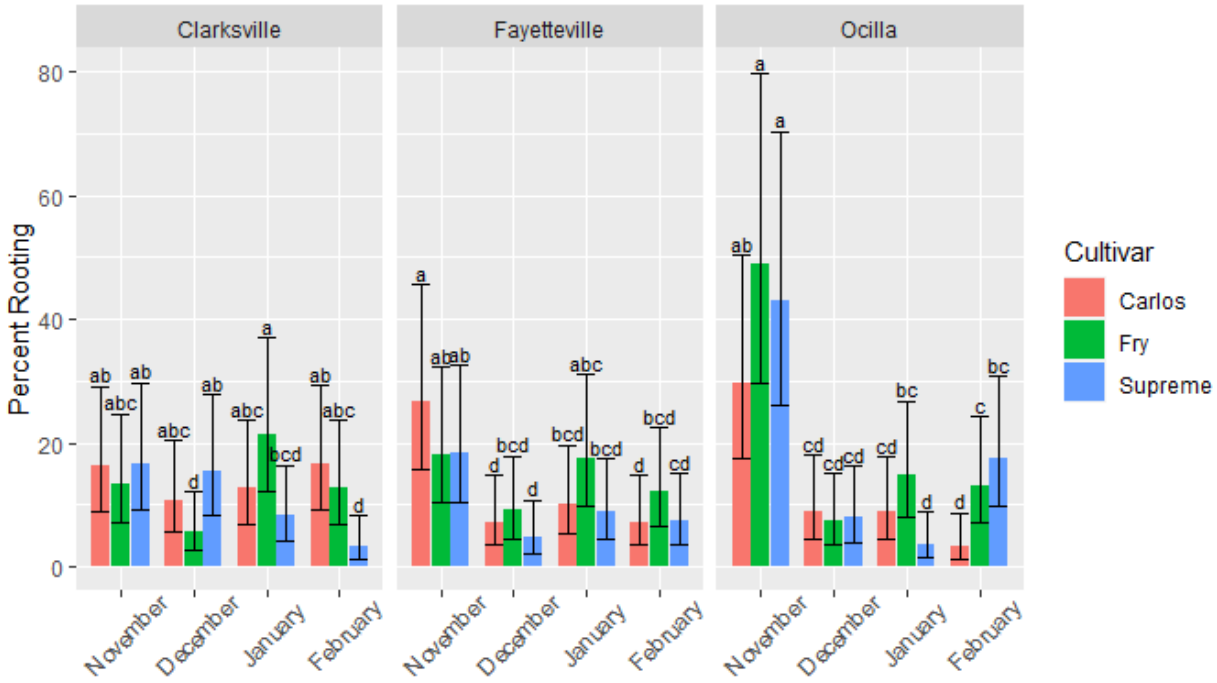


Figure 1. Percent of cuttings successfully rooted from 'Carlos', 'Fry', and 'Supreme' vines collected in early November, December, January, and February from vineyards in Clarksville, AR, Fayetteville, AR, and Ocilla, GA. Because of a significant three-way interaction, data is presented separately for each location. Means with different letter(s) in each panel are significantly different (a = 0.05) according to Tukey's honestly significant difference.

Figure 2. Muscadine vines that have been successfully rooted from hardwood cuttings.

Is 'MidSouth' a suitable grape for wine?

Haley Williams and Dr. Eric Stafne, Mississippi State University

Decades of development followed the grape research that was initiated by the United States Department of Agriculture in Meridian, Mississippi in 1937. Eventually this research led to the release of a new grape cultivar from Mississippi State University in 1981. That new cultivar was 'MidSouth': a self-fertile hybrid bunch grape with some European and many American species in its lineage. 'MidSouth' is still grown in Mississippi and some surrounding states for its adaptability to difficult environmental conditions, relatively good disease tolerance, and excellent jelly.

'MidSouth' clusters before harvest at the MAFES McNeill Research Unit.

