

Small Fruit News



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Featured Additions to the 2021 Southeast Regional Strawberry IPM Guide

By Rebecca A. Melanson, MSU Extension

The **Southeast Regional Strawberry Integrated Pest Management Guide Focused on Plasticulture Production** is revised annually by a team of university specialists. These annual revisions include updates to pesticide efficacy ratings, management recommendations, and product information. Along with these regular annual updates, a number of additions have been incorporated into the 2021 guide to help improve its usefulness for growers and stakeholders.

Major additions include:

- An update on a new disease (Neopestalotiopsis fruit rot and leaf spot)
- A seasonal "at-a-glance" disease guide
- A section with information on cultivar resistance to anthracnose
- A section with information on anaerobic soil disinfestation and on cover cropping and soil incorporation techniques
- A section on viruses in strawberries
- An efficacy table on the various chemicals for strawberry insect management
- A section on wildlife damage prevention (focused on birds, deer, and voles)
- Photo pages of various diseases, insects, and weeds discussed in the guide

The 2021 Southeast Regional Strawberry Integrated Pest Management Guide Focused on Plasticulture Production is now available online on the Southern Region Small Fruit Consortium webpage (<http://smallfruits.org>) under the IPM/Production Guides tab.



Updates to the 2021 Southeast Regional Caneberry IPM Guide

By Jonathan E. Oliver, UGA Extension

Annual updates have been made to the **Southeast Regional Caneberry Integrated Management Guide**. These include:

- ◆ Information on registered pesticides and weblinks to state pesticide databases
- ◆ A “Mobile and Online Tools” page featuring Apps and online tools for recognizing and managing caneberry diseases, pests, and weeds
- ◆ Updated pesticide efficacy ratings and management recommendations
- ◆ Additional insecticide and fungicide recommendations for control of broad mites, *Phytophthora* root rot, and *Botrytis* gray mold
- ◆ Additional information on fungicide-resistant caneberry pathogens

The 2021 Southeast Regional Caneberry Integrated Management Guide is now available online on the Southern Region Small Fruit Consortium webpage (<http://smallfruits.org>) under the IPM/Production Guides tab.



Supporting small fruit producers: regional fungicide resistance testing of *Colletotrichum* (anthracnose) and *Botrytis* (gray mold)

By Emran Ali, Phillip M. Brannen, and Tammy Stackhouse

Fungicide resistance is a major problem for growers, as it can lead to loss of disease control, reduced yields, and unnecessary expense by applying products that no longer work. Fungal pathogens are managed with a limited number of fungicide classes. There is, therefore, a high risk of disease

control failure due to potential fungicide resistance development against these fungicide classes. Pathogens can become resistant to a fungicide class through various means, with at times a single base pair mutation conferring resistance. For the proper management of fungal pathogens, early, rapid, and accurate testing methods are required to identify fungicide resistance in various fungi.

The [University of Georgia Plant Molecular Diagnostic Laboratory](#) (MDL), directed by Dr. Emran Ali, provides fungicide resistance testing support and routine advanced disease diagnosis to extension and research personnel, commercial growers, and homeowners for a wide range of plant pathogens. With financial support provided by the [Southern Region Small Fruit Consortium](#) in 2020, a total of 175 suspected strawberry samples were received from growers or extension county agents in seven southern states and tested against different fungicide classes. These states included North Carolina, South Carolina, Virginia, Tennessee, Arkansas, and Georgia.

The overall fungicide resistance frequencies were analyzed based on 145 *Botrytis* spp. (gray mold) isolated from six member states and 30 *Colletotrichum* spp. (anthracnose) isolated from three states. Results showed that the efficacy of pyraclostrobin (QoI fungicide) against both *Botrytis* and *Colletotrichum* spp. is decreasing (Figure 1). Thiophanate methyl (example product: Topsin M) is also showing weakness due to the increasing resistance phenotype against *Botrytis* spp. (Fig. 1).

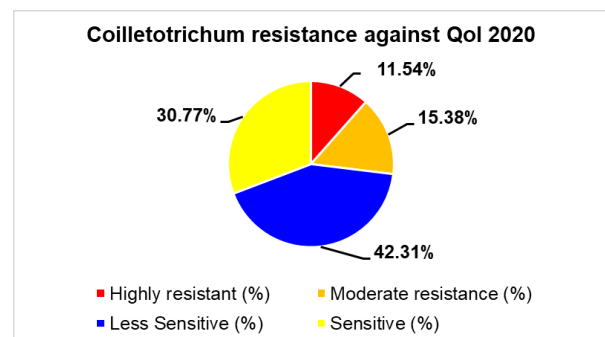
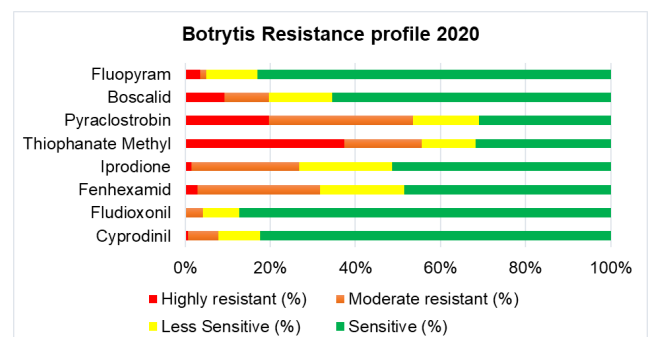


Figure 1. Fungicide resistance frequencies in 2020 for *Botrytis* and *Colletotrichum*.

This MDL program allows for a single location in the Southeast that can provide resistance testing for multiple

fungus organisms and multiple fungicides. The overall goal of this program is to optimize fungicide resistance testing and to establish a system to provide support to growers and crop advisers. This program is crucial to guide growers in the use of effective fungicides to reduce losses caused by fungicide resistance. The Southern Region Small Fruit Consortium has once again provided funding for 2021 to provide this service free of charge to small fruit producers in member states – until the funds run out. After that point, producers will need to pay for the service. Continue reading for information on sample collection, submission, and processing.



Figure 2. Appropriate and inappropriate samples for *Botrytis* fungicide resistance testing. Photos courtesy of Guido Schnabel at Clemson University.



Figure 3. Appropriate sample for *Colletotrichum* fungicide resistance testing.

Fungicide Resistance Sample Collection:

The MDL at the University of Georgia in Tifton provides fungicide resistance profiles for *Botrytis cinerea* and *Colletotrichum* spp. from strawberries and other small fruits.

