

1. Research and extension projects according to crop and objective.

Blackberry and Raspberry:

Blackberry Cultivar Development Program. Various funding sources

Clark, Worthington, Threlfall, Lee – University of Arkansas System Division of Agriculture

Objective 1

Dissemination of results: Results were disseminated to stakeholders during the Arkansas Blackberry Field Day, NARBA, SEFVC, NC Blackberry Growers Association, etc...

Plans for next reporting period: Repeat of field trials, continuation of crossing and evaluation

Blackberry Reference Genomes: Various funding sources

Worthington, University of Arkansas System Division of Agriculture; Ashrafi and Fernandez, NC State University; Bassil, USDA-NCPN Oregon; and many others

Objective 1

Dissemination of results: Results were disseminated to stakeholders at ASHS, chromosome scale assembly made available on DNAZoo, manuscript in preparation

Plans for next reporting period: Submit manuscript to GigaScience and make genome and annotation available on Genome Database for Rosaceae

Genomic breeding of blackberry for improved firmness and postharvest quality: USDA-NIFA AFRI Foundational Program

Worthington, Clark, Wang, University of Arkansas System Division of Agriculture; Ashrafi and, NC State University

Objective 1

Dissemination of results: Results were disseminated to stakeholders at ASHS

Plans for next reporting period: Prepare manuscripts for publication

Tools for Polyploids: Development of a Community Resource: USDA-NIFA SCRI

Byrne, TAMU; Worthington, University of Arkansas System Division of Agriculture; many others

Objective 1

Dissemination of results: Results were disseminated to stakeholders at ASHS

Plans for next reporting period: Prepare manuscripts for publication, develop genomic selection models for blackberry, validate candidate genes discovered in GWAS, present results at PAG, SRASHS, and ASHS.

Pairwise GWAS and Collaborator Trial: Pairwise

Worthington, University of Arkansas System Division of Agriculture; Fernandez and Ashrafi, NC State University; Bassil and Bushakra, USDA-NCPN Oregon; Hardigan, USDA-HRCU Oregon; Weber, Cornell; Dossett, BC Berry Breeding; many Pairwise and Plant Sciences staff

Objective 1

Dissemination of results: Results were disseminated to stakeholders at NARBA

Plans for next reporting period: Prepare GWAS manuscripts for publication, finish collaborator trial

Evaluation of Gibberellic Acid and Prohexadione Calcium for Cane Management in Novel and Standard Height Blackberries: Southern Region Small Fruit Consortium

Worthington, McWhirt, Johns, University of Arkansas System Division of Agriculture; Kon, NC State University

Objectives 1 and 2

Dissemination of results: Results still being analyzed

Plans for next reporting period: Prepare manuscripts for publication, present results at SRASHS

Rotating Cross Arm Trellis and Standard T-trellis Comparison: Arkansas Dept of Ag-Specialty Crop Block and Southern Region Small Fruit Consortium

McWhirt, Threlfall, Lee- University of Arkansas System Division of Agriculture

Objectives 2 and 4

Dissemination of results: Results in final preparation for publication.

Plans for next reporting period: Present results at NARBA, ASHS

Preliminary evaluations of timing and rates of prohexadione calcium on blackberry :
Arkansas Dept of Ag- Specialty Crop Block

McWhirt - University of Arkansas System Division of Agriculture, Kon- NC State University

Objectives 2 and 4

Dissemination of results: Results being analyzed. initial comparison of rate and timing of prohexadione calcium on Ouachita complete in 2020 and second year underway in 2021 at the University of Arkansas Fruit Research Station in Clarksville, AR.

Plans for next reporting period: Prepare manuscripts for publication

Blackberry Nitrogen Rate Fertility Trial

McWhirt- University of Arkansas System Division of Agriculture, Fernandez- NC State University

Objectives 2 and 4

Dissemination of results: Trial planted in summer of 2021 for a trial to compare impacts of nitrogen and potassium rates on blackberry at the University of Arkansas Fruit Research Station in Clarksville, AR

Plans for next reporting period: Preliminary results under review.

Determining the Impact of Early and Late Summer Broad Mite Infestations and Evaluating New Products for Potential Registration: Southern Region Small Fruit Consortium

Cato and McWhirt - University of Arkansas System Division of Agriculture

Objectives 2 and 4

Dissemination of Results: Trial still in progress, results still being analyzed

Plans for next reporting period: Progress report in December

Assessing Pest Management Strategies in Blackberries Produced on a Rotating Cross Arm Trellis: Southern Region Small Fruit Consortium

Cato and McWhirt - University of Arkansas System Division of Agriculture

Objectives 2 and 4

Dissemination of Results: Trial still in progress, results still being analyzed

Plans for next reporting period: Progress report in December

Statewide Broad Mite and Spotted Wing Drosophila Monitoring in Blackberry

Cato - University of Arkansas System Division of Agriculture

Objective 4

Dissemination of Results: Results continually posted through social media/newsletters

Plans for next reporting period: N/A - Very Bad SWD and broad mite year in 2021

Evaluation of preemergent herbicides for newly planted blackberries: Southern Region Small Fruit Consortium

Bertucci, McWhirt, Cato - University of Arkansas System Division of Agriculture

Objective 2

Dissemination of Results: Trial was presented at Blackberry Field Tour on June 9, 2021. Trial was described in the Autumn 2021 issue of The Bramble

Plans for next reporting period: Prepare manuscripts for publication, present results at SRASHS

Greenhouse screen for a selection of preemergence herbicides for blackberry: Start-up funding

Bertucci, McWhirt, Cato -- University of Arkansas System Division of Agriculture

Dissemination of results: First year data completed. Results still being analyzed. Trial to be repeated in 2022.