Berries of 'MidSouth' have an intriguing slightly foxy, raspberry flavor. They contain seeds, a dark blue-purple slip-skin, and are capable of producing dark ruby colored juice. The juice typically has relatively low total soluble solids (TSS) (<20 °Brix) and high titratable acid (TA) (>10 g/L) content, though, and has not been recommended for wine use in the past. However, canopy manipulation practices have shown to improve these juice qualities in some other cultivars. There are currently studies on early pruning, leaf removal, and shoot thinning being done to determine if these practices would be worthwhile for 'MidSouth'. Conclusions regarding these studies will be made later this season.

While 'MidSouth' use as a varietal red wine grape is still being evaluated, it does show promise for use in red blends with other cultivars of a higher TSS: TA ratio which would balance out the low ratio of 'MidSouth'. It may also be well-suited for sparkling or rosé style wines, which require TSS and TA content that more closely resembles that of 'MidSouth'. No matter the style, there is much potential for 'MidSouth' as a relatively low maintenance wine grape for the South.

Mealybugs in the vineyard: Current management and recent research

By Pragya Chalise and Douglas G. Pfeiffer, Dept. Entomology, Virginia Tech, Blacksburg, VA.

While working on your grapevines or small fruit crops, you may come across small,

white slow-moving insects. These are mealybugs, named for the white powdery secretions covering their bodies. They occur in perennial crops including grapevines and deciduous fruit crops. They use their piercing-sucking mouthparts to pierce through the tough tissues of the host to feed on the phloem sap. They can infest all plant parts including the roots. Although few can be seen on the underside of the leaves or on the new spurs, the number of insects might be higher especially on the cordon or trunk.

We have been surveying mealybugs in commercial vineyards in Virginia from 2019 through 2021. Grape mealybug, *Pseudococcus maritimus* (Ehrhorn), has been the predominant pest mealybug in the past. In an earlier survey of mealybugs in Virginia (part of a larger study on grapevine viruses by Taylor Jones and Mizuho Nita), grape mealybug, Gill's mealybug, *Ferrisia gilli* (Gullan), and a low number of obscure mealybug, *Pseudococcus viburni* (Signoret) were recorded. Our survey indicates that the majority consist of grape and Gill's mealybugs, with only 2-6 specimens of obscure mealybugs from some sites.

Gill's mealybug is a newly described species of mealybug found in pistachio-growing regions of California and found infesting almonds, grapes, persimmons, and stone fruits as well as mulberry. Grape mealybug and obscure mealybugs are easily confused with each other, and both have been found in Virginia.

Identifying mealybugs in the field:
In the field, species are usually identified based on the females which are more easily found. Females are elongated oval and lack wings. Females often have shorter filaments on the sides and longer filaments on the rear end. Males are small, gnat-like insects with a single pair of wings. The immature stage of mealybugs is called a nymph. The first nymphal stage, often called 'crawlers', are most active and quickly moves within the vine to find a suitable feeding spot.

Grape mealybug and obscure mealybug look exactly like each other, except that when poked grape mealybug releases bright red/orange liquid towards the rear and top surface near the front of the body, while obscure mealybug releases a transparent liquid. Gill's mealybug does not exude such liquid. Grape mealybug has four slender white tails, while Gill's mealybug has two thick broad tails. Grape mealybug also has shorter filaments on the sides of the body, while Gill's mealybug has none. It has also been observed that female grape mealybug lays eggs in egg sacs and immature disperse from their mother, while the immatures of gill's mealybugs remain aggregated around the mother, especially on the underside of the body. The presence of wax-secreting pores gives Gill's mealybug a distinct two-striped appearance on the back.