For *Botrytis cinerea* (gray mold) samples, the MDL accepts samples from flowers, leaves, and fruit. You may send cotton swabs with spores from fruit for analysis as shown in Figure 2.

- **For all sample types:** Place each individual flower/fruit/swab in individual sealable plastic bags. Make sure your specimens (flowers/leaves/fruits/swabs) are taken throughout the area and represent the entire field.
- **For flowers and leaves:** Send 20 to 40 dead strawberry flowers from each strawberry field you would like to have tested. Send as many dead leaves as you like in addition to the flowers.
- **For fruits:** Please send 15 to 20 symptomatic strawberry fruits (individually bagged in sealed plastic bags).
- **For swab collection:** Buy cotton swabs and collect spores with swabs from 15 individual berries with fresh *Botrytis* lesions. Use a fresh cotton swab for each berry and carefully rub one side of the swab on the diseased portion of each berry without getting strawberry juice on the swab. The swab should look lightly gray (lower right image in Fig. 2). A tiny bit of gray color is sufficient for analysis.
- Proceed to shipping section below.

For *Colletotrichum* (anthracnose) samples, the MDL accepts **only fruit** with disease symptoms (Fig. 3).

Please send 15 to 20 freshly collected symptomatic strawberry fruits. Place each fruit in an individual sealed plastic bag. Make sure specimens are taken throughout the area and represent the entire field.

Proceed to shipping section below.

Shipping guidelines for all fungicide resistance testing samples:

- Collect fresh samples following the guidelines in the above sections. Provide adequate amounts of each sample and ensure each sample is in an individual sealed plastic bag.
- Keep samples refrigerated after collection until they are shipped.
- Please fill the submission form, available at <https://site.caes.uga.edu/alimdl/resistance-test-submission-form/>, as completely as possible, including the submitter information, spraying history, host species, sampling location, pathogen being tested, etc. Incomplete forms can delay results.
- Place all specimens for a given set in a sealed plastic bag, and clearly label the outside of the bag with a permanent marker.
- If you include multiple bags in a package, clearly indicate whether each bag corresponds to a separate test or whether the bags represent multiple samples for the same test. If you have separate fields far from one another, multiple sets are recommended.
- To prevent damage during transit, ship prepared samples in cardboard boxes and add packing material such as newspaper. Do not ship prepared samples in paper bags.
- Send samples via **overnight** delivery to: Plant Molecular Diagnostic Lab, Plant Science Building, 2360 Rainwater Rd., Tifton, GA 31793.

Fungicide Sample Processing at the MDL:

Based on a protocol developed from Dr. Guido Schnabel at

Clemson University, samples are tested using the following procedures:

- Samples from flowers, leaves, fruit, and cotton swabs with spores from fruit will be received for analysis (as shown in Fig. 2).
- Suspected samples will be incubated for several days in a moist chamber. This initial incubation process allows the pathogen to grow and sporulate on the sample surface.
- Then the pathogen will be transferred onto the centers of fungicide-amended plates and nonamended control plates.
- Microplates will be incubated for 5 days at 22°C (approximately 72°F) before measuring the radial growth in two perpendicular directions and determining the pathogen's sensitivity to the respective fungicide.
- To better understand the fungicide resistance of a given location, several isolates (up to ten) are tested and their sensitivity compared. In general, this process takes about 7 days to make a final decision on fungicide sensitivity.

Any questions about these services including costs, mailing, and information about the other sample types we process should be directed to Emran Ali at 229-386-7230 or alimdl@uga.edu.

The Plant Molecular Diagnostic Lab has many services meant to help growers with pathogen issues. Detailed information about hosts and pathogens tested can be found at: <https://site.caes.uga.edu/alimdl/>.

A New Blackberry from Arkansas: 'Prime-Ark® Horizon'

John R. Clark, University of Arkansas



Florican berry along with primocane flower buds present, late June in Arkansas.

A new blackberry has been released by the University of Arkansas System Division of Agriculture (UA), named Prime-Ark® Horizon. This is the sixth public primocane-fruiting variety from the UA breeding program. Although primocane fruiting does not hold substantial potential in the deep South, this type of berry is having some success in mid to upper South in some years.

Key items to note about Prime-Ark® Horizon:

- **Primocane fruiting, thorny**
- **A complement to Prime-Ark® 45 for commercial production for primocane fruit**
- **High florican crop potential**
- **Primocane berries are large, with larger fruit size potential than other primocane-fruiting varieties in summer heat and potential primocane crop extension beyond the Prime-Ark® 45 season**
- **Berries are very firm in storage, and otherwise comparable to Prime-Ark® 45 in postharvest potential**
- **Soluble solids averaging 10% and titratable acidity 0.92%, providing good sugar/acid balance**

The majority of the testing of Prime-Ark® Horizon was done at the location of its development, the UA Fruit Research Station, Clarksville, AR, with data and observations collected from plants over 8+ years. The cross for Prime-Ark® Horizon was made in 2008, and it was selected in 2010. Additional data and observations were collected by Josh Beam at a Dole Berry test site near Lincolnton, NC (six years), and Karen Blae-dow, North Carolina State University Mountain Horticultural Crops Research and Extension Center in Mills River, NC (two years). I greatly appreciate the testing results attained by these colleagues. I have included comments from their findings in the following discussion.

Ripening: Florican first harvest is a few days later than Prime-Ark® 45 and near that of Ouachita (June 12). Florican harvest period averaged 40 days. Primocane first harvest averaged August 4, just before Prime-Ark® 45. Primocane fruiting can potentially extend until mid-October, providing a fruiting period of over 60 days.

Josh often found florican harvest date to be similar to that observed in Arkansas. Primocane harvests began a little earlier than Arkansas, ranging from mid to late July. He harvested primocane fruit to late September or mid-October depending on the year. Karen's first harvest for primocane fruit was August 6 in 2019.

Berry: Prime-Ark® Horizon's berry weight averaged 7.8 g overall for floricanes. Berries were often up to 10 g for floricanes. The primocane berries averaged 7.3 g. The floricanes and primocane average weights are much closer than other primocane-fruited varieties, suggesting more berry weight stability in summer heat during primocane flowering and fruiting.

Josh found floricanes berries to range from 9-11 g, and Karen's planting averaged over 13 g in 2019. Josh found primocane berries to be 11-15 g, equally as large as floricanes berries. This is unusual as primocane berry weight in southern locations is typically associated with smaller berries due to the impact of heat on fruit set and development.

