

Objective 1 - Develop improved small fruit germplasm through cooperative breeding and evaluation programs.

Blackberry and Raspberry:

Breeding primocane-fruiting raspberries for Ontario. Adam Dale and Carol Singleton, University of Guelph, Simcoe ON.

Genetic mapping of Tetraploid Blackberry. J. Clark, University of Arkansas, Fayetteville, AR; E. Stafne, Mississippi State University, Poplarville, MS. P. Castro, IFAPA, Córdoba, Spain.

Evaluating blackberry and raspberry cultivars for adaptability to Utah's arid high-elevation climate and alkaline soils. Brent Black, John Clarke, Chad Finn and Pat Moore.

Assessment of Performance of Newly Developed and Well-Established Rabbiteye Blueberry Cultivars. E. Coneva, E. Vinson, and A. Caylor, Auburn University, Auburn, AL.

Assessment of Performance of the UoG Blueberry Breeding Program New Releases, focusing on Rabbiteye Blueberry Cultivars. E. Coneva, E. Vinson, and A. Caylor, Auburn University, Auburn, AL, and Scott NeSmith, University of Georgia, Griffin, GA.

Determining the Performance of Selected Blackberry Cultivars in Central AL. James Pitts, E. Coneva, Auburn University, Auburn, AL, and John R. Clark, University of Arkansas.

Our last set of crosses was for primocane fruiting types. From 20 crosses we set out 3000 seedlings in 2013. These established very well—many flowered this fall—so we plan to select pf-types from them in 2014. A new pest was found in abundance in this planting—the grape flea beetle—which fed on the younger leaves. We have never seen it in our vineyard and wonder where it came from and whether it will be an on-going problem. A. Jamieson.

We also have about 1600 florican-fruiting seedlings to select from in 2014. These crosses were meant to provide a later harvest—to extend the season to the start of the primocane-fruiting harvest. Another way to fill this gap is with controlled-atmosphere stored fruit. Post-harvest storage and fruit quality research with Charlie Forney has indicated very good shelf-life of 'AAC Eden' and K02-15. Berries still appeared quite good after 8 weeks of CA storage. A. Jamieson.

'AAC Eden' (PBR certificate # 4567) has been licensed to the Luc Lareault Nursery of Quebec. 'AAC Eden' is more productive than industry standard 'Nova', with larger, sweeter berries, easily detached and a favorite of pickers. Canes are spineless. Harvest season is similar to 'Nova'. Lareault Nursery will have some plants available in 2015. A. Jamieson.

Our attempt to develop spineless blackberries with greater hardiness began with crossing spineless cultivars with hardier spiny germplasm in 2001 and following years. F1 selections from 2005 and 2006 were crossed in 2008 to give segregating F2 populations. Spineless F2 selections from 2011 and subsequent years have been crossed. The resulting spineless seedlings were planted in 2012 and 2013. Perhaps we will have some trial-worthy selections by 2015 or 2016 (or perhaps a warming climate will allow for the widespread utility of foreign-bred cultivars!). A. Jamieson.

Blackberry and Raspberry Breeding. Gina Fernandez, Absalom Shank and Christine Bradish.

Viruses in Rubus Germplasm. NC State, Univ. AR, USDA-ARS.

Evaluate Rubus selections from USDA-ARS (Chad Finn) and Univ. Ark (John Clark) (NC State: Fernandez, Pattison, Perkins-Veazie)

Evaluation of performance of raspberry selections in the Pacific Northwest. Patrick Moore, Washington State University, Chad Finn, USDA-ARS, Corvallis, OR, Chaim Kempler and Michael Dossett, PacificAgri-Food Research Centre, Agriculture and Agri-Food Canada, Agassiz, BC

Evaluation of adaptation of raspberry selections to machine harvesting. Patrick Moore, Washington State University, Chad Finn, USDA-ARS, Corvallis, OR, Chaim Kempler and Michael Dossett, PacificAgri-Food Research Centre, Agriculture and Agri-Food Canada, Agassiz, BC

Evaluation of raspberry selections to root rot. Patrick Moore, Washington State University, Chad Finn, USDA-ARS, Corvallis, OR, Chaim Kempler and Michael Dossett, PacificAgri-Food Research Centre, Agriculture and Agri-Food Canada, Agassiz, BC

Blackberry breeding. John Clark, University of Arkansas

Florican and Primocane Red Raspberry Breeding- traditional breeding for temperate climates and high tunnel production. C. Weber, W. Boone, Cornell University, New York State Agricultural Experiment Station, Geneva, NY

Florican and Primocane Black Raspberry Breeding-traditional breeding for temperate climates. C. Weber, W. Boone, Cornell University, New York State Agricultural Experiment Station, Geneva, NY

Primocane High Tunnel Red Raspberry Variety Trial- double cropping for maximizing yield. C. Weber, W. Boone, Cornell University, New York State Agricultural Experiment Station, Geneva, NY

Florican High Tunnel Black Raspberry Trial- 7 High density planting system for maximizing yield. C. Weber, W. Boone, Cornell University, New York State Agricultural Experiment Station, Geneva, NY

Primocane Blackberry Breeding- Evaluation of seedling populations for temperate climate adaptation and early primocane production. C. Weber, W. Boone - Cornell University, New York State Agricultural Experiment Station, Geneva, NY, Dr. John Clark – U. Ark, and Dr. Jim Luby – U. Minn.

Developing the genomic infrastructure for breeding improved black raspberries. Germplasm evaluation from ORUS in collaboration with NCSU and WSU. PI: C. Finn, USDA ARS, Corvallis, OR. CoPI: C. Weber et al.

Roadmap Development for U.S. Raspberry Producers: Forging Links Between New Tools For Breeding Programs and Crop Markets. PI: C. Daniels, WSU CoPIs: C. Weber, Cornell University, P. Moore, WSU, C. Finn, USDA-ARS, G. Fernandez, NCSU.

*Whole genome sequencing of Red Raspberry, *Rubus idaeus*. C. Weber- Cornell University, USDA-Beltsville (Kim Lewers), BYU (Josh Udall) and Salve Regina University (J.D. Swanson)*

Primocane Blackberry Breeding Collaboration to develop primocane fruiting blackberry germplasm suitable for northern climates. C. Weber – Cornell University, J. Clark- U. Ark., J. Luby U. Minn.

Primocane bearing blackberries and black raspberries Kentucky observation trials. S. Wright – U. KY

Blueberry & Huckleberry:

Blueberry Breeding. Maggie Schaber and Jim Ballington.