Grape mealybug

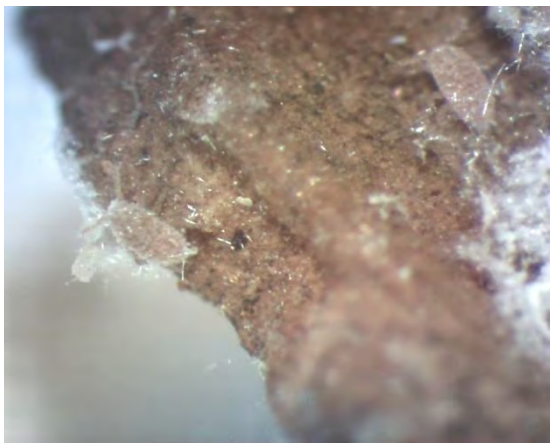
Gills' mealybug

Obscure mealybug

Grape mealybug egg mass

Gills' mealybug with crawlers on its back and lower side

Male mealybug captured on the trap



First nymphal stage called crawlers

Seasonal Distribution

Mealybugs overwinter as crawlers in the cracks or crevices inside the bark. The overwintering crawlers migrate to the new buds during bud break and start feeding. Gill's mealybugs were usually seen feeding on the base of new buds, while grape mealybugs were usually on the trunk. Although the population is not that high during this phase, one easy way to spot

mealybugs on the vineyard is by looking at the base of the new buds.

Both sexes were seen both on sticky traps and the vines in mid-June. The number of mealybugs often increases rapidly in the second and the third generations. One of the most devastating effects of mealybugs is their appearance on the grape clusters before the harvest.

Ants and the mealybugs

Ants tending a mealybug

The pavement ant, *Tetramorium immigrans,* and the smaller yellow ant, *Lasius (Acanthomyops) claviger* were found in close association with mealybugs in 2020, while pavement ant, the smaller yellow ant, odorous house ant, *Tapinoma sessile,* and cornfield ant, *Lasius (Lasius) neoniger* were recorded in 2019. While sampling mealybugs in the field, we observed ants picking up the nymphs when disturbed and transporting nymphs around. Some of the vines had ant nests within their crevices, and when disturbed, ants were observed to grab mealybug adults as well as every egg being laid into the inner portion of the nest hole. They were also observed carrying the insect, trying to find a suitable location (time range from 2 minutes to 10 minutes), when they dropped to the ground.

Effect on the vines

Mealybugs can often be found in aggregations when the population is relatively high. One of the main problems with this aggregation is the elevated level of honeydew on the trunk. Honeydew is a sugary liquid excreted by the insect after the removal of nutrients from its liquid diet. Honeydew attracts ants towards the vines and supports the growth of dark sooty mold fungus as well.

Mealybug aggregation on the trunk

Mealybugs (especially longtailed, obscure, citrus and grape) have the potential to transmit the grape leafroll-associated virus (GLRaV-3 isolates). A study conducted in Virginia and surrounding states has reported the three most common grapevine viruses as grape leafroll-associated virus-3 strain, grapevine red blotch associated virus, and grapevine rupestris stem pitting associated virus. The widespread presence of virus-infected vines points out the importance of the control of the mealybug vectors.

Monitoring mealybugs

Extra precaution must be taken in the sites with a history of mealybug infestations when planting new vines or replacing near next to an old vine. Mealybug monitoring can be a painstaking task, considering the fact that they have relatively clumped distribution. The location on the vines also varies throughout the season. A magnifying hand lens (10x-30x) can be useful in examining these insects carefully.

During budbreak, as mentioned earlier, the base of these buds can be checked with or without the hand lens. The insects can also be seen on the underside of the newly formed leaves. The population can be monitored by peeling a few pieces of bark off, especially if you see lots of ants moving up and down the trunk. Sometimes they may appear on the vines before harvest or in the case of small fruit crops, in the stem and stalk end of the fruit.

In cases of extreme infestations, when a single vine can have more than 20 egg-laying adults aggregated together in a single vine, the trunk is often darker in color with sooty mold growth due to large amounts of honey dew prodution. The younger nymphal stages in this case can be seen more on the leaves or the base of the new shoots/canes.