Plans for next reporting period: Prepare manuscripts for publication, present results at SRASHS

Intelligent Soft Robotic Gripper for Fresh-Market Berry Harvesting: University of Arkansas Chancellor's Innovation and Collaboration Fund grant

Threlfall, MS student Andrea Myers - University of Arkansas System Division of Agriculture

Objectives 2 and 3

Dissemination of results: Results were disseminated to stakeholders at ASHS

Plans for next reporting period: Prepare manuscript

Composition, Volatile and Descriptive Sensory Attributes of UA System Blackberry Cultivars: Southern Region Small Fruit Consortium

Threlfall, Clark, Worthington, MS student Andrea Myers - University of Arkansas System Division of Agriculture

Objective 3

Identifying unique attributes and harvest practices that impact marketability of Arkansas fresh-market blackberries

Threlfall, MS student Andrea Myers - University of Arkansas System Division of Agriculture

Objective 3

Evaluating Impact of Harvest Date on Flavor and Volatile Attributes of Fresh-market Blackberries

Threlfall, MS Student Jordan Chenier- University of Arkansas System Division of Agriculture

Objective 3

Blueberry and Huckleberry:

Blueberry Cultivar Evaluation

McWhirt-University of Arkansas System Division of Agriculture

Objective 4

Dissemination of results: Trial established in 2021 for use in future extension outreach

Plans for next reporting period: Report on preliminary cultivar performance

Grapes and Muscadines:

Grape Cultivar Development Program. Various funding sources

Clark, Threlfall, Lee – University of Arkansas System Division of Agriculture

Objective 1

Dissemination of results: Results were disseminated to stakeholders at the Arkansas Grape Growers Assn Annual Meeting

Plans for next reporting period: Repeat of field trials, continuation of selection evaluation

Muscadine Cultivar Development Program. Various funding sources

Worthington, Threlfall, Lee – University of Arkansas System Division of Agriculture

Objective 1

Dissemination of results: Results were disseminated to stakeholders at ASHS and the North Carolina Muscadine Growers Association etc...

Plans for next reporting period: Repeat of field trials, continuation of selection evaluation

Evaluation of a Rooting Protocol for Hardwood Cuttings of Muscadine Grapes: Southern Region Small Fruit Consortium

Worthington, Buck, University of Arkansas System Division of Agriculture; Conner, University of Georgia

Objective 2

Dissemination of results: Results were disseminated to stakeholders at ASHS and in the Small Fruit News

Plans for next reporting period: Prepare manuscript for publication in HortScience, present results at SRASHS

Evaluating postharvest quality attributes of fresh-market muscadine grapes

Threlfall, MS student Cody Rawls, University of Arkansas System Division of Agriculture

Objective 3

Dissemination of results: Results were disseminated to stakeholders at ASHS

Plans for next reporting period: Determining the impact of skin contact time during wine production of Noble and AM-77 muscadine grapes

Investigate the impact of the Arkansas Quality Wine Program on perception and quality of Arkansas wines and the Arkansas Grape and Wine Industry

Threlfall, MS student Amanda Fleming, University of Arkansas System Division of Agriculture

Objective 3

Evaluate the use of non-*Saccharomyces* yeasts to modify acidity in wine fermentations from grapes grown in Arkansas

Threlfall, MS student Amanda Fleming, University of Arkansas System Division of Agriculture

Objective 3

Identification of flavor and aroma attributes of fresh-market and processing muscadine grapes

Threlfall, MS student Jordan Chenier, University of Arkansas System Division of Agriculture

Objective 3

Strawberry:

Row covers and planting date for strawberry production: MASGA and SRSFC

McWhirt, University of Arkansas System Division of Agriculture

Objective 2 and 4

Dissemination of results: Results were disseminated to stakeholders at MASGA meetings and in the Small Fruit News

Plans for next reporting period: Prepare manuscript for publication in HortScience, present results at SRASHS

Strawberry Variety Trial: MASGA

McWhirt, University of Arkansas System Division of Agriculture

Objective 2 and 4

Dissemination of results: Results were disseminated to stakeholders at MASGA meetings and in the Small Fruit News

Plans for next reporting period: Prepare manuscript for publication in HortScience, present results at SRASHS

Southeastern Strawberry School Webinar Series: SRSFC

McWhirt, Cato-University of Arkansas System Division of Agriculture

Webinar series featuring seasonal updates from specialists across the Southeast in six 90 minute webinars. All recordings available on YouTube: <https://www.uaex.uada.edu/strawberry-school>