Variation among highbush and rabbiteye cultivars for fruit quality and phytochemical characteristics (Kazim Gündüz, Sedat Serçe and Jim Hancock).

New highbush blueberry releases (Jim Hancock and Pete Callow).

Elderberry: none

Grapes:

Development of rootstocks to extend vinifera grape production into areas with more severe winters in the south central region of Ontario. Adam Dale, Helen Fisher, John Kelly, Toktam Taghavi and Alireza Rahemi, University of Guelph, Simcoe ON.

Evaluation of Performance of Newly Bred Seedless Table Grape Selections from the University of Arkansas Breeding Lines. E. Coneva, E. Vinson, and A. Caylor, Auburn University, Auburn, AL; and John Clark, University of Arkansas.

Evaluation of Performance of PD Tolerant American and French-American Hybrid Bunch Grapes in AL. E. Coneva, E. Vinson, J. Ducar, Auburn University, Auburn, AL.

Investigations of Performance of UC Davis Developed Pierce's Disease (PD) Resistant 87.5% V. vinifera Grapes in AL. E. Coneva, E. Vinson, J. Pitts, Auburn University, Auburn, AL, and Andy Walker, UC Davis.

Assessment of Selected Muscadine Grape Cultivars in AL. E. Coneva, E. Vinson, J. Pitts, Auburn University, Auburn, AL.

Small populations of KW96-2 x New York Muscat and KW97-2 x NYM were added to the Kentville vineyard in 2013. Both Kentville selections have 'Siegerrebe' heritage. We are looking for early ripening, aromatic types. In collaboration with Sean Myles (www.cultivatingdiversity.org), a larger population of 'New York Muscat' x 'L'Acadie' has been planted on a commercial site and additional crosses were performed in 2012 and 2013 with a view to ice wine. Sean has taken a participatory plant breeding approach in which the growers grow seedlings and select the genotypes they prefer. A. Jamieson.

Table grape breeding. John Clark, University of Arkansas

Table grapes are being evaluated in Kentucky, but the primary emphasis is for wine production. S. Wright – U. KY

Ribes: none

Strawberry:

Development of June-bearing strawberries adapted for Ontario. Adam Dale, University of Guelph, Simcoe ON and Becky Hughes, University of Guelph, New Liskeard ON.

Development of glyphosate resistant strawberries. Adam Dale, and Toktam Taghavi, University of Guelph, Simcoe ON.

Breeding seed-propagated F1 hybrid dayneutral strawberries. Adam Dale, Toktam Taghavi and Carol Singleton, University of Guelph, Simcoe ON, Craig Chandler and Bielinski Santos, Gulf Coast Research and Education Center, University of Florida, Balm, FL.

Comparison of in vitro techniques for the production of strawberry nursery stock on nursery and field performance. Becky Hughes, University of Guelph, New Liskeard ON and Vance Whitaker, Gulf Coast Research and Education Center, Wimauma FL.

Evaluation of performance of strawberry selections. K. Lewers, USDA-ARS Beltsville MD; B. Smith, USDA-ARS, Poplarville, MS; M. Newell, U. Maryland (WREC), Queenstown, MD; G. Johnson, U. Delaware, Georgetown, DE; G. Nonnecke, Iowa St. U., Ames, IA; D. Archbold, U. Kentucky, Lexington, KY; D. Handley, U. Maine, Monmouth, ME; A. Jamieson, AAC, Kentville, NS, Canada; K. Demchak, Pennsylvania St. U., University Park, PA., L. Ponce, Lassen Canyon, Redding CA; R. Swanekamp Jr., Kube-Pak, Allentown, NJ; C. Keddy, Keddy Nursery, Inc., Kentville, NS, Canada; B. Krohne, Krohne Plant Farms, Inc. Hartford, MI; S. Irwin, Indiana Berry and Plant Co. LLC., Plymouth, IN; T. Nourse, Nourse Farms, Whately, MA; F. Laforge, Luc Lareault, Inc., Lavatrie, QC, Canada; D. Sakuma, Sakuma Bros. Inc., Bulington, WA; P. Stewart, Driscoll's Strawberry Associates, Watsonville, CA; L. Moore, Larriland Farms, Woodbine, MD; S. Butler, Butler's Orchard, Germantown, MD; D. Pike, Farmington, ME; P. Johnson, Walnut Springs Farm, Elkton, MD; D. Baugher, Baugher's Orchards, Westminster, MD.

Of our two new cultivars introduced in 2012, 'Laurel' has sold very well in 2013 and 'AAC Lila' is being propagated by Luc Lareault Nursery of Quebec for limited sales in 2014. A. Jamieson.

*Collaborative work with plant pathologist Paul Hildebrand has allowed us to pursue resistance to *Xanthomonas fragariae*. Six resistant selections—three each from 2010 and 2012—were entered into a performance trial in 2013. These are 3 or 4 generations from the Beltsville germplasm US4808 and US4809. An additional 4 selections from 2013 will be tested for resistance to *Xanthomonas fragariae* next month, and there are 7 resistance-containing seedling families in the field to select from next year. A. Jamieson, P. Hildebrand.*

*Collaborative work with RosBREED scientists has validated the SSR marker for red stele resistance gene *Rpf1* and identified some potentially important sources of resistance, especially to race A-5. We plan to breed with FRA48 (an *F. chiloensis* from Oregon) and JH101-1 (an *F. chiloensis* x UNK17) both sourced from Chad Finn. A. Jamieson, C. Finn.*

Fruit shape was studied by crossing the elongated K09-11 with B1033 ('Flavorfest') and K09-3. Primary and secondary fruit from the seedlings were measured in 2013 and the data awaits analysis. A. Jamieson.

Evaluation of short-day and day-neutral strawberry varieties and advanced selections. Kathy Demchak and Rich Marini, Penn State University; Kim Lewers, USDA-ARS, Beltsville, MD.

Strawberry Breeding. Jeremy Pattison, Elizabeth Clevinger, Rocco Schiavone and Ray Jacobs.

Day-neutral strawberry cultivars and management under high tunnels. (Diane Brown, Jim Hancock, Eric Hanson).

Evaluation of performance of strawberry selections in the Pacific Northwest. Patrick Moore, Washington State University, Chad Finn, USDA-ARS, Corvallis, OR, Michael Dossett, PacificAgri-Food Research Centre, Agriculture and Agri-Food Canada, Agassiz, BC.