Sometimes vines with leaf roll-associated virus can appear stressed, although the mealybugs may or may not appear on the aerial plant parts. In this condition, a few vines can be dug out and checked for the presence of mealybugs on the roots. The movement to the roots is mostly assisted by the ants, and tendency to appear in the roots varies among species.

After harvest, overwintering populations can be assessed by checking the bark of the vines. Mealybugs often leave behind white cottony material in the bark. Live crawlers can often be seen around this cottony mass or in the trunk camouflaged with the color of the trunk. Egg masses can often be seen in bark crevices at this phase.

Sticky traps are often placed within the vine canopy to monitor the presence of mealybugs. Sex pheromone traps are often used to attract winged males and are species-specific. The trap may be used to signify the presence of mealybugs on the vines, especially when the population is low and building up. It does not necessarily indicate the level of infestation. As the adult males are feeble fliers, lack of males in the traps can be misleading. The number of males captured on the trap does not indicate the level of infestation on the vine or even their presence or absence. Males can also be seen on the trunk, even when they fail to be detected on the trap.

If summer pruning can be carried out, it can help in removal of any infested plant parts and provide better spray coverage.

Gills' mealybug at the base of the new growth in the spring

Crawler settled on the leaf

Natural predators on the vines

From a variety of generalist predators found on the vines, we will mention a few that are interesting in the field. Two commercially available important predators are green lacewing and mealybug destroyer. The lacewing larva is a voracious predator, feeding on aphids and mealybugs. One interesting question asked in a grower meeting was, "is there a mealybug feeding on other mealybugs?" This could be the impression after viewing the larval stage of mealybug destroyer lady beetle, *Cryptolaemus montrouzieri*. The larval stage is covered with wax and resembles a mealybug, although they are much faster than mealybugs. The larvae feed voraciously on mealybugs and hence are important predators on your vines.

Another interesting predator in the field can be predatory midge larvae. These were one of the most numerous predators seen in our survey. Mealybugs can often be seen moving around trying to get rid of these larvae. As many as 4-5 were seen trying to feed on an adult female mealybug.

I also would like to mention another generalist predator – spiders! Leaves containing spider webs were often seen in the vineyard. Most of the spiderwebs were filled with mealybug crawlers, most likely used as food by these spiders.

Mealybug destroyer

Predatory midge larvae on the mealybug

White cottony wax left on the trunk severely infested with mealybugs

Chemical control and future work

Our work on chemical control of mealybugs is ongoing; we well report on this later. The crawler stage is the most vulnerable stage when chemical control is being taken into consideration. More information on chemical control can be found in our 'Virginia Cooperative Extension Pest Management Guide for Commercial Vineyards' and pest management guides published by the Southern Region Small Fruit Consortium.

We are continuing our work on the mealybugs in Virginia. If you have question, please feel free to reach out to us (Pragya Chalise pragyac9@vt.edu or Doug Pfeiffer dgpfeiff@vt.edu).

An Evaluation of Preemergence Herbicides in Newly Planted Blackberries

Kayla Knepp, Masters Graduate Student, University of Arkansas

Weed management continues to be a major issue in blackberries. With increasing acres being dedicated to blackberry production there is a growing need to find more tools to combat the timeless issues of weeds. New plantings are particularly sensitive to weed competition and can quickly become overgrown. Also, due to blackberries being a perennial broadleaf crop, chemical weed management can be tricky. The opportunity to start with a clean field only happens once and the need to keep it clean continues throughout the duration of the blackberries production life. This trial is looking into chemical control methods for weed management in newly planted blackberries.