Berry shape was noted to vary with Prime-Ark® Horizon, and in some years curved berries were observed in most test locations. Primocane double berries were not seen, as is common with Prime-Ark® 45 in Arkansas, due to heat effects. This further suggests some heat tolerance for Prime-Ark® Horizon. However, temperatures above 90°F were observed to occasionally result in primocane flower death with Prime-Ark® Horizon, so full heat tolerance is not implied.

Yield: Prime-Ark® Horizon has very high yield potential on floricanes, and exceeded yield of Natchez in some years. Floricanes yields have exceeded 30,000 lb./acre in research plots usually in the year after planting. Floricanes yield is influenced by the degree of primocane fruiting the prior year. More primocane fruit production often equates to lower floricanes yields the following season. Crop control with pruning is strongly advised to balance crop, particularly in the first year of floricanes fruiting if no primocane crop is produced in the planting year. Primocane yields ranged from 3,000-9,000 lb./acre depending on year and environment.

Josh reported very high yields also, with over 2,500 flats/acre on floricanes, and then another 1,500 flats per acre on primocanes (a flat has 4.5 lb. weight). Cane management will likely be a key component to achieving full yield potential and consistency.

Flavor: Flavor has consistently been rated good with light aromatics over many years of evaluations. As with most blackberry varieties, Prime-Ark® Horizon can have variation in sweetness. Berries were noted at times to be tart, particularly when very high floricanes crop was experienced. The overall average soluble solid content was 10% (ranging from 9-11%). Titratable acidity averaged 0.9% (ranging from 0.8-1%), which is within the "reduced acidity" target of the UA breeding program.

Josh consistently noted the fruit to be sweet over many years of observation, with soluble solids content of 10% or higher. Karen found fruit to have a pleasant flavor but at times variable.

Postharvest: Storage for 7 days has been comparable to Prime-Ark® 45 in reddening/reversion. It has also shown potential for longer-term storage particularly in the retention of firmness. In addition to excellent firmness in storage, leakage and decay have been among the best measured in the Arkansas program.

Plants: Prime-Ark® Horizon plants have shown good health, except when excessive floricanes yields were experienced that resulted in reduced floricanes leaf size as well as upward leaf curling. No orange rust nor anthracnose were observed on Prime-Ark® Horizon. Winter hardiness has been comparable to Ouachita, and has shown very limited winter injury to a low of 1°F. Spring freeze damage has not been observed. Chilling requirement is unknown, but is anticipated to be approximately 300 hours.

Plant vigor can be high, and this can result in extended primocanes with long fruiting laterals. Overall, Prime-Ark® Horizon has reduced thorns compared to Prime-Ark® 45. Thorn density on canes is 45% lower than Prime-Ark® 45 but density is similar on laterals and leaf petioles.

Josh noted high vigor and commented that primocane management would have to be worked out to attain maximum yield. Karen found Prime-Ark® Horizon to be one of the more vigorous varieties in her trial.



(L) Prime-Ark® Horizon with extended fruiting on the primocane, late August, 2020, Arkansas and (R) Prime-Ark® Horizon floricanes berries.

Strawberry variety evaluations in open-field and high tunnel production system

Jayesh B. Samtani, Assistant Professor

Small Fruit Production Specialist

Hampton Roads Agricultural Research and Extension Center
Virginia Tech University

This past season, we were able to evaluate seven short-day varieties, Camino Real, Chandler, Flavorfest, Keepsake, Merced, Rocco, and Ruby June and three, day-neutral varieties- Albion, San Andreas and Sweet Ann. The day-neutral varieties were evaluated for their bearing capacity in spring and early summer season. All varieties were transplanted on Oct 4, 2019, in an experimental design both inside the high tunnel, and in open-field neighboring the high tunnel at the Hampton Roads Agricultural Research and Extension Center in Virginia Beach. The plug plants of all varieties except Flavorfest and Keepsake came from Aaron's Creek Farm in Buffalo Junction, VA. Flavorfest and Keepsake came from a nursery in New Jersey. Open field plots were harvested twice per week from Apr 10, 2019, to June 18, 2019. High tunnel plots were harvested from Jan 12, 2019, to June 18, 2019. The average berry diameter of a random subsample of 5 marketable fruit per plot was recorded once per week per variety. Below are the key findings so far from the study:

- Rocco, Sweet Ann, and Chandler cultivars had the highest total yield in the open field, while most cultivars except Albion, Flavorfest, and Keepsake had good yield in the high tunnel (Tables 1 and 2). Both Flavorfest and Keepsake had poor plant growth and we even lost some plants during the growing season.
- The day-neutral cultivars had higher fruit diameter than short-day cultivars in the high tunnel.

- Highest monthly yield under both production systems was in May for all cultivars.
- Percent marketable for each cultivar was higher in open-field than in the high tunnel, which indicates more pest management practices are required in high tunnel.

We encountered several challenges with high tunnel production.

- The high tunnel roof blew off from the severe storm that passed through the southeast U.S. on 7 Feb. 2020 and had to be replaced soon after.
- We noticed herbicide damage on strawberry plants from paraquat application on ryegrass inside the tunnel. This occurred due to air inversion inside the tunnel. Strawberry plants took two to three weeks to recover from injury this may have impacted strawberry fruiting capacity in March.
- Raccoons and birds can be a nuisance in urban areas and we had some damaged fruit from the same inside the tunnel, particularly in winter time and early spring season when food can be scarce for wildlife.

We have an economist on this project, Dr. Darrell Bosch who is creating enterprise budgets by cultivar and production systems to determine the economic feasibility of strawberry cultivation in the high tunnel and open-field production. We also have a post-harvest physiologist, Dr. Toktam Taghavi from Virginia State University who will determine anthocyanin, sugar and pH content by varieties in open-field and high tunnel production system. Additional findings on this study will be presented as data are generated and analyzed. This study was made possible through funding received by the Virginia Department of Agriculture and Consumer Services administered, USDA Specialty Crop Block Grant.

Table 1. Open-field yield production (lb/plant) at the Hampton Roads AREC, Virginia Beach in 2019-20 growing season.

Treatment	Marketable (M)	Nonmarketable (NM)	Total (M+NM)	% Marketable
4.10 to 6.18.2020				
Albion	0.7	0.1	0.8	88
Camino Real	1.1	0.2	1.3	85
Chandler	1.3	0.5	1.8	72
Flavorfest	0.2	0.2	0.4	50
Keepsake	0.5	0.3	0.8	66
Merced	1.0	0.1	1.1	91
R. June	0.9	0.3	1.2	75
Rocco	1.5	0.4	1.9	79
San Andreas	1.1	0.2	1.3	85
Sweet Ann	1.4	0.3	1.7	83

Table 2. High tunnel production (lb/plant) at the Hampton Roads AREC, Virginia Beach in 2019-20 growing season.