MSU strawberry selections ready for final trial before possible release (Jim Hancock, Pete Callow, Richard Sakuma)

Short Day Strawberry Breeding- traditional breeding for matted row production. C. Weber, W. Boone, Cornell University, New York State Agricultural Experiment Station, Geneva, NY

Increasing strawberry productivity in NY with Day Neutral/Everbearing strawberries. C. Weber, W. Boone, Cornell University, New York State Agricultural Experiment Station, Geneva, NY

Short day strawberry trials. C. Weber, W. Boone, Cornell University, New York State Agricultural Experiment Station, Geneva, NY

Kentucky is evaluating new strawberry germplasm for suitability in the annual plasticulture strawberry system. This project is part of a Specialty Crops Block Grant from the Kentucky Department of Agriculture. S. Wright – U. KY

Other small fruit crops: none

General:

Blackberry, raspberry, blueberry, strawberry breeding. Chad Finn, Ted Mackey, Mary Peterson, Bernadine Strik, Gil Buller, Kimmie Ernst, Bob Martin, Nola Mosier; Jungmin Lee, Brian Yorgey, Pat Moore, Michael Dossett, Enfield Farms (Lynden, Wash.)- Julie and Adam Enfield, Fall Creek Farm and Nursery- Peter Boches, Wendy Ranger, and Dave Brazelton.

Development of Kiwifruit Growing Recommendations for Alabama. James D. Spiers, William Dozier, Elina Coneva, and. Floyd Woods, Auburn University, Auburn, AL.

Propagation of Sparkleberry (Vaccinium arboreum). Jessica R. Bowerman, James D. Spiers, Elina Coneva, Kenneth M. Tilt, and Eugene K. Blythe, Donna A. Marshal, USDA-ARS Southern Horticulture Laboratory (SHL), 810 Highway 26 West, Poplarville Mississippi State University.

Project Title: Expanding Specialty Arkansas Crop Production with High Tunnel Technology. M. Elena Garcia, D. T. Johnson, Entomology Dept. U of A, C. R. Rom

Extending the Market Season with High Tunnel Technology for Organic Fruit Production. Curt R. Rom, University of Arkansas Horticulture, Donn Johnson, University of Arkansas Entomology Jennie Popp, University of Arkansas Ag Business and Economics, and Elena Garcia, University of Arkansas Cooperative Extension Fruit Specialist

Objective 2 - Develop practices for small fruit production tailored for climatic and market needs of growers.

Blackberry and Raspberry:

Protected culture systems for raspberries. Adam Dale, University of Guelph, Simcoe ON, Becky Hughes, University of Guelph, New Liskeard, ON, John Zandstra, University of Guelph, Ridgetown ON, Yves Desjardins, Laval University, Quebec City, PQ, Andre Gosselin, Laval University, Quebec City, PQ and Elliott Currie, University of Guelph, Guelph ON.

Weed Management Practices for Organic Production of Trailing Blackberry. I. Plant Growth and Early Fruit Production. R. Harkins, B.C. Strik, and D. Bryla. Oregon State University and USDA-ARS.

Weed Management Practices for Organic Production of Trailing Blackberry. II. Accumulation and Loss of Plant Biomass and Nutrients. R. Harkins, B.C. Strik, and D. Bryla. Oregon State University and USDA-ARS, HCRU.

Weed Management, Irrigation, and Training Practices for Organic Production of Trailing Blackberry. I. Plant Growth and Fruit Production of Mature Plants & II. Accumulation and Loss of Plant Biomass and Nutrients in Mature Plants. E. Dixon, B.C. Strik, and D. Bryla. Oregon State University and USDA-ARS, HCRU.

Response of Blackberry Cultivars to Fertilizer Source in an Organic Production System. J. Fernandez-Salvador, B.C. Strik, C.E. Finn, and D.R. Bryla. Oregon State University and USDA-ARS, HCRU.

Impact of fertilizer source applied through the drip irrigation system on trailing blackberry grown in a processed organic blackberry production system. Impact of fertilizer source applied through the drip irrigation system on trailing blackberry grown in a processed organic blackberry production system.

Organic production of trailing blackberry – Impact of cultivar on plant establishment, production, and fruit quality. J. Fernandez-Salvador, B.C. Strik, and C.E. Finn. Oregon State University and USDA-ARS, HCRU.

Leaf tissue nutrient levels of primocane-fruiting blackberry are affected by summer pruning. B.C. Strik and G. Buller, Oregon State University.

Leaf tissue nutrient levels of florican-fruiting blackberry – impact of blackberry type, cultivar, and sampling time. B.C. Strik and A. Vance, Oregon State University.

Training systems for blackberries in high tunnels. M. Pritts.

Long cane production of raspberries. NC State.

RCA trellis and row orientation of blackberries. (Fumi Takeda USDA, and Penny Perkins-Veazie NC State.)

Spotted wing drosophila workshop and monitoring in Arkansas 2013. Donn Johnson-Entomology and Elena Garcia-Horticulture

Visual and chemical cues attracting rednecked cane borer to primocanes. Donn Johnson-Entomology, U. Ark.

Organic raspberry production - high tunnels. (Grieshop, Hanson, Isaacs, Lang, Schilder)

Evaluation of SWD management in raspberries (Rufus Isaacs, Keith Mason, and Eric Hanson)

Potted raspberry culture in high tunnels (Diane Brown, Eric Hanson)

Blueberry & Huckleberry:

Mulch and Fertilizer Management Practices for Organic Production of Highbush Blueberry. I: Plant Growth and Allocation of Biomass during Establishment. Larco, H., B.C. Strik, D.R. Bryla, and D.M. Sullivan. Oregon State University and USDA-ARS.

Mulch and Fertilizer Management Practices for Organic Production of Highbush Blueberry. II. Impact on Plant and Soil Nutrients during Establishment. H. Larco, B. Strik, and D. Bryla, Oregon State University, USDA-ARS, HCRU.

Mulch and Fertilizer Management Practices for Organic Production of Highbush Blueberry from Planting through Maturity. B.C. Strik, D.R. Bryla, and D.M. Sullivan. Oregon State University and USDA-ARS.

The impact of plant age and cultivar on yield and its components in highbush blueberry. Bernadine C. Strik and Chad E. Finn, Oregon State University & USDA-ARS, HCRU.

The Effect of Harvest Frequency on Yield and Fruit Quality of Highbush Blueberry Cultivars. Bernadine C. Strik and Chad E. Finn, Oregon State University & USDA-ARS, HCRU.

Nitrogen fertilization rate, sawdust mulch, and pre-plant incorporation of sawdust – long-term impact on yield, fruit quality, and soil and plant nutrition in ‘Elliott’. B.C. Strik and G. Buller, Oregon State University.