The trial began in May of 2021 in Fayetteville, AR and Clarksville, AR. "Ouachita" seedlings were transplanted and sprayed with the experimental herbicides. Directed sprays allowed the lower canopy to intercept some herbicide to simulate unshielded applications. Evaluation of plant safety was the primary subject of interest. Preemergent applications of pendimethalin (Prowl H2O), *S*-metolachlor (Dual Magnum), flumioxazin (Chateau), and mesotrione (Callisto) were applied. Also included were commercial standards oryzalin (Surflan) and napropamide (Devrinol) and an untreated check.

and the plants were clearly stunted relative

Treatment	Chemical	Trade name	Rate (product)	Rate (ai)
1	Weed Free Check	N/A	N/A	N/A
2	Oryzalin	Surflan	3 qt/A	4 lb ai/A
3	Napropamide	Devrinol	8 lbs/A	4 lb ai/A
4	Pendimethalin	Prowl H2O	3.2 qt/A	3 lb ai/A
5	*S*-metolachlor	Dual Magnum	1.5 2 pt/A	1.425 lb ai/A
6	Flumioxazin	Chateau	6 oz/A	3 oz ai/A
7	Mesotrione	Callisto	4.5 fl oz/A	2.25 oz ai/A

During the first year, plots were kept weed-free with routine applications of fluazifop (Fusilade) and hand-weeding when herbicides were determined to have broken down on a plot by plot basis.

Plots were maintained as weed-free with notable weedy checks between.

Preliminary results showed that between one and two weeks after treatment the flumioxazin and mesotrione caused unacceptable foliar injury. At that growth stage all plants maintained similar overall growth and development. The effects of mesotrione persisted long into the season reduction in height. In contrast, effects of flumioxazin were no longer visible after one month.

Results of mesotrione caused long-lasting, though initially minor, injury. At the end of the season the effect of stunted growth was visible. Pendimethalin and S-metolachlor have displayed no injury to newly planted blackberries. Aside from mesotrione, other materials may be justified for recommendations or registrations for use in first-year blackberry plantings based on these preliminary findings. It will be important to collect second year data to evaluate the effects on yield.

On the left flumioxazin symptoms at 14 days after treatment. The right photo demonstrates mesotrione symptoms of bleaching.

These two photos are to show the contrast of a mesotrione plot(bottom) verses a control plot(top).

Testing once, testing twice… Keeping plants clean from viruses

By Ioannis Tzanetakis, Professor/Director of the Arkansas Clean Plant Center, University of Arkansas System, Division of Agriculture

Viruses can be a menace to berry crops. A single breeding selection or mother plant can easily be propagated to millions daughter plants, and if the mother plant is infected, all daughter plants will also be infected. An infected plant could translate to poor establishment and loss of yield and could possibly lead to the need for growers to replant. For these reasons, virologists put a lot of effort into virus testing and

elimination. Virus elimination is a laborious procedure in which small pieces of meristematic tissue (in the millimeter range) are excised from plants grown in conditions that are restricted for virus replication and movement and then regenerated in tissue culture.

Scientists at the University of Arkansas/Arkansas Clean Plant Center for Berries in collaboration with the Oregon Clean Plant Center conducted a study to compare new detection technologies with the current testing standards to determine whether virus detection in production operations could be improved. Instead of the two testing regimes over a one-to-two-year period, the current standard in the industry, four testing regimes over the same time period using new detection technologies was tested. Current detection tests use either a genetic testing method called reverse transcriptase polymerase chain reaction (RT-PCR), biological indexing, or both. In RT-PCR, specific sequences of RNA/DNA (the genetic code) of the viruses are detected if present within a sample. In biological indexing, indicator plants that produce symptoms when infected with a virus are used to determine whether viruses are present within a sample. The new detection technologies use a process called high-throughput sequencing (HTS), in which the RNA/DNA of all the organisms and viruses in a sample are sequenced. The sequences are then compared to known virus sequences, which allows for the detection and identification of all viruses present within a sample.

Results from the study indicated that the new testing technologies not only provided better detection than the current standard testing methods but also had the capacity to detect new viruses, which current testing methods cannot do. In addition to these benefits, the new technologies could also eliminate a major bottleneck in the propagation pipeline by reducing the need to graft onto indicator plants, a tedious, expensive, and time-consuming step required for biological indexing.