Treatment	Marketable (M)	Nonmarketable (NM)	Total (M + NM)	% Marketable
1.12 to 6.18.2020				
Albion	0.5	0.5	1.0	52
Camino Real	1.1	0.6	1.7	62
Chandler	0.7	0.9	1.6	44
Flavorfest	0.1	0.3	0.4	25
Keepsake	0.2	0.3	0.5	40
Merced	0.9	0.5	1.4	63
R. June	0.8	0.5	1.3	61
Rocco	0.6	0.8	1.5	44
San Andreas	0.7	0.6	1.2	52
Sweet Ann	0.6	0.8	1.4	41

Winter Blackberry Chores

Dr. Gina Fernandez

North Carolina State University

This checklist was originally developed for blackberry growers in North Carolina. You may have to adjust your work activities either earlier or later depending on your location. For more detailed information, check the Southern Region Integrated Bramble Management Guide and the Southeast Regional Bramble Production Guide at: [Link to SRSFC Caneberry IPM and Production Guides](#).

This list is intended as a general guide. However, it can be used to guide you to think about what types of activities occur at various times of the year. Check the items off as they get done. If you would like other items to be added to this list, send them to me and I will add them next time.

WINTER

Plant growth and development

- Plant is not visibly growing during the winter months although many blackberries will retain their leaves through the winter
- Some floral differentiation is occurring in the flower buds (i.e. they are forming flowers)
 - Low chilling cultivars can break bud in January after adequate winter chilling. You can monitor chilling hours accumulated in eight states in the eastern US by accessing this site: [Link to Blackberry Chill Model](#)
 - Developmental stages at this time of year as mentioned in the [2021 Southeast Regional Caneberries Integrated Management Guide](#) are : 1. Dormant
 - 2. Delayed dormant (swollen bud) to green tip.

Pruning and trellising

- Pruning should occur in late winter. However, in some areas winter ice storms can do tremendous damage to plants and trellis systems. If you produce blackberries in one of these areas, pruning can take place early winter to help avoid severe damage.
- Pruning and training videos can be found at:
- [University of Arkansas Winter Blackberry Pruning](#)
- [NC State University Blackberry Pruning](#)
- Make trellis repairs after plants have defoliated but before pruning and training.
- If you have a Rotating Arm Trellis, lay the canes to the ground. If you are in a colder region, have row covers available for protection from cold temperatures.

Erect types

- Prune out the spent floricanes
- Cut lateral branches back to 12-18"
- Tie or weave canes to lower and upper wires
- Thin canes to 4-8 canes/ hill (4 ft spacing)

Trailing types

- Prune out spent floricanes
- Tie or weave canes to wire so that they do not overlap
- Prune side laterals to 12-18"
- Thin canes to 6-8 hill (6-8 ft spacing)

Primocane fruiting raspberries and blackberries

- Prune (mow) primocane fruiting types to ground level

Weed control

Check the [2021 Southeast Regional Caneberries Integrated Management Guide](#) for recommendations.

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 local extension agent for cultural or chemical means to control these weeds.

Insect and disease scouting

Check the [2021 Southeast Regional Caneberries Integrated Management Guide](#)

for recommendations.

- Scout fields for insect and disease damage and remove those canes

Remove wild blackberries and raspberries by the roots if they are within 600 ft of your planting during the winter

Winter injury from cold

- Injury from cold temperatures can occur to the canes and buds throughout the winter. Most often the damage occurs in the spring after the winter chilling hours have accumulated.
- Review types of injury that can occur to the canes and buds. One site for cold injury information is the [Team Rubus Blog](#).

Planting

- Take soil tests to determine fertility needs for spring plantings.
- There are new raspberry and blackberry cultivars available each year. If you have not tried them or it is not known how they will do in your region, it is best to order a small quantity to see how well they will perform in your area
- For larger growers, prepare list of cultivars for 2022 plantings and order now. Smaller quantities of plants can be ordered in early 2021 for spring planting.
- Nursery lists can be found at:

[North American Raspberry and Blackberry Association](#)

For a comprehensive nursery list for all small fruits, see Cornell's [Nursery Guide for Berry and Small Fruit Crops](#)

Water management

- Make repairs to irrigation system (check pumps, lines, etc)

Plants generally do not need supplemental water in winter

Marketing and miscellaneous

- Order containers for next season

Make contacts for selling fruit next season

Attend grower meetings

North American Raspberry and Blackberry Association is virtual this year. For more information check here their [link](#). Here is a brief summary of the meeting.

- This virtual conference February 21-25, 2021 will feature more than 25 hours of educational sessions, plus virtual exhibitors, scientific posters, and networking.
- A special seven-session virtual short course, "Getting

Started in Raspberries & Blackberries," precedes the conference during the first three weeks of February and may be registered for separately or with a conference registration.

North Carolina Commercial Blackberry and Raspberry Association will be holding a series of one hour Zoom sessions through the spring.

Contact Daniel_Shires@ncsu.edu or [Karen_Blaedow@ncsu.edu](#)

Please check with your local Extension service to learn of meetings in your state.



Rabbiteye Blueberry Cultivar Evaluation Trial: Preliminary Observations

Elina Coneva, Extension Specialist, ACES, Auburn University

Blueberries are a high value fruit crop that are becoming increasingly popular worldwide. Rabbiteye blueberries are historically an important commercial crop for Alabama, and many farms produce rabbiteye blueberries for sale in the fresh market either exclusively, or as a supplemental crop.

Proper cultivar selection is one of the first and perhaps the most important decisions a grower can make when planting blueberries. The University of Georgia Blueberry Breeding Program has accelerated the development of rabbiteye blueberry varieties in the past two decades in order to facilitate commercial and home garden demand for new varieties. New, large-fruited rabbiteye blueberry cultivars have been recently released. The USDA-ARS has also released a hybrid selection named 'Pink Lemonade' that has a potential appeal for landscape planting and for the novelty or specialty fruit market. The purpose of this trial is to evaluate the overall adaptability, plant vigor, productivity and fruit quality of selected newly released blueberry cultivars under central Alabama environmental conditions and compare with more established, traditionally grown rabbiteye blueberry cultivars.

Three years old potted plants from 'Alapaha', 'Climax', 'Premier', 'Krewer', 'Titan', 'Vernon', 'Tifblue', 'Powderblue', 'Ochlockonee' and 'Pink Lemonade', each represented by 4 bushes were planted at the Chilton Research and Extension Center (CREC), Clanton, Alabama in 2019 and grown under a conventional production system. During the spring of 2020, shortly after fruit set, about two-thirds of the berry crop was thinned out on each individual bush with the goal to encourage better root system estab-

ishment. Preliminary observations on cultivar's season of ripening, mean berry size and fruit quality is shortly discussed below.