Effect of organic matter (incorporated vs. surface mulch) and nitrogen fertilization rate on plant biomass and allocation, carbon mass and mycorrhizal infection in mature blueberry plants. D. Nemeth, B.C. Strik and J. Lambrinos, Oregon State University.

Carbon stocks and fluxes in a northern highbush blueberry field and their response to organic matter addition and nitrogen fertilization. D. Nemeth, J. Lambrino, and B.C. Strik, Oregon State University.

Seed set and berry development in commercially-grown blueberry cultivars. Bernadine Strik and Chad Finn, Oregon State University and USDA-ARS, HCRU.

Effect of grafting, cultivar, and soil amendment on plant growth, fruit quality and yield. Wei Q. Yang, Adrienne Basey, and Heather Andrews, North Willamette Research and Extension Center (NWREC), Aurora.

Blueberry rootstock selection and evaluation on mineral soils. Wei Q. Yang, Adrienne Basey, and Heather Andrews, North Willamette Research and Extension Center (NWREC), Aurora.

Preventing Fruiting on Young Blueberry Plants (Bill Lindberg, Gustavo Lobos, Eric Hanson).

Limiting bird damage in blueberry crops: integrating economic, biological, and consumer information to determine testable strategies for the future. (Catherine Lindell, Mark Longstroth, John Wise, Ben Hawes, Della Fetzer)

Blueberry pollination (Rufus Isaacs, Jason Gibbs, Keith Mason).

Elderberry: none

Grapes:

Mealybug and virus, a deadly mix in vineyards. Walton V.M., Dalton D.T., Kaiser C., and R. J. Hilton. Department of Horticulture, Oregon State University, Corvallis Oregon; Daane K. M., Department of Policy Science and Environment, University of California, Berkeley, California.

Impact of timing and level of cluster thinning on vine growth, fruit composition, and wine quality of Oregon Pinot noir. Patricia A. Skinkis, Department of Horticulture, Oregon Wine Research Institute, Oregon State University, Michael Qian, James Osborne and Elizabeth Tomasino, Department of Food Science & Technology, Oregon Wine Research Institute, Oregon State University.

Understanding vine vigor and yield management on Oregon Pinot noir production and fruit quality. Patricia Skinkis, Department of Horticulture, Oregon Wine Research Institute, Oregon State University, Jungmin Lee, USDA-ARS Horticultural Crops Research Laboratory, Parma, ID, and Julie Tarara, USDA-ARS Horticultural Crops Research Laboratory, Prosser, WA.

Determining optimal levels of N, P, and K for Pinot noir based on vine growth, physiology, and fruit quality. R. Paul Schreiner, USDA-ARS Horticultural Crops Research Laboratory, Corvallis, OR, Patricia A. Skinkis, Department of Horticulture, Oregon Wine Research Institute, Oregon State University, James Osborne, Department of Food Science & Technology, Oregon Wine Research Institute, Oregon State University, Jungmin Lee, USDA-ARS Horticultural Crops Research Laboratory, Parma, ID, and Michael Qian, Department of Food Science & Technology, Oregon State University.

Validating Canopy Quantification Methods for VSP Canopies. Patricia A. Skinkis, Department of Horticulture, Oregon State University, and R. Paul Schreiner, USDA-ARS Horticultural Crops Research Laboratory, Corvallis, OR, both of the Oregon Wine Research Institute at OSU.

Statewide Crop Load Project: Defining Yield Management Practices for Oregon Pinot Noir. Patricia A. Skinkis, Department of Horticulture, Oregon Wine Research Institute, Oregon State University, James Osborne and Elizabeth Tomasino, Department of Food Science & Technology, Oregon Wine Research Institute, Oregon State University.

Understanding the control of fruit ripening through the angle of grape berry variability. Laurent DeLuc, Dept. Horticulture, Oregon State University.

Muscadine grapes evaluated for fresh market and storage life. NC State.

Economic thresholds for grape berry moth in juice grapes (Rufus Isaacs, Craig Roubos, Keith Mason).

Kentucky grape production research continues and is expanding but it is geared for wine production. S. Wright – U. KY

Ribes: none

Strawberry:

Development of day-neutral strawberries adapted to the Canadian climate and to new sustainable production systems. Yves Desjardins, Laval University, Quebec City, PQ, Adam Dale, University of Guelph, Simcoe ON, Becky Hughes, University of Guelph, New Liskeard, ON, John Zandstra, University of Guelph, Ridgetown ON, Andre Gosselin, Laval University, Quebec City, PQ and Anthony Mintenko, Manitoba Agriculture, Food and Rural Initiatives, MN.

Management of Plant Parasitic Nematodes in Strawberries and Ginseng with Pre- and Post-Plant Products: Mike Celetti, Sean Westerveld, Pam Fisher.

Evaluation of low-tunnel strawberry production for season extension. K. Lewers, USDA-ARS Beltsville MD; D. Fleisher, USDA-ARS, Beltsville, MD; S. Poppe, U, Minnesota, Morris, MN; M. Pritts, Cornell U., Ithaca, NY, E. Garcia, Arkansas State U., L. Moore, Larriland Farms, Woodbine, MD

Determining the Status of Recently-Detected Strawberry Viruses in Pennsylvania. Kathy Demchak Penn State University, and Bob Martin, USDA-ARS Corvallis, OR.

Modeling yield as a function of fall growing degree day (GDD) accumulation. VA, NC and SC.

Day neutral production practices for high elevation NC. NC State.

Strawberry decline due to virus infection with SMYEV and SMOV has been an issue in eastern Canada and a large research project looking at the viruses and their vectors will be undertaken. The project leaders are plant pathologist Pervaiz Abbasi (Kentville) and molecular plant virologist H  l  ne Sanfa  on (Summerland).

Optimizing nitrogen fertilization and spider mite management of extended season strawberry production under high tunnels (Year 1). M. Elena Garcia, U. Ark., D. T. Johnson, Entomology Dept. U. Ark.

Increasing strawberry productivity in NY with Day Neutral/Everbearing strawberries. C. Weber, W. Boone - Cornell University, New York State Agricultural Experiment Station, Geneva, NY, D. Shaw – U. C. Davis, K. Lewers – USDA-ARS-Beltsville, MD.

Annual Plasticulture Strawberry Production research at the University of Kentucky is expanding. S. Wright – U. KY

Other small fruit crops:

Haskap and other specialty berries. Evan Elford-OMAF, Melanie Filotas.

