

2015 NORTH AMERICAN RASPBERRY & BLACKBERRY CONFERENCE

POSTER ABSTRACTS

Phenotypic evaluations of heat tolerance and fruit quality traits in segregating black raspberry (*Rubus occidentalis* L.) populations in North Carolina.

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In recent years there has been a significant expansion in both the production and consumption of many small fruit crops, yet the black raspberry industry is limited to a small commercial acreage. Black raspberry breeding has been hindered due to a lack of elite germplasm and a lack of adapted, disease resistant cultivars. Despite this, recent research focused on the health benefits of berries has led to a resurgence of interest in this fruit and a renewal of breeding efforts. In North Carolina, we seek to standardize phenotyping procedure and calculate yield parameters for black raspberry, and to define the best method to assess heat tolerance. Two black raspberry populations were planted in 2012 at the Sandhills Research Station in Jackson Springs, NC and evaluated over two harvest seasons in 2013-2014 for fruit traits, yield, and heat tolerance. In 2013, average fruit size ranged from 0.17 – 3.12 g/berry, with highest fruit weight found in 'Jewel' elite checks and two progeny. Average yields were 1.4kg (3 lb) per plant, with no difference between populations. Yield was normally distributed, and positively correlated with 11 plant and fruit traits. Heat tolerance was measured by chlorophyll fluorescence, and ranged from 0.015 – 0.940, where 0.7 – 0.8 is normal and >0.8 is heat tolerant, by convention. Fluorescence was negatively correlated with florican vigor and lateral length. Further, fluorescence was normally distributed and these results were consistent with previous research done on red raspberry in the same location. Genetic mapping between red and black raspberry will be used to further develop genetic tools for breeding small fruits in the future.

Organic Fruit Production; an Internship and Apprenticeship for Sustainable Horticulture.

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The purpose of this project was to involve an aspiring horticulture student in production, outreach, and research in the Southern SARE project, Extending the Market Season with High Tunnel (HT) Technology for Organic Fruit Production. The project aimed to develop environmentally and economically sustainable organic fruit production systems combining HT production with traditional field (FD) production providing for expansion of crop production in the region. The intern participated in three project objectives; 1) To develop HT production systems for season extension of organic blackberry and raspberry; 2) To develop and test pest management strategies for organic HT crop production systems; and 3) To extend the knowledge acquired through the production, pest management, and economic analyses into a multi-dimensional educational, outreach, and extension program. The student participated in the operation and management of the HT and FD systems, in pest scouting and management and in information extension by participating in a workshop on high tunnel management. The student managed experiments on the effects of shade on primocane blackberry growth, flowering, and yield. The outcome of this project resulted in a student with training and experience in sustainable and organic horticultural production, who is now equipped with the tools needed to pursue a career in sustainable production, research, education, or outreach.

XIth International Rubus and Ribes Symposium: Who, What, When, Where, Why and How.

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Learn more about this quadrennial event that will be held in NC June 19-24, 2015. If you like to think, talk and consume blackberries, raspberries, currants and gooseberries, this is the place to be. People in all aspects of Rubus and Ribes research, teaching, extension, business, and public services gather together every four years to promote international co-operation between colleagues from all over the world. More information and registration at <http://www.rubusribes2015.com/>

The National Strawberry Sustainability Initiative: Phase I Accomplishments and Phase II Initiation.

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The University of Arkansas Center for Agricultural and Rural Sustainability launched the National Strawberry Sustainability Initiative (NSSI) in February 2013 with a grant from the Walmart Foundation. In May 2013, Phase I of the NSSI awarded 20 grants to land-grant and public universities around the country totaling \$2.64M. The projects worked to increase the sustainability of the strawberry industry with the following priorities: 1) increase local strawberry production, supply and availability within the U.S.; 2) reduce chemical and energy inputs; 3) conserve and preserve water resources; 4) improve soil quality and health; 5) reduce food safety risk of fresh berries; 6) reduce crop losses and spoilage; 7) improve yield and economic return to producers; and 8) develop appropriate metrics for strawberry production sustainability. Phase I of the NSSI closed in July 2014 with significant outputs and impacts to project areas highlighted in the e-book "Moving the Needle: Accomplishments of the National Strawberry Sustainability Initiative 2013-2014." Some of these accomplishments included creating an e-learning tool, an online diagnostic tool, and an interactive budget tool, patenting two Rutgers developed cultivars, the expansion of strawberry production areas and season extension in Texas, Kansas, Arkansas and Nebraska, and over 60 project and production videos on the NSSI YouTube channel. Five of the Phase I projects and one new project were selected for Phase II funding beginning July 2014. These projects will run through June 2015. Complete NSSI information including the e-book can be found at <http://strawberry.uark.edu>.