A



B

Figure 1 A, B. Early season berries of 'Alapaha' (A) and 'Krewer' (B), CREC, AL, 2020.

Our preliminary results suggest the berries of 'Alapaha', 'Krewer', 'Premier' and 'Vernon' started to mature early in the season with the standard cultivar 'Climax'. The first ripe berries were harvested on June 1, 2020 (Figure 1 A, B). Berries of 'Ochlockonee', 'Powderblue' and 'Tifblue' ripened late, about two weeks after the early season cultivars, and 'Pink Lemonade' (Figure 3A) and 'Titan' (Figure 3B) were ready to harvest mid-season, on June 5.

'Krewer' berries had the largest size of 3.0 g on average, followed by 'Titan' with mean berry size of 2.9 g (Figure 2). 'Ochlockonee', 'Vernon' and 'Tifblue' produced medium berry size during the season. Soluble solids content varied between 12% for 'Titan' and 13.8% for 'Tifblue' (Table 1). Studies will continue to completely assess cultivar performance

in multiple seasons. New rabbiteye blueberry cultivar evaluation will help growers select the best suited cultivars for their growing location and targeted market, which can lead to improved sustainability and profitability in blueberry production.



A



B

Figure 3 A, B. Mid-season berries of 'Pink Lemonade' (A) and 'Titan' (B), CREC, AL, 2020.

Table 1. Soluble solids content of selected rabbiteye blueberry cultivars, CREC, Clanton, AL, 2020.

Cultivar	Brix, %
Ochlockonee	13.1
Vernon	13.0
Krewer	13.2
Powderblue	12.7
Climax	13.6
Titan	12.0
Alapaha	13.1
Premier	13.3
Tifblue	13.8
Pink Lemonade	12.8

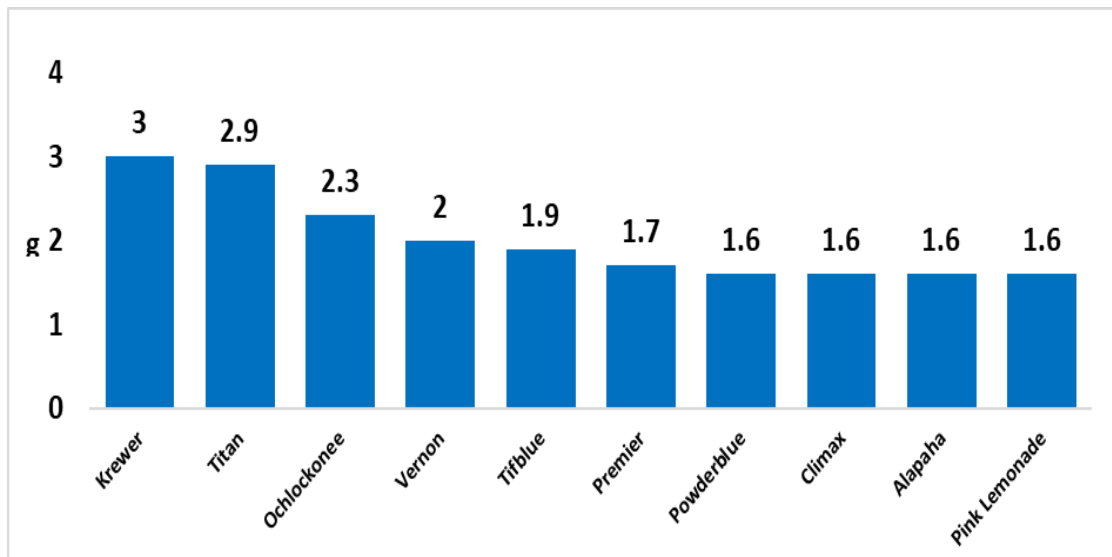


Figure 2. Mean berry size of selected rabbiteye blueberry cultivars grown at the CREC, AL, 2020.

Prime-Ark® Freedom Shows Local-Market Success

John R. Clark, University of Arkansas



Floricane fruit of Prime-Ark® Freedom at Froberg's Farm, Irvin, TX.

Prime-Ark® Freedom was released in 2013 by the University of Arkansas, the first *thornless*, primocane-fruiting blackberry ever developed. At the time, I recommended it pri-

marily for home-garden use along with possible local-market production. I gave this limited-use recommendation largely due to its yield and postharvest storage shipping potential were not as promising as other UA developments for the commercial shipping market (note the shipping potential pertains to fruit storage after harvest, not the shipping potential of the plants).

Now that Prime-Ark® Freedom has been in the commercial trade for a few years, I am getting many positive comments about its use for local retail market production, particularly in the Deep South. I want to share some of what I have learned and feature comments from several growers including Arnold Caylor and Jeremy Calvert at J. Calvert Farms, Cullman, AL, Alfred Froberg at Froberg's Farm, Irvin, TX, and Bob Welker, Tifton, GA. I also got comments from Johnny Hoblick with Agristarts, a major propagator/marketer of the variety. Key items I want to express:

- ***The floricane crop is what is being utilized commercially.***
- ***Its early ripening allows fruit sales up to 2-3 weeks or more before other blackberry varieties, overlapping with strawberries and blueberries for local markets.***
- ***Berries are large and exciting to consumers.***

Prime-Ark® Freedom had a rather precarious path in its development. When I first selected 'APF-153T', which became Prime-Ark® Freedom, on June 26, 2007, I noted it had very large berries but a light crop in a spring-freeze-damage year. That season, 25°F was experienced on April 9, long

after budbreak and likely during bloom. Late June was the first ripe date that year on this plant, which turned out to be about a month later than it normally has the first ripe berries. The early blooms were killed, masking its early ripening potential that year. Further, the original plot of this selection was established in a wet area of our Fruit Research Station, and the plants grew poorly. The area of the Station where it was first established was also not trellised, and the canes did not stand up well without support. In 2009, I noticed a few monster-sized berries on the plants, so I decided to establish it in a more suitable site for further evaluation. It came quite close to being discarded simply due to weak growth in this poor site. After planting in a more desirable location, it was able to show its merits which included very early ripening, large berries, and overall good flavor.

As with many new varieties, when they are planted in the “real world”, we start learning their full potential, or conversely, their limited value. Prime-Ark® Freedom is one that has blossomed with potential.