Improve propagation of own-rooted chokecherry selections. Brent Black.

Lycoberry (autumn olive) is being harvested from old farm sites and the desire is to develop a full scale industry to meet a goal of 50,000 lbs per year. NC State.

General:

Spotted Wing Drosophila monitoring and management. Pam Fisher, Anne Horst, Hannah Fraser, Margaret Appleby, Denise Beaton, Leslie Huffman, Kristy Grigg-McGuffin, and several others.

Develop improved management strategies for high tunnel berry production (strawberry, blackberry, raspberry) in an arid high-elevation climate. Brent Black.

Management of Spotted Wing Drosophila on Small and Stone Fruit. Walton V.M., Dreves A. J. De Franchesco. J., Shearer P.W., Yang W., Lee J., Miller J., Strik B., Conway, F., Seavert C., Oregon State University; Zalom, F., Chui, J., Begun, D., Goodhue R., Van Steenwyk, B., Bolda, M.. University of California; Walsh D., Beers, B., Tanigoshi L., Washington State University.

A novel chemigation method to control spotted wing drosophila. Wei Q. Yang, Lynell Tanigoshi, Beverly Gerdeman, and Hollis Spitler. North Willamette Research and Extension Center (NWREC), Aurora, OR. Northwest Washington Research and Extension Center, Mt. Vernon, WA.

Soil health, active carbon and strawberry rhizosphere dynamics. M. Pritts.

Spotted winged drosophila. M. Pritts.

Farm business management study. M. Pritts.

Monitoring and Bait Testing for Spotted Wing Drosophila. Kathy Demchak and David Biddinger, Penn State University; Bryan Butler, Univ. of Maryland.

Classical biological control of the Japanese Beetle in Arkansas. Donn Johnson-Entomology and Don Steinkraus-Entomology.

Evaluation of insecticides for control of key small fruit pests (Rufus Isaacs, John Wise, Steve Van Timmeren, Keith Mason)

Control of spotted wing Drosophila (Rufus Isaacs, Steve Van Timmeren, John Wise).

Improved monitoring for spotted wing Drosophila (Rufus Isaacs, Steve Van Timmeren).

Small fruit extension program for insect management (Rufus Isaacs, John Wise, Carlos Garcia, Mark Longstroth).

Work at Kentucky State University continues to focus upon organic production systems for small fruit. S. Wright – U. KY

Objective 3 - Explore the association between fruit constituents and human health impacts.

Blackberry and Raspberry:

Evaluation of organic fertilizer type on the physicochemical properties, sugar profiles, and rates of leakage/decay of two blackberry cultivars. George Cavender, Mingyang Liu, Javier Fernandez, Bernadine Strik, and Yanyun Zhao, Oregon State University, Department of Food Science and Technology, Corvallis, OR.

Microbial Safety of Fresh and Processed Blackberries. Mark Daeschel and Melissa Sales, Oregon State University, Department of Food Science and Technology, Corvallis, OR.

Blackberry fruit (Natchez, Ouachita, Navaho) phenolic profiles were compared using fresh (0 storage) and 15 days (at 4 C). NC State.

Blueberry & Huckleberry:

Elderberry: none

Grapes:

Impact of non-Saccharomyces yeast on wine quality. Isolation and identification of non-Saccharomyces yeast with β -glycosidase activity. Harper Hall, Michael Qian, and James Osborne. Oregon State University, Corvallis, OR.

Impact of Oenococcus oeni on the hydroxycinnamic acid content of Pinot noir wine and production of volatile phenols by Brettanomyces bruxellensis. Stuart Chescheir, Oregon State University, Corvallis, OR, David Philbin, Oregon State University, Corvallis, OR, Charles Edwards, Washington State University, Pullman, WA, and James Osborne, Oregon State University, Corvallis, OR.

Formation of volatile sulfur compounds in Pinot noir post-fermentation. Daniel Kraft, Michael Qian, and James P. Osborne. Oregon State University, Corvallis, OR.

Ribes: none

Strawberry: none

Other small fruit crops: none

Impact Statements:

Objective 1

The new June-bearing strawberry cultivars released over the last five years have given growers in Ontario more choice especially for early and late-season cultivars. However, more producers in Ontario and Quebec are growing dayneutral strawberries. The cultivars currently grown in Ontario and Quebec for the most part were bred in California and, therefore, are not well suited to the Canadian climate, and cannot be propagated economically in Canada. Hybrid seed-propagated strawberry varieties are a radically new approach for strawberries being addressed.

The official release of selection B1033 as 'Flavorfest' December 2012 led to sales to nurseries and growers in 2013. 'Flavorfest's resistance to Colletotrichum accutatum has increased Mid-Atlantic grower awareness that resistant varieties are available with excellent performance in plasticulture, and some nurseries are expanding variety selection beyond 'Chandler.'

This first genetic map of tetraploid blackberry confirms tetrasomic inheritance, identifies several markers linked to primocane fruiting, and shows that primocane fruiting (the F locus on LG7) and thornlessness (the S locus on LG4) are unlinked.

The fruit industry in Alabama is provided new knowledge on the performance and production systems of previously underutilized high-value specialty crops.

Growers have needed information to a) choose cultivars that will result in increased yields of quality berries, and b) avoid cultivars that may result in crop loss, increased insect and disease pressure, or reduced demand for their product.

The goal of the NC State Rubus breeders was to determine if resistance was present in advance material in our respective breeding programs. Virus symptoms are much more prevalent in NC in material from all of the breeding programs.

Two NC State short day strawberry genotypes are scheduled for release that provide agronomic and fruit quality improvements over Chandler for growers in the Mid-Southern states.

NC State breeding for strawberry foliar resistance to the major anthracnose species has the potential to provide increased disease management in both the nursery and fruiting environments.

The continuity of the blueberry breeding program at NCSU has been maintained through the overlap of Maggie Schaber with Jim Ballington during December 3, 2012 to June 30, 2013. This transfer of knowledge allowed Maggie to quickly transition into her new position making for a more streamlined transition from one breeder to the next. This will mean that researchers and the growers in NC will see few disruptions in the program.

Small fruit plant sales in the Pacific Northwest (PNW) for 2012-2013 were reported by plant propagators. The PNW public breeding programs developed small fruit cultivars that comprise 65% of the raspberry PNW plant sales, 63% of the strawberry plant sales and 67% of the blackberry plant sales. The value of production for 2012 in Washington and Oregon was \$25.52 million for strawberries, \$44.515 million for raspberries and \$44.52 million for blackberries.