An unexpected finding from the study was how well viruses could "hide" or go unnoticed. Independent of the technologies used, virus detection could be unreliable with some viruses not being detectable in three of four samplings. These findings indicate the need to change the testing approach and increase the number of times testing occurs over a certain period of time so that scientists can provide nurseries and producers the cleanest berry plants possible.

For more information visit: https://aaes.uada.edu/news/virus-detection-in-berry-plants/?utm_source=slider&utm_medium=banner&utm_campaign=virus-detection-in-berry-plants

Symptoms of strawberry necrotic shock virus on a strawberry indicator plant. Strawberry necrotic shock is one of the viruses that could be undetectable during certain time periods and one of the reasons for the proposed changes in the testing regimes. Credit: I. Tzanetakis, University of Arkansas System, Division of Agriculture

Strawberry Growers Checklist

By Barclay Poling, Mark Hoffmann and Jayesh Samtani
Professor Emeritus and Assistant Professor, Small Fruit Extension Specialist, North Carolina State University
Jayesh Samtani, Assistant Professor, Small Fruit Extension Specialist, Virginia Tech.

OCTOBER

Planting

- Check plants for possible biological (insects and diseases) and physiological (nutrient) disorders prior to planting and treat appropriately. Consult your extension agent if plants appear unhealthy. Get diagnosis if disease is suspected. Notify plant seller of any problems. If you have planted 'Albion', a day-neutral variety for a fall/spring production system, check for mites very early!
- In Fall/Spring production systems, have a picking crew ready.
- Set plants carefully – planting depth is extremely important to getting off to a good start. Set plug plants deep enough to have approximately 3/8" of soil covering the top of the media plug. Set fresh dugs at the depth at which they were growing in the nursery or mid-way on the crown.
- If you establish plugs with drip irrigation only, be sure to hook up the system before planting. Drip irrigate often enough after transplanting to keep beds near field capacity during the first four weeks. Avoid having standing water. Using a water wheel transplanter is recommended, if no overhead irrigation is available.
- Irrigate fresh dug plants 9 am–5 pm for 7–12 days. (More may be needed if weather is hot and sunny.) Growers typically reduce irrigation times on the "tails" of the day during the latter part of fresh dug establishment (later am start times and earlier pm stop times). Let the plants tell you when they are becoming established and adjust irrigation schedules based on plant response.

Post-Planting Maintenance

- If deer predation has been a historic site problem, install fencing NOW. A double row of electrified fence (tape or wire type) has been effective when installed early in the season. Consider attaching foil, paper plates or grocery store plastic bags at regular intervals to increase the visibility of the fence.
- Drip irrigate in the fall as needed to keep soil from drying out.
- Scout for pest injury, including deer.
- Check for dead plants and reset ASAP. Send suspicious-looking plants to the Disease & Insect Clinic for positive ID; notify plant seller of any problems.
- Crown rot diseases can be of concern, particularly during warm and wet, fall season. 'Sweet Charlie' and 'Flavorfest' for example are susceptible to Phytophthora crown rot while 'Chandler' can be susceptible to anthracnose crown rot. The following links are useful resourecs to understand these disease signs and symptoms: Anthracnose Crown Rot of Strawberry | NC State Extension Publications (ncsu.edu) and Phytophthora Crown Rot of Strawberry | NC State Extension

Publications (ncsu.edu). There's a new disease threat of Neopestalotiopsis emerging from certain nursery sources and information on this disease can be found at : PP357/PP357: Pestalotia Leaf Spot and Fruit Rot of Strawberry (ufl.edu)