Earliness of the Floricane Crop

Earliness is the most important attribute for Prime-Ark® Freedom. Alfred shared that it begins harvest about April 20 in Texas, and overlaps with strawberries for nearly a month. He says, “we are able to give the customer a taste of blackberry and get them hooked so they will come back from May-July to pick our other varieties.” He further states that, “my customers can pick strawberries, blueberries, and blackberries all the same day.” Johnny, in commenting on growers use of it in Florida, reported that Prime-Ark® Freedom ripens at a perfect time to compliment blueberry harvests there as well with overlapping transition into additional blackberry varieties after the end of blueberries. Bob indicated that Prime-Ark® Freedom ripens about a month before most other varieties in his area, and this early crop is enough to make a difference in profits in his operation. Arnold and Jeremy share the same thoughts, and Prime-Ark® Freedom gets blackberries on the shelf 2-3 weeks before other varieties. Although I noted it to ripen on average nine days earlier than Natchez in Arkansas, these growers are finding a more extreme expression of earliness than usually seen in Arkansas.

Size of the Berries

Prime-Ark® Freedom can produce very large berries, in Arkansas the average for the season is about 10-11 grams but larger berries have been observed. Alfred said it best: “Big berries fill buckets..... and buckets pay bills!” Likewise Arnold and Jeremy note large size in Alabama. Large berries are eye-

catching to customers, maybe more so with blackberries compared to other fruits.

Yield

I had concerns regarding yield potential on Prime-Ark® Freedom in early evaluations in Arkansas. Our research plot yields ranged from 6,000 to 17,000 lb/acre. Natchez usually produces 19,000 to 25,000 lb/acre, and also ripens in the early season. I get concerned with yield when considering a variety release, particularly when yield varies, as it can expose a grower to reduced profit potential. I think we have learned a key fact in recent years; yields of Prime-Ark® Freedom are likely better in the Deep South compared to our research location in west-central Arkansas. I think this is due to at least two factors:

1. Prime-Ark® Freedom blooms very early, and we often experience late winter and early spring freezes that impact yield (and earliness) at our location unlike further south where these occurrences are less likely.
2. Prime-Ark® Freedom produces a larger primocane crop at our Arkansas location, and the more primocane crop produced, the greater the reduction in floricanes the next year. In the hotter locations in Alabama, Texas, Georgia, and Florida, the primocane performance is repressed and fewer buds are “spent” in primocane-flowering, allowing more buds for the floricanes.

Quality

Prime-Ark® Freedom produces berries that are good in flavor, but like most blackberries, flavor varies due to ripeness, weather, and crop load. My average flavor ratings for Prime-Ark® Freedom were the same as Prime-Ark® 45, a little higher than Natchez, but not as high as Osage and Ouachita. Soluble solids averaged about 10%, a little lower than the floricanes and Prime-Ark® 45. However, if the last time a local-market consumer had a fresh blackberry was 10 months ago, the early berries taste mighty good.

Postharvest storage trials were conducted on Prime-Ark® Freedom prior to release. It did not store as well as Prime-Ark® 45, and the biggest concern was berry leak after 7 days of storage. However, all of the growers commented that they sell the berries the same day harvested (either pick-your-own or on-farm sales) or within two days of harvest. Prime-Ark® Freedom stores adequately for short periods of time.

Chilling Requirement

In recent years, I have had numerous inquiries about blackberry production in Florida. I have always discouraged this to

varying degrees, particularly in central Florida or further south. Prime-Ark® Freedom shows the lowest florican chilling requirement of any Arkansas variety, and has shown some potential all the way to central Florida. Johnny states that it is his favorite blackberry in his home planting just south of Ocala, FL. I still have concerns with adequate and consistent budbreak in this region, but the plants will fruit and can help supplement other berry sales, particularly blueberries. Alfred's and Bob's locations likely benefit from the low-chilling requirement also, as chilling has varied substantially in recent years in Deep South locations. Prime-Ark® Freedom is providing a reliable variety even when chilling is less than optimum.

The Downsides

I have mentioned several concerns with Prime-Ark® Freedom in Arkansas. As with any variety, there are limitations. One of the main ones I mention again, and that is early budbreak and bloom, which can lead to crop reduction. Prime-Ark® Freedom is the variety I go to when I visit our research location to indicate to me if late winter freeze or spring frost damage has occurred in our program. It jumps out early in the spring! Interestingly, I have not found it to suffer winter injury on canes much worse than other varieties, but buds and flowers can be damaged severely. Johnny shared that he believes there is slight risk of freeze damage on flowering/fruitletting in the southern parts of USDA Hardiness Zone 7, but the risk increases substantially in more northern zones. Canes of Prime-Ark® Freedom are erect and grow quite large, but they are very subject to falling over in the wind. This variety absolutely requires trellising due to this tendency and might benefit from tying canes to the trellis wire also. Arnold and Jeremy comment that the laterals are quite stiff and break more easily than other cultivars in management.

Berry doubling is seen on Prime-Ark® Freedom, but this is most common on primocane berries. I have observed this ranging from a few berries to the majority of the primocane crop being impacted. This is not acceptable for berries that must be handled long-term after harvest. I showed this tendency to a home garden marketer one time, and he said, "two for one, that is not a problem!" This is likely not a concern for pick-your-own markets and is rare on florican berries.

Final Comments

It is always exciting to see a variety perform better than expected, and I am pleased that Prime-Ark® Freedom is providing a benefit to a range of Deep South, local-market grow-

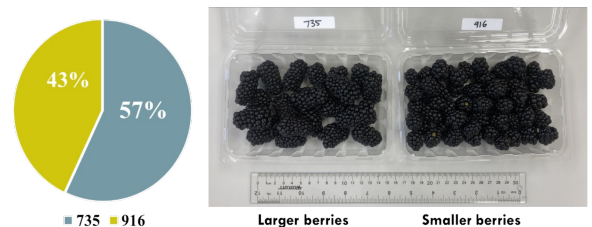
ers. Alfred said it best, "I am a fourth-generation strawberry grower. Looks like blackberries may save my farm!" That is a message I love to hear.

What do Consumers Like about Fresh-market Blackberries?