Released in 2013, 'Prime-Ark® Freedom' (APF-153T) is the world's first primocane-fruiting thornless blackberry commercial introduction.

Osage (A-2362) was released in 2012, a new thornless, florican-fruiting blackberry cultivar.

Four new table grapes were released from the University of Arkansas: Faith (A-2412) is a blue, non-slip-skin, seedless grape that ripens early, late July to early August in Arkansas; Hope (A-2053) is a white (green) seedless grape with a fruity flavor and high yields; Joy (A-2494) is a blue, non-slip-skin, seedless grape with exceptional fruity flavor; Gratitude (A-2505) has an exceptional crisp texture with seedless, green (white) berries. Increased plantings of these new cultivars releases along with Jupiter and Neptune in a range of states in the east and Pacific Northwest are being made. The exceptional fruit quality is exciting for growers and consumers. This is leading to expanded diversification in fruit plantings for local markets which often had limited cultivar choices for table grapes. Consumers are being provided with a top-quality fruit with exciting flavor for enjoyment and health enhancement.

Two new highbush blueberry varieties were released from Michigan State University: 'Calypso' and 'Osorno' highly productive cultivars with excellent fresh fruit quality.

The Cornell strawberry breeding program focuses on developing varieties for perennial production systems in cold climates. This production system is still prevalent in the upper Midwest and Northeastern U.S. and is especially important for many producers selling into the local food markets. This program is uniquely situated to develop varieties suited to this climate area by combining the best traits from a wide range of germplasm into a genetic background suitable for growing in the perennial production system.

Black raspberries are a healthy, flavorful fruit with great potential for expansion due to high consumer interest. However, minimal resources have been devoted to developing new germplasm and varieties. Germplasm and varieties from across the native range of black raspberry are being evaluated to contribute positive traits to the breeding of new, improved black raspberry varieties.

Developing productive, high quality raspberry varieties for cold climate areas strengthens local economies and enhances the local food movement. Cornell varieties currently allow from growers in NY to produce raspberries from mid-June to November by utilizing varieties with varying production seasons and protected production systems like high tunnels and/or rain shields. Varieties are being developed with larger, better tasting fruit with longer shelf life to allow growers to access a wider market for their fruit. A U.S. Plant Patent PP23,375 P3 was granted on Feb. 5, 2013 for 'Crimson Giant' primocane red raspberry that was tested as NY99-45. European plant breeders rights applied for in May 2011. 'Crimson Giant' was released as 'in 2011 with large a large commercial plantings established with our European collaborator no totaling over 90 acres total. It is available from North American Plants in Oregon as well as Burpee Seed Co. and other mail order companies. 'Double Gold' (NY04-25) (apricot color) and 'Crimson Night' (NY03-56) (burgundy color) are pimocane/everbearing selections that were released in April 2012 to the homeowner market. 'Double Gold' and 'Crimson Night' are available from North American Plants, Awald Farms, Burpee Seed Co. and other mail order companies.

Roadmap Development for U.S. Raspberry Producers: Forging Links Between New Tools For Breeding Programs and Crop Markets will provide a foundation for the development of improved raspberry varieties and production practices for the red raspberry industry. This project will develop a full plan for collaborative research on red raspberry for a wider SCRI grant proposal in 2012/13.

Developing the genomic infrastructure for breeding improved black raspberries will provide a framework and informational foundation for breeding improved black raspberry varieties. The collaborative nature of the project includes the majority of researchers in the U.S. with an effort in black raspberry. It also has close ties to industry to ensure that the results are quickly available to growers to enhance their operations.

*Whole genome sequencing of Red Raspberry, *Rubus ideaus* is foundational in its approach and will provide information to breeders throughout the world that can be used to enhance efficiency and productivity in breeding programs for red raspberry.*

Primocane Blackberry Breeding Cornell U., UA and UM to develop primocane fruiting blackberry germplasm suitable for northern climates has the potential to revolutionize blackberry production in cold climate areas. New varieties will provide growers the opportunity to introduce a new crop into their market by allowing the reliable production blackberries in areas where low winter temperatures prohibits this now.

Objective 2

Recommendations for crop management practices in different environments/climates are required to maximize production and profitability for dayneutral strawberry production and protected culture of raspberries. To date, we have been able to make recommendations on dayneutral strawberry cultivars, mulch types, blossom removal and high tunnel production in two diverse climates in Ontario.

Several researchers have received grant funds to study strawberry season extension with low tunnels: S. Poppe received a North American Strawberry Growers Association grant for additional research. M. Pritts was invited to submit a NE SARE grant proposal on strawberry season extension using low tunnels. E. Garcia received funding from WalMart for a proposal that included low tunnels. Barclay Poling received funding to test strawberry production in low tunnels in North Carolina.

(Walton) D. suzukii continue to be a key pest in several small fruit. Basic management practices regarding monitoring and chemical control are in place. Growers are aware of D. suzukii through outreach activities, resulting in effective management. Stakeholders are however demanding softer lower input methods for managing D. suzukii and these methods are currently being addressed.

(Yang) The novel chemigation application utilizing Netafim® micro-sprinklers shows promise as an economical method for controlling SWD in highbush blueberry. Benefits foreseen include: eliminating berry loss occurring with conventional sprayer applications, reducing the need for expensive helicopter applications, conservation of water and reductions in labor and ground equipment use. This method can potentially be used to control other pests and diseases in blueberry and may also be useful in other crops where row applications result in unacceptable damage.

(Strik) Weed management strategies were found to affect primocane growth and florican yield in a certified organic trailing blackberry planting during the establishment years. Machine-harvested yield was similar to what would be expected in a commercial conventional field of similar age. 'Black Diamond' had 15% more yield than 'Marion', and weed control increased yield by 67% with hand-weeding and 100% with porous landscape fabric ("weed mat"), on average. The initial cost of the weed mat was far less than the cost of hand-weeding during the first 3 years following planting, and after only one season of fruit production, the yield benefit of weed mat provided enough profit to warrant its use over no weeding or hand weeding. The planting was successfully established using only drip irrigation and fertigation with fish emulsion/hydrolyzate. The results of the study indicate that weed control is beneficial during establishment of trailing blackberry and can be done successfully in organic plantings using hand-weeding or weed mat.

(Strik) Weed management strategies and the cultivar being grown were found to affect many primocane and florican leaf nutrient concentrations in trailing blackberry when fertilized with organically approved products in a certified organic production system. Fruit calcium concentration was higher when grown with weed mat in 'Marion' than with hand-weeding or no weeding. Cultivar and weed management strategy affected nutrient accumulation and losses (fruit harvest and pruning) with the largest gains and losses in nitrogen, potassium, and calcium.