Objective 4

Dissemination of results: Report under development, training materials have reached over 400 participants

Plans for next reporting period: Prepare manuscript for publication summarizing three fruit schools

Evaluation of Promax and Zap as Effective Soil Fungicides in Non-Fumigated Strawberry: MASGA

Cato, McWhirt, and Rojas - University of Arkansas System Division of Agriculture

Objectives 2 and 4

Dissemination of Results: Trial still in progress, results still being analyzed

Plans for next reporting period: Progress report in February

Foliar Fungicide Termination Timing in Strawberry: MASGA

Cato and Mcwhirt - University of Arkansas System Division of Agriculture

Objectives 2 and 4

Dissemination of Results: Trial still in progress, results still being analyzed

Plans for next reporting period: Progress report in February

Other Small Fruits:

2. Research and Extension Highlights

Fruit Breeding (Clark, Worthington, Threlfull, Lee):

Historical low temperatures in February (-15 °F) and a very late freeze event on April 22 at the UA Fruit Research Station (FRS) in Clarksville, AR affected all crops. Primocane fruiting blackberries suffered significant cane damage in February, while most floricanes fruiting cultivars and selections experienced minimal damage. The late April freeze resulted in anywhere from a 5% to 90% crop reduction in cultivars and selections depending on bloom date and other factors. Prime-Ark[®] Horizon was first offered for sale in winter 2020/2021 and we anticipate no new releases this season though crossing and evaluation continues!

Many table grapes and wine grapes in the Arkansas Fruit Breeding Program were also impacted by the April freeze. ‘Indulgence’ and ‘Dazzle’ wine grapes were released in fall 2020 and were first offered for sale in winter 2020/2021. These releases complete the wine grape breeding effort. A limited number of table grape selections remain under evaluation for potential release. Muscadine grapes were hit particularly hard by the arctic vortex in February, and approximately 85% of vines growing at FRS were killed to the ground. However, some cultivars, particularly Carlos and Noble, survived these historical cold temperatures with only minimal spur damage, highlighting genotypic differences in cold hardiness. We are continuing to cross with seedless material from the Jeff Bloodworth/Gardens Alive! breeding program. And we are preparing to make our first seeded fresh-market and processing cultivar releases in 2022/2023.

A manuscript describing two new diploid blackberry reference genomes is currently being prepared. Several interesting QTL and candidate genes for thornlessness, primocane fruiting, internode length, berry size, and acidity have been discovered as a result of fresh-market blackberry GWAS research sponsored by USDA-NIFA AFRI and SCRI programs.

3. Retrievable or archived publications arising from collaborative research and extension projects.

- Armour, M.E., M. Worthington, J.R. Clark, R.T. Threlfall, and L. Howard. 2021. Effect of harvest time and fruit firmness on red drupelet reversion in blackberry. *HortScience*. 56:889–896.
- Cureau, N., R. Threlfall, M. Savin, D. Marasini, L. Lavefve, and F. Carbonero*. 2021. Year, Location, and Variety Impact on Grape-, Soil-, and Leaf-Associated Fungal Microbiota of Arkansas-Grown Table Grapes. *Microbial Ecology*. <https://doi.org/10.1007/s00248-021-01698->
- Cureau, N., R. Threlfall, D. Marasini, L. Lavefve, and F. Carbonero*. 2021. Year, Location, and Variety Impact on Grape-Associated Microbiota of Arkansas-Grown Wine Grapes for Wine Production. *Microbial Ecology*. <https://doi.org/10.1007/s00248-021-01705-y>
- Cureau, N., R. Threlfall*, F. Carbonero, L. Howard, and L. Lavefve. 2021. Fungal diversity and dynamics during grape wine fermentations with different sulfite levels and yeast inoculations *Am. J. Enol. Vitic.* 73(3): 240-256.
- Mayfield, S.E., R.T. Threlfall*, and LR. Howard. 2021. Impact of Inactivated Yeast Foliar Spray on Chambourcin (*Vitis* Hybrid) Wine Grapes. *ACS Food Sci. Technol.* 1:1585–1594.
- Mayfield, S.E., R.T. Threlfall*, D. Leis, L.R. Howard, E. Leitner, and J.R. Clark. 2021. Investigating the Winemaking Potential of Enchantment, a New *Vitis* Hybrid Teinturier Cultivar. *Am. J. Enol. Vitic.* 72:2:194-207.
- Threlfall, R., J.R. Clark, A. Dunteman, and M. Worthington. 2021. Identifying marketable attributes of fresh-market blackberries through consumer sensory evaluations. *HortScience*. 56:30-35.
- Threlfall*, R.T., J.R. Clark, J.N. Moore, and J.R. Morris. 2021. ‘Indulgence’ and ‘Dazzle’: Two New White Wine Grapes for the United States Mid-South. *Hortscience* (In Press).

Patents

- ‘Dazzle’ and ‘Indulgence’ Wine Grapes, John R. Clark, James N. Moore, Justin R. Morris and Renee T. Threlfall, University of Arkansas System Division of Agriculture. Plant patents pending 2021