Renee Threlfall, Research Scientist, Dept of Food Science, University of Arkansas

At the University of Arkansas System (UA System) Division of Agriculture, 80 consumers looked at and tasted fresh-market blackberries to help us determine attributes they liked. The consumers looked at individual blackberries and preferred oblong, large blackberries as opposed to round or small (Figure 1a). Consumers also looked at blackberries in clamshells and preferred to purchase clamshells containing larger blackberries or clamshells without blackberries with red drupelet reversion (Figure 1b). Consumers then tasted six UA system cultivars (Caddo, Natchez, Osage, Ouachita, Ponca, and Prime-Ark® Traveler) and liked Ponca, Osage, Caddo, and Natchez the most. Ponca (10% soluble solids and 0.8% titratable acidity) was highly rated for sweetness, overall flavor, and overall impression. Understanding what consumers like about fresh-market blackberries provides blackberry breeders and blackberry growers with information to advance retail sale.

A



B



Fig. 1. Percent of consumers (n=81) that ranked clamshells of blackberries as most preferred for different size berries (A)^z and different amounts of red drupelet reversion (B)^y.

^z Clamshell '735' had about 22 10-g to 12-g berries, and '916' had about 50 4-g to 5-g berries.

^y Clamshell '942' had 0% of the blackberries with red drupelet reversion, '516' had about 25%, and '378' had 65%.

Spring 2021 Strawberry Crop Monitoring: Impacts of High GDD Accumulation in November of 2020

Amanda McWhirt, University of Arkansas

Jayesh Samtani, Virginia Tech University

Mark Hoffmann, North Carolina State University (NCSU)

Barclay Poling, Professor Emeritus, NCSU

Guido Schnabel, Clemson University

During the fall of 2020 much of the Southeastern region experienced above-average temperatures during November. These warmer than average temperatures resulted in above-average growing degree day (GDD) accumulation during that month. Average GDD accumulated in November 2020 were two to six times greater in 2020 compared with previous years (Table 1). This has resulted in higher total GDD accumulation from October to December during 2020 compared to the recent 2019 and 2018 seasons.

- In Arkansas, despite below-average GDD accumulation in December, above-average total GDD were accumulated from the period of October through December (Table 1).
- In North Carolina, above-average GDD units were accumulated in October to early December in Eastern NC as well as in the piedmont region (Table 1).

The potential impacts of this occurrence on strawberry crown development will vary based on location and planting date. For example, plug plants that were planted in the correct time window may have accumulated above-average GDD from October to December resulting in excessive crown development (Image 1). Cutoffs and late-planted plug plants likely benefited from increased GDD accumulation in November which has resulted in adequate crown development despite being planted later.

Inspect your plants for branch crown numbers.

Growers should inspect plants now and count branch crown numbers (Image 2). This is typically done by digging up an entire plant and pulling off the branch crowns (Image 3). The ideal crown number for optimum fruit production and fruit size is cultivar dependent, but in general, branch crown number on short-day cultivars in January should range from 1-2 per plant which will normally result in 4-6 crowns per plant by spring. Branch crown numbers of 2-3 or more in January could result in 6-8 crowns by spring which is of concern due to the impact on reducing fruit size, especially on cultivars such as 'Sweet Charlie'. Significant fruit size reduction occurs on strawberry plants with eight to 10 crowns.



Image 1. One of the more advanced plantings of 'Sweet Charlie' observed on 18 Dec. 2020 in Virginia Beach, VA. Plug plants were transplanted on 27 September 2020 (Source: Jayesh Samtani).

- In Arkansas we counted crown numbers in late December of 2020 at our Vegetable Research station in Kibler (Zone 7b) and observed:
 - 'Chandler' planted September 30th had on average 3 crowns per plant
 - 'Chandler' planted October 8th had on average 1.75 crowns per plant.
- In North Carolina we counted crown numbers in mid-January of 2021:
 - 'Camarosa' planted Oct 20th in the Wilmington area: 2-3 crowns
 - 'Camarosa' planted Oct 21st (two weeks too late) in the Raleigh area: 1-2 crowns
- In Virginia, plants crown numbers observed in mid-December 2020 varied by farm, geographic locations, planting dates and variety. Branched crowns ranged from 0 to 3 with 'Sweet Charlie' and 'Ruby June' being more advanced in branch crown development.



Image 2. A branch crown forming off the main strawberry crown. Source: Barclay Poling

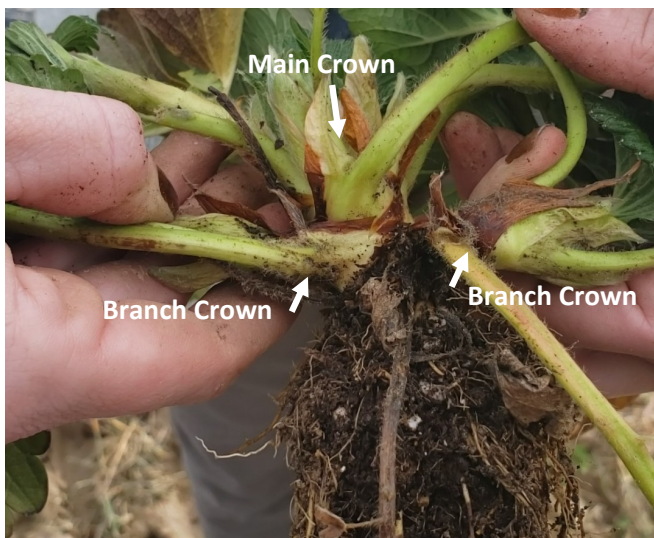


Image 3. Strawberry plant dug up with main and branch crowns separated. Source: Amanda McWhirt

(2) Early blossoms are expected.

Because of the unusually high amount of GDD that were accumulated mostly in November of 2020, it is not surprising that cultivars such as 'Camarosa', 'Fronteras' or 'Sweet Charlie' may have blossoms and even fruited in late fall.

In Arkansas, there have been some observations of early blossoms on 'Chandler' and 'Fronteras', and even ripe fruit on 'Sweet Charlie' in late December. Similar observations were made in Eastern North Carolina.

Additional observations in Virginia indicated early blossoms on 'Chandler', 'Ruby June', and 'Sweet Charlie' with even fruiting on some plants in late fall in Virginia Beach for the latter two varieties.

Because strawberry plants have likely gotten both sufficient

chilling and sufficient GDD, the crop in some areas could be quickly 'pushed' toward bloom with additional warm temperatures.

At this point, we do not have major concerns that these early blooms will represent a significant loss of crop production, particularly if plants are showing good branch crown development. Instead, a concern is that dead early blooms and any fruit left on the plant could be a source of inoculum for botrytis crown rot or botrytis fruit rot. In general, sanitation (i.e. removal of dead leaves, blooms, and fruit) should reduce fungal inoculum levels, shorten drying time after rainfall, and improve spray coverage. Whether sanitation practices actually have a significant impact on disease or yield in NC, AR, or VA is still unclear, however. One study out of Florida shows very little effect of sanitation on disease development and no effect on yield.