(Strik) Fresh market blackberry cultivars grown at a certified organic farm varied in yield, fruit quality and plant nutrient status. In contrast, there appeared to be relatively little effect of fertilizer source in this two-year study. More time may be required to determine whether these products consistently impact berry size and yield.

(Strik) We have shown that blackberry plantings can be successfully established using drip irrigation and fertigation in an organic production system.

(Strik) From 2006, the start of our study, through 2012, total blueberry harvested area in Oregon increased from 4,400 to 7,900 acres, an average of approx. 585 acres per year planted. Organic area in Oregon increased from an estimated 60 acres in 2006 to 750 acres in 2011 and in the USA from 480 acres to 4,115 acres from 2003 to 2011. The nearly 7-fold increase in organic area planted in Oregon can be attributed, at least in a large share, to our positive research findings. The farm gate value of organic production in Oregon in 2006 was estimated at \$2.7 million (1% of fresh production x \$1.56/lb); this value increased to \$8.4 million (9.5% of fresh production x \$2.45/lb). Organic fruit has increased grower price by an average of 20% compared to conventional.

(Strik) Our economic analyses (shared via Extension publications) have shown that cumulative economic costs are repaid in 8 years in hand-harvested, fresh market organic production compared to 11 years in conventional production. Conventional blueberries when mature and hand harvested for fresh market have an estimated annual return over full production total economic costs of \$5,035/acre (18,000 lb/acre at \$1.30/lb). In contrast, organic blueberries at the same yield and field age have a return of \$11,925/acre when price is \$1.75 and \$16,425 when price is \$2/lb (note that the fresh organic price was \$2.45 in 2012). Thus, net returns to growers are more than two- to three-fold higher for mature plantings. Note, however, that organic growers do have a higher risk (e.g. a pest infestation that may be difficult to control with organically approved products).

(Strik) Over 95% of the planted organic area in Oregon is estimated to be established on raised beds using weed mat mulch. In addition, the use of weed mat mulch in new conventional plantings in Oregon has increased from an estimated 10% of the acreage in 2006 to more than 80% of the new acreage from 2010-2012. We believe that our positive findings have had a significant impact on the establishment of weed mat mulch as a “standard” production system in Oregon at present. Growers with weed mat use an average of 2 fewer strip herbicide applications per year than those with sawdust mulch, saving \$100 per acre. During the 6 years of this study, the impact of this would be \$280,000 (2,800 acres planted with weed mat x \$100).

(Strik) Use of feather meal fertilizer with 12 times more Ca and seven times more B than fish emulsion, increased soil Ca and soil and leaf B in both cultivars. Use of fish emulsion which contained three times more P, 100 times more K, and 60 times more Cu, resulted in higher levels of soil P, K, and Cu, as well as a higher level of leaf P and K. Fish emulsion also reduced soil pH. Compost+sawdust mulch increased soil pH and organic matter and resulted in higher levels of many soil nutrients than use of sawdust alone and increased leaf K and B. Weed mat, in contrast, resulted in the lowest soil pH, increased soil ammonium-N, and reduced soil Ca and Mg, but its effects on leaf nutrients were variable. Fish emulsion, weed mat, and compost were generally the most favorable practices in terms of plant and soil nutrition. However, given the impact of each on soil pH and/or plant and soil K, further investigation is needed to determine whether these practices are sustainable over the long term for both conventional and organic production of highbush blueberry.

(Strik) Some growers are interested in picking less frequently due to labor shortages. In most cultivars, yield was unaffected when cultivars were picked every 7 to 12 days (medium to high interval). Of note is that there is greater risk to fruit loss from birds and drop during harvest when fruit are left to “hang” longer. Fruit quality (berry weight, firmness, Brix, and TA) were not adversely affected by increasing the harvest interval from 4 to 7 days in 2011 or 7 to 12 days in 2012. In some cultivars such as Draper waiting longer.

(Strik) In mature northern highbush blueberry, some of the variation in dormant plant biomass and carbon from year to year was likely due to changes in pruning severity. However, a gain in biomass and C indicate that these mature plants were still growing and, therefore, increasing the C pool of the plant.

(Strik) In a long-term study, we showed that a typical blueberry production system had carbon net primary productivity (NPP) and patterns of standing C stocks that are broadly similar to less managed perennial systems in western Oregon. Also, in contrast to other woody crops such as apples much more of the carbon that is fixed in the blueberry system is retained in relatively long-term stocks. Common management practices modify this overall picture somewhat. The use of cover crops is essential for maintenance of soils with high OM, SOC, and total C storage. Encouraging both practices could reduce the C footprint of blueberry production and would also have additional direct benefits to farmers such as reduced costs associated with periodic mulching.

(Yang) There are currently no commercial rootstocks for blueberry production. Once a viable blueberry rootstock is identified, using grafted blueberry plants for commercial production may offer reduced mechanical harvesting loss and decreased water, fertilizer, and soil amendment inputs, therefore increasing production efficiency.

(Walton) Results from survey work illustrate that leafroll and mealybugs are an important disease complex in Southern and Eastern Oregon wine production areas, and that growers should monitor for both these pests in order to minimize the risk of spread.

(Skinkis) Use of permanent cover crops in wine grape production has many ecological benefits such as decreased soil erosion, increased water infiltration, and greater soil organic matter and aggregation for increased stability. Agricultural and economic benefits of this research suggest that reduced vine vigor (leaf area and yields) decreases canopy management costs (more than \$700/acre in leaf removal, shoot thinning, hedging, crop thinning). This project is defining appropriate yields for Oregon Pinot noir growers to maximize profits without decreasing quality. Even a 0.5 ton/acre increase in yield could increase profits by nearly \$100,000 annually for a 50 acre vineyard.

(Skinkis) Early results from a multi-year trial helped develop updated industry guidelines for nutrient assessment of winegrapes for Oregon. Those guidelines are shared with industry annually, and growers have been able to alter their nutrient management programs accordingly. For example, we are finding that some nutrient sufficiency levels from California guidelines are too high for winegrapes in Oregon, and fertilization is not required in some cases. This has led to more informed decision-making by growers and a more judicious use of fertilizers.

(Skinkis) While work is still in progress, we aim to develop practical and efficient ways to conduct canopy measures within vines and vineyards. These will be in the form of protocols that can be implemented by researchers or industry to quantify canopy size to make better informed decisions for managing vine balance through pruning, crop thinning, etc.