Sensory Comparison of an Extremely Firm Fresh-Market Blackberry Selection to Industry Cultivars.

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The University of Arkansas has one of the largest blackberry breeding programs worldwide where unique traits are incorporated into breeding selections and cultivars. One new trait in the program is an extreme firmness of blackberries, which is of potential value for improved postharvest handling. Berries with this firmness attribute seem "crispy" when ripe. However, it was undetermined if these berries would be considered too firm by consumers and not as a positive attribute. Our study compared the breeding selection A-2453, which exhibits the extremely firm attribute, to four commercial cultivars (Natchez, Ouachita, Osage, and Prime-Ark® 45) using a trained sensory descriptive panel (n=9), a consumer panel (n=74), as well as fruit composition. The descriptive panel identified A-2453 as the firmest blackberry, but not different from 'Osage' or 'Ouachita', two firm cultivars but not considered as "crispy". The consumer panelists liked the firmness

of A-2453 the same as the other genotypes, all having high liking ratings (6.9-7.3) on a 9-point scale. There were no differences among genotypes for consumer overall impression (how the consumers rated the liking of all the factors of the blackberry). This indicated that A-2453 was liked as much as the other genotypes, even though it was substantially firmer. Consumers identified 'Natchez' as the largest berry as compared to the others, paralleling compositional measurements. Soluble solids values of the genotypes were within an acceptable commercial range (8.9-10.6%) and descriptive ratings for sweetness were similar indicating the panelists could not differentiate among the small differences in soluble solids values among these genotypes. Descriptive ratings for sourness, a reflection of tartness, were not different. Our results show that A-2453 has positive acceptability from consumers, furthering its usefulness in the program and the pursuit of developing a firmer fresh-market blackberry.

Rednecked cane borer and broad mite monitoring and management.

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The larva of the rednecked cane borer, *Agrilus ruficollis*, girdles a blackberry primocane which causes a gall. This gall predisposes the cane to winter injury which results in yield loss. A green MultiFunnel trap coated with fluon effectively captured adult beetles from early-May to mid-July 2014. This trap can be used to monitor for adult flight and aid in timing insecticide sprays. One soil drench application of Imidacloprid to base of blackberry plants in April and several weekly blackberry foliar sprays of JMS Stylet Oil in May during the adult flight period significantly reduced the number of galls per plant. Broad mites, *Polyphagotarsonemus latus*, have recently caused terminal leaf cupping, reduced leaf area, flower bud deformation and yield loss in blackberries in Arkansas and North Carolina. Photographs of this mite and its damage will be presented. The recommended mite sampling method and preliminary findings from a miticide efficacy study will be included. It will be stressed that growers look for this new blackberry pest in their planting.

Raspberry Demonstration and Distillation at the Missouri State University Fruit Experiment Station.

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Several field trials of primocane bearing raspberries were conducted at the Missouri State Fruit Experiment Station (MSFES) in the 1980s including cultivar evaluation and shading and tipping experiments designed to delay harvest. Results showed that this crop was difficult to grow for profit due to summer heat during harvest and high perishability of the fruit. The primary goal of this demonstration was to see how primocane bearing raspberries performed in a high tunnel compared to the field in this region. A secondary goal was to develop a distilled fruit product using raspberries. This trial was not replicated for statistical analysis, but rather designed as a pilot study to see if further research is warranted. Results indicate that primocane bearing raspberries have potential to be a commercial crop in high tunnel production in southern Missouri and warrant further investigation. The Josephine cultivar was identified to be the base line cultivar to which other cultivars can be compared to in future high tunnel research. The procedure to produce a distilled product using raspberry fruit was worked out and can be used in recommendations to craft distillers. Prior to the arrival of Spotted Wing *Drosophila* (SWD) in June, 2013 in southern Missouri pests and disease problems were minimal on raspberries in the high tunnel and pesticides were used only infrequently for mites. SWD will be a component in the management strategy for future investigation of high tunnel primocane bearing raspberry production at the MSFES.