(3) Avoid crop enhancement with row covers.

Growers have wondered how early accumulation of GDD and early blooms may impact the crop moving forward.

At this point we recommend growers focus on protecting the crop that is set in the crowns and holding it in dormancy. This means leaving plants un-covered. Row-cover use might lead to more vegetative growth, very early bloom, and higher disease incidence, rather than more fruit. Early blooms will lead to a very high risk to yield losses due to frost and freeze events in early spring. Plants already have accumulated plenty of GDD and the aim for the rest of the winter is to keep plants from blooming for another two months as much as possible.

If temperatures remain cool in February, early bloom is less likely. If, however, we do experience above-average temperatures in February, there is a concern that due to the extra GDD accumulated in November the crop will be pushed to bloom early. Early bloom in February would put many blooms at risk of cold damage if temperatures drop again later in the month or in March and this could represent a real risk of major crop loss.

For growers who planted late and have concerns about small plants size. Using a row cover at this point is not advisable as it is not believed that row covers in late winter/early spring will result in additional crown development and instead will only result in "pushing" the crop to develop earlier. This could be particularly risky this year due to the increased GDD that we observed in November which by Jan

1, 2021, has put the crop in many locations with sufficient GDD and bloom will advance with additional warm temperatures.

Growers should also proceed with normal fertility rates and not try to push the crop with higher rates of Nitrogen.

(4) Now is the time to buy row-covers to protect your blossoms in spring.

While we do not recommend the use of row covers for crop enhancement at this point, we are concerned about the possibility of an earlier bloom and therefore the higher need for frost and freeze protection. We highly recommend **growers stock up on row-covers now and get pipes and sprinkler systems set up in fields.**

To be prepared for cold temperatures or even a freeze event, we recommend an integrated cold protection approach. Having sprinklers and sufficient row covers in place can make the difference between a good and a low yielding season. We recommend the use of heavy row covers (1.5 oz) for cold protection. Strategies such as double covering can help to protect blossoms from arctic freeze events. For additional reading, refer to VT publication on [Frost Freeze Protection \(1\) \(vt.edu\)](https://www.vt.edu/frost-freeze-protection-1). We have listed some row-cover suppliers located in the Southeast in Table 2.

Our team plans to reconvene in February to provide another crop update.

Table 1. Growing degree day (GDD) accumulation in different regions of the Southeast during October, November and December over the last three seasons. GDDs accumulated in November 2020 is on average 2-3 times more than in 2018/19.

		2018				2019				2020			
		Oct	Nov	Dec	Total	Oct	Nov	Dec	Total	Oct	Nov	Dec	Total
Arkansas	Harrison (7a)	326	34	10	370	253	61	32	346	264	149	24	437
	Clarksville (7b)	370	41	18	429	329.0	41	41	411	326	143	9.0	478
	Monticello (8a)	533	12	69	614	470	123	103	696	406	226	40	672
North Carolina	Castle Hayne*	524	206	122	852	570	101	142	813	557	300	70	947
	Clayton	424	111	84	619	507	45	75	627	458	224	26	708
	Salisbury	369	58	31	458	440	20	26	486	366	155	10	531
Virginia	Virginia Beach (8a)	419	145	65	629	456	38	64	558	508	273	62	843
	Charlottesville (7a)	384	58	13	455	396	20	22	438	347	183	13	543
	Manassas (7a)	266	32	5	303	293	17	7	317	289	111	10	410
	Blacksburg (6b)	233	9	1	243	257	2	5	264	198	56	0	254

Source: Arkansas data is sourced from the National Weather Service. North Carolina data are source from CRO-NOS.* Planting dates in Castle Hayne are end of October, most October GDDs are accumulated before planting. Virginia data is sourced from AgACIS climate data.

Table 2. Row cover and sprinkler suppliers for the Southeast (source: North Carolina Strawberry Association)

Atmore Industries

Row cover manufacturer (Gro-Guard UV) 115 Industrial Drive, Atmore, AL 36502 888-396-2566
bfarrai@frontiernet.net
www.flotecinc.com

Agrifabrics, LLC

Row covers (AGROFABRIC)
5905 Atlanta HWY, Suite 101,
Alpharetta GA 30004
770-663-7600
peter@agrofabric.com
www.agrofabric.com

AutoVerters

Row cover manufacturer (DuPont/Typar)
P.O. Box 850, Roanoke Rapids, NC 27870 252-537-0426
barbaradickens@autoverters.com
www.autoverters.com

Berry Hill Irrigation

Row covers (Atmore GroGuard, Dupont Typar), hold-downs, row cover hoops, sprinkler systems
3744 Hwy 58, Buffalo Junction, VA 24529 434-374-5555, 800-345-3747
sales@berryhilldrip.com
www.berryhilldrip.com

Coor Farm Supply Service, Inc.

Row covers (DuPont/ Typar and WinterBlanket) sprinkler systems, thermometers, frost alarms
P. O. Box 525, Smithfield, NC 27577
919-934-4573, 800-999-4573
mail@coorfarmsupply.com
www.coorfarmsupply.com

Gra-Mac Irrigation

Sprinkler systems
2310 NC Hwy 801 N.,
Mocksville, NC, 27028
336-998-3232, 800-422-3560 gramacirr@yadtel.net
www.gramacirrigation.com

J & M Industries

Row covers (Agribon; also woven and needle-point covers), loop hoops
300 Ponchatoula Pkwy.
Ponchatoula, LA 70454
800-989-1002, 985-974-6751 jgideon@jm-ind.com
www.jm-ind.com

Johnson & Company

Sprinkler systems
P. O. Box 122, Advance, NC 27006
800-222-2691, 336-998-5621
hrj@jc-irrigation.net
www.jc-irrigation.net

Pro-Ag

Row Covers, Hold Downs
250 26th Street Drive SE
Hickory, NC 28601
828-328-2501
sales@proagonline.com

Strickland Bros. Enterprises, Inc.

Row cover management equipment
3622 Wiggins Rd., Spring Hope, NC 27882 252-230-0345
www.stricklandbros.com

TriEst Ag Group, Inc.

Row covers (Atmore Gro-Guard, DuPont, Frost Alarms, Digital Thermometers, Hold Downs)
P.O. Box 448 Greenville, NC 27835
844-878-5178
customerservice@triestag.com

Walker Bros, Inc.

Row covers (DuPont), high tunnels
105 Porchtown Rd., Pittsgrove, NJ 08318 856-358-2548
scott@walkerseed.com
www.walkerplants.com

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