(Skinkis) In a statewide crop load project we have actively engaged growers in research trials on-site, and they have learned how to utilize data collection protocols. Many of them report having a higher understanding of the whole vineyard system and are much more observant of things happening in their own vineyard. Some growers have implemented the protocols in other vineyards and have altered their methods of estimating yield as a result of the protocols.

(DeLuc) Progression of fruit development relies on successive genetic programs governing cell division, growth, and maturation; and plants utilize many interacting hormones to coordinate these programs. In this study, grape clusters are found to synchronize ripening by accelerating the ripening of developmentally lagging berries without perturbing the overall genetic program from green to mature stages. Instead, the genes involved in this process are activated or deactivated more rapidly in lagging berries to achieve similar transcriptional states among berries in a cluster at maturity. Evidence suggests temporal changes in hormone concentrations as part of the mechanism that hastens the ripening process in some berries. Characterization of this alternate regulatory mechanism for fruit ripening will be important for enhancing agricultural productivity in several fruit and cereal crops suffering from ripeness heterogeneity.

Growers were made aware of whether their strawberry plantings were virus infected or likely to be at risk, and were able to avoid carrying over infected stock. One nursery that had utilized infected runner tips enacted protocols to allow better tracking of plant material.

Through this work, and similar work conducted by other institutions, growers have better tools for monitoring for SWD, thus allowing them to take management steps before berries are infested with SWD larvae and crops are lost.

Pack N Cool trailer, a 5 x8 trailer designed to operate as a cooling source either on 110v or with a generator, provides small growers with a means to pack early for direct markets or to cool in the field or en route to packinghouse facilities. Costs are <\$5,000 for supplies; operates using cool bot technology and 12,000 btu AC unit. Temperature can go to 37 F. Plans are freely available at <http://plantsforhumanhealth.ncsu.edu/2012/08/20/pack-n-cool/>

Improved row cover deployment strategies using a growing degree day model has the potential to maximize per acre yields and minimize variation across years for the eastern plasticulture strawberry industry.

Growing table grapes under high tunnels in Arkansas has been shown to have potential. Second year yields are much higher than under field conditions and we were able to greatly reduce pesticide inputs.

The University of Arkansas' project growing strawberries under high tunnels demonstrated that extending the strawberry production season is feasible in Arkansas. Higher yields, better fruit quality, and reduced pesticide inputs obtained from this production system has encouraged several growers to adapt this technology. The adaption of high tunnel technologies in the state continues to increase giving farmers new market opportunities. In addition, this research allowed us the opportunity to receive grant funding from the North American Strawberry Growers Association and National Strawberry Sustainability Initiative to continue research to expand strawberry production in Arkansas.

In 2012, the spotted wing drosophila (SWD), an exotic pest of ripening soft-skinned fruits, was first detected in Arkansas. In 2013, the three SWD workshops had a total of 124 participants. All were trained to identify and sample for SWD and given the following materials: fact sheet on SWD identification, trap design and bait recipe, fruit inspections, and list of effective insecticides; vial containing spotted wing drosophila male and female flies in alcohol; and prototype trap. Thirteen Arkansas counties had fly specimens confirmed as spotted wing drosophila. Issues of the Arkansas Fruit and Nut News were used to alert fruit growers that SWD were present. Most fruit growers successfully implemented weekly applications of recommended insecticides to prevent fruit infestations by SWD larvae.

The Japanese beetle is an introduced pest of many fruit plants in Arkansas since 2002. In 2013, we alerted growers via the Arkansas Fruit and Nut News that Japanese beetle densities would be low in 2013 due to two years of drought and probably saved growers from applying one or more insecticide applications.

The rednecked cane borer causes galls on blackberry primocanes that increase winter cane death and reduce yield of floricanes the following spring. The development of a rednecked cane borer monitoring trap will allow growers to detect the flight period of this blackberry pest and improve timing of insecticide applications such as imidacloprid at post-bloom or JMS Stylet Oil.

We are collaboratively improving detection methods for several of the viruses infecting berry fruit crops to ensure more sensitive as well as wider isolate range detection, and have detected new viruses. We have identified two new viruses associated with blackberry yellow vein disease (BYVD); we are evaluating different detection protocols for Blueberry mosaic virus including ELISA, RT-PCR and qRT-PCR; we have identified two new carlaviruses in strawberry.

Dayneutral/everbearing strawberry production in New York is developing information for growers about varieties and growing techniques that have not traditionally been utilized in the Northeastern U.S. Adapting day-neutral varieties and annual production practices to a cold climate region requires more precise information on timing of plantings, plant types and varieties to minimize the risk to income due to weather, pests and low production output. . This information is vital for growers to extend their production season, access wider markets and provide a more stable income stream.

Objective 3

(Zhao) While historically, much work has been published regarding the effects of different agricultural methods and materials on fruit production (including caneberry production), it has been primarily focused on horticultural measures of success. While total yield, biomass, plant nitrogen and the like are very important to growers, if the quality of the fruit, as perceived by the consumer, begins to suffer due to changes in agricultural practice, the end result is a potential financial loss to the industry. This research seeks to address that deficiency, and offers the potential to develop guidelines for the industry so that agricultural decisions (e.g. fertilizer type) can take into account not just the quantity of production, but also the quality.

*(Daeschel) The overall results suggest that blackberries are not an ideal environment for *E. coli* O157:H7, *Salmonella* Typhimurium, *L. monocytogenes*, and *S. aureus* to grow. However, these microorganisms may be able to survive depending on the type of blackberry product and its subsequent storage. Many constituents of blackberries may offer bactericidal activity, with organic acids appearing to have the greatest effect. Blackberries may be viewed as a low risk food in terms as a source of bacterial foodborne illness.*

(Osborne) Cold soaking is a winemaking technique that winemakers perform based on anecdotal evidence that it can improve a wines color and aroma/flavor. This work has clearly demonstrated that cold soaking does influence the volatile aromas of a wine and that these changes are caused by yeast present during the cold soak.

(Osborne) The impact of different seasons on yeast diversity and populations during pre-fermentation maceration was more significant than the differences observed between different vineyards. In years where rain occurred during harvest higher diversity and populations of yeast were observed and the consequences of this should be considered by winemakers.

(Osborne) Brettanomyces spoilage can be reduced by using malolactic bacteria strains that cannot degrade tartaric acid bound hydroxycinnamic acids. Commercial starter cultures of malolactic bacteria should be screened for this property so as to minimize the amount of substrate available for conversion to spoilage products by Brettanomyces.

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