Innovative packaging technologies to enhance the safety and the quality of fresh raspberry

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The major postharvest pathogen of raspberry is *Botrytis cinerea*, the causal agent of gray mold disease. Essential oils (EO's) from common herbs such as thyme and oregano have been known for centuries to have anti-microbial activity, and are generally regarded as safe (GRAS). The problem with using EO's is that they are volatile and difficult to handle. We solved this problem by incorporating the EO's into controlled release packaging, which releases the active compounds at differentiable rates suitable for inhibition of microorganisms in fresh fruits. For our delivery system, we encapsulated the EO's into cyclodextrin (CD), which stabilizes them, and sealed the capsules in a Tyvek™ sachet, which can be placed inside the clamshell package. When the fruit release water vapor naturally inside the clamshell, the water vapor displaces the EO's from the sachet, into the clamshell and the fruit, so the EO's can inhibit the growth of microorganisms. Multiple clamshells may be packaged together and wrapped in a plastic film (MAP) designed to reduce water condensate and maintain optimal oxygen and carbon dioxide for fruit storage. Raspberry fruit were stored for 5 days at 1°C, with or without MAP, and for 2 additional days at 10°C without MAP to simulate supermarket shelf storage. Disease incidence and weight loss were significantly reduced at both 5 and 7 days for the fruit receiving the thyme oil sachet treatment in the presence of MAP.

Extending the Market Season with High Tunnel Technology for Organic Blackberry and Raspberry Production.

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High tunnels are being evaluated as a technology for season extension of blackberry and raspberry production systems as a complement to field production. Two studies have been developed; 1) to advance the production of early season florican blackberries, and 2) to extend the season of primocane blackberries and raspberries. As experiments within these studies, the following modifications to tunnels are being evaluated: screening for insect pest exclusion; using tunnels-in-tunnels for additional heat-unit accumulation and thermal protection from freezes; shading to reduce temperature load, delay flowering and fruiting of primocane fruiting blackberries and raspberries; and over-plant Microsprinklers to cool temperatures during summer and autumnal heat. Screening the tunnels resulted in temperature increase within the tunnel compared to unscreened tunnels. Shade cloth (50% shade) structures were built within the tunnel and imposed prior to first bloom of primocane plants and continued for 30 days during the flowering and early fruit development period. Shade treatments significantly reduced seasonal cumulative yield of Prime-Ark 45® blackberry but resulted in increased berry size, and marketable yield percentage. However, for 'Nantahala' raspberry, shade increased total seasonal yield >30%, but resulted in reduced average berry weight. Using Microsprinklers mounted along the centerline of the high tunnel resulted in a significant temperature reduction for a period of 1-3 hours after discontinuing the misting. Operating Microsprinklers for approximately 6 hours significantly reduced temperatures for the entire day, and resulted in air temperatures equal to or close to the external ambient temperatures.

Characterization of Crispy Selections of the Arkansas Blackberry Breeding Program.

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Flesh firmness of blackberry fruits is critical for successful postharvest handling. Therefore, this trait is a priority in the development of new cultivars in breeding programs across the U.S. and world. The University of Arkansas blackberry breeding program has released a number of cultivars with excellent postharvest quality. Crispy and exceptionally firm fruits have been identified. Two thornless Arkansas selections have this trait, A-2453T and A-2454T. After storage for 7-14 d, they maintain firmness, crispiness, and low color reversion (one or more drupelets turning red from black after harvest) beyond that of existing cultivars. This is of importance, because fresh-market potential is determined by how a genotype responds to storage and handling. The objective of this study was to characterize the fruit morphology of crispy blackberry fruits, determine the components contributing to this trait, and determine the relationship between fruit firmness and color reversion. Shiny-black fruits of 15 blackberry genotypes were harvested into 0.24 L clamshells during the 2013 season. Color reversion and fruit compression firmness and penetration (skin and drupelet) were measured. After one week of cold storage, the two crispy genotypes along with A-2218 presented low levels of color reversion and were superior to other selections and cultivars. Crispy genotypes showed the highest compression firmness values compared to non-crispy genotypes. Skin drupelet penetration force showed a similar trend as compression force. Lastly, crispy genotypes also showed a higher receptacle penetration force, reflecting enhanced firmness of the internal core of the berry. These results are promising, showing superior flesh fruit firmness, low color reversion, superior postharvest quality and shipping potential of these crispy genotypes.

Prime-Ark® 45 in California: Best Practices for Cane Management and Color Reversion Prevention.

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The story of Prime-Ark® 45 in California is a tale of success. Released from the University of Arkansas in 2009, roughly five years has passed since the first commercial acreage of was planted. High productivity and favorable market prices in the late summer months, combined with the unique coastal climate and wide adaptability to a range of soil / water qualities have contributed to Prime-Ark® 45's success. Current acreage in California is estimated at 600 - 700 acres. High tunnels covered with specialized plastics are commonly used on the coast. In the Central Valley, tunnel use is less common though sometimes shade cloth is deployed. Cane management is critical for success; both single- and double-tipping are used to remove apical dominance and force branching. Increasingly, canes are tipped by mechanical means. As with any success story, there are hurdles to overcome. Proper cane management (timing of tipping) and postharvest storage and handling to prevent color reversion (reddening of drupelets) are challenges that remain for growers.