- Place order for row covers NOW; these will help greatly to conserve irrigation water during frost protection next spring and...
- If planting is delayed a week or more, fall row covers can help enhance plant growth and partially compensate for late planting for both 'Chandler' and 'Camarosa'.
- A row cover applied in the first 2 weeks of November may enhance flower bud development in the crowns and improve spring yields – this may be especially helpful for later plantings of Chandler. Row cover research in the Mountains, Piedmont and Coastal Plain has shown that Camarosa yields are optimized with 800 Growing Degree Day units in the fall (Oct-Dec), and Chandler needs about 650 GDD units.
- Growers should consult seasonal climate data and predicted long range forecasts before they install row covers. Growers can look for guidance from the Climate Prediction Center's 6-10 and 8-14 day outlooks here: National Weather Service If unseasonably warm temperatures during row cover treatment were followed by unseasonably cold temperatures, plants may not acclimate and tissues could have a reduced cold tolerance. One way to improve winter cold hardiness of Albion is to de-blossom in the fall. This may be needed on plug plants of Albion, but not cutoffs. Do not pull off the blooms - you could damage the root system; use small scissors instead. Also, be mindful that 'Albion' is very susceptible to cold injury in the fall, and row covers must be applied in October is there is threat of any temperature below mid-20s.
- Consider removing dead leaves from plants in Nov-Dec to minimize grey mold. Don't hand prune if anthracnose is known to be present.

NOVEMBER-DECEMBER

- Inspect plants late fall and during winter for crown development. You should see two to three crowns.
- Plants should adapt to cold temperature in November and early December ('cold-hardy).
- Protect plants and plastic from deer.
- Order chemicals for spring. The list of pesticides commonly needed for strawberry production can be found in the 2021 Southeast regional Strawberry IPM guide that can be accessed at: 2021-Strawberry-IPM-Guide.pdf (smallfruits.org)
- Hand pull the winter weeds from the planting holes. Particularly, check for vetch in holes as the winter temperatures won't kill them. Broadleaf weed control, in row middles seeded with ryegrass can be achieved using a post-directed spray of Aim herbicide using a shielded-sprayer. Grass control in planting holes can also be achieved using grass herbicide such as Poast 1.5 C or Arrow. For specific rates and label options, refer to the Southeast regional IPM guide.
- Examine plants for spider mite damage; they can be mistaken for winter damage. Control as needed

- Place row covers in mountains in December, leave on until spring.
- Remove row covers this month if used for fall flower enhancement or late planting in the NC piedmont and coastal plain.
- Remove dead leaves from strawberry plants. They can harbor gray mold and removal should lessen the disease in the fruiting season.
- Remove runners only after 4 to 5 weeks of transplanting and once plants are established.
- Think about ways you would want to market your strawberry crop for the harvest season, including your farm presence on social media.
- Provide periodic updates of your crop and farm using social media, so your customers know where to access your farm information during harvest season.
- Make plans to attend production meetings in the winter and early spring season.

Blackberry and Raspberry Seasonal Checklist Fall 2021

Gina Fernandez, Small Fruit Specialist, North Carolina State University

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 after harvest is complete
✓ 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 http://www.smallfruits.org

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 https://blogs.cornell.edu/berrynurseries

Nutrition management

- ✓ 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
- ✓ In states near the Atlantic coast (not just the southern states), prepare for hurricanes and assess damage afterward. Some tips can be found at https://teamrubus.blogspot.com/search?q=Hurricane
- ✓ If you are harvesting this fall, be sure you have COVID-19 plans for your farm, addressing issues such as worker health, social distancing, masks, customer communication, etc. Find out and follow any specific requirements for your state or locality.

www.raspberryblackberry.com/covid-19-resources/. There is also a link at the home page.

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

- **Southeast Regional Conference and Tradeshow, Savannah, GA**
  - January 6-9, 2022, at the Savannah International Trade and Convention Center
  - https://seregionalconference.org/
- 2022 North American Raspberry and Blackberry Conference
  - Feb 21-24, 2022, Gaithersburg, Maryland
  - https://www.raspberryblackberry.com/2022-north-american-raspberry-blackberry-conference/

Key Resources:
SRSFC IPM/Production Guides
https://smallfruits.org/ipm-production-guides/

Blackberry and Raspberry Grower Information Portal:
http://rubus.ces.ncsu.edu

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

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