Small Fruit News

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Special Reports:

'Osage' A New Blackberry for Local and Shipping Markets

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University of Arkansas

'Osage' is the thirteenth release in a series of erect-growing, high-quality, productive, floricane-fruiting blackberry cultivars developed by the University of Arkansas Division of Agriculture. An enhanced effort in the improvement of flavor in blackberries has been underway in the Arkansas program for a number of years, and 'Osage' was developed with the intention of advancing flavor to a higher level in a thornless blackberry cultivar. 'Osage' ripens mid-early, slightly before 'Ouachita' and just after 'Natchez'. 'Osage' produces medium-sized berries, smaller than that of 'Natchez' but comparable to that of 'Ouachita'. 'Osage' has excellent postharvest quality for the shipping market in addition to local markets. It is expected that 'Osage' will complement 'Ouachita' in the mid-early to mid-season harvest period.

Important information on 'Osage':

Type: Thornless, floricane-fruiting.

Ripe date: Average first harvest date for 'Osage' is 10 June, 5 d after 'Natchez', 3 d before 'Ouachita', at Clarksville, AR. The first ripe date in 2012 was in late May, but this was the earliest blackberry season possibly ever in Arkansas.

Berry characteristics: Average weight usually 6-7 g; soluble solids (sweetness) 11%; mostly round to conic shape similar to 'Ouachita'; very firm; excellent flavor; glossy; white drupelets not observed.

Plant characteristics: Yield comparable to higher than 'Ouachita'; chilling requirement not verified, likely near that of 'Ouachita' or possibly lower; hardiness comparable to hardiest Arkansas varieties but not tested in severe environments; very erect canes and consistently healthy plants.

Post-harvest handling: 'Osage' demonstrated excellent storage potential, comparable to 'Ouachita', 'Natchez' and 'Prime-Ark® 45 and exceeding that of 'Tupy'. Development of red drupes on berries was very low in most years for 'Osage', 0 to 1% except for 2008 where this value was higher for 'Osage' along with most other cultivars. 'Osage' is expected to perform well in commercial shipping use based on this comparison.

'Osage' has completed virus testing and heat treatment at the USDA-ARS Horticultural Crops Research Laboratory, Corvallis OR. Plants should be available in 2013 from tissue culture sources and from conventional propagation sources in 2014.

Figure 1: *Osage fruit (top) and flowers (lower).*

Innovating Blackberry Production System

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Abstract: This article provides an overview of progress made on blackberry production system at the Appalachian Fruit Research Station in Kearneysville, WV. Several lines of research have made a significant positive impact to the blackberry industry as the new technology has have been successfully transferred to private-sector partners. The commercial Rotating Cross-Arm (RCA) trellis in combination with the USDA-ARS cane training system has gained a wide industry and commercial adoption as it is being used in more than 25 states and has helped to increase blackberry acreage by ~ 200 acres in the Midwest and Northeast in the last two years. The RCA trellis and cane training system has been used in propagation of blackberry plants that offer opportunities for growers to produce blackberries in out-of-season.

Blackberry production requires high labor and chemical inputs. This means that in the current global economic market, it is more difficult in the United States to maintain a profitable operation with ever-increasing competition and market share by countries to the south with lower production costs. This has renewed interest in improving cropping efficiency and production systems in order to increase fruit production and quality at times when blackberry shipments from Mexico are low. This can be achieved in part with proper cultivar and site selection and plant manipulation. These improvements will foster commercial expansion of blackberries and help mitigate production factors limiting profit potential.

Blackberry research program at the Appalachian Fruit Research Station: At the Appalachian Fruit Research Station, scientists have conducted a series of research projects since early 1980 to develop improved blackberry production systems. These include:

1. Determine efficacy of novel cultural and chemical treatments to improve harvest mechanization
2. Mitigate low-temperature damage
3. Manipulate the environment to accelerate and intensify floral bud initiation and subsequent reproductive development
4. Better understand the mechanisms controlling flower development in blackberry and growth processes involved in regulating the flower size and inflorescence development, and
5. Identify the effects of plant material source and environmental conditions on vegetative propagation.

Our research into alternative production systems and evaluation of novel germplasm materials is expected to provide new technology and to create new opportunities to produce berries for fresh market. Technology transfer efforts are expected to improve the viability of small fruit farming and the rural vitality in several parts of the United States. Currently the culmination and focus of this is to develop novel production systems.

Growing blackberries in areas with low winter temperatures: In the Mid-continent and Northeastern United States where low (< -5 °F) temperatures in the winter are common fruit pack-out can be adversely impacted due to winter kill. In other areas of the country intense sunlight and high temperatures in the summer can cause poor fruit quality. We hypothesized that the manipulation of blackberry plant canopy can be used to mitigate the effects of adverse environmental conditions. We used the Rotating Cross-Arm (RCA) trellis system and cane training method that had been developed for mechanical fruit harvesting research (Takeda and Peterson, 1996; 1999). The RCA trellis and cane training system also allowed the canopy to be laid close to the ground in winter so that a rowcover could be placed on top of the canopy and moderate the temperatures (Takeda et al., 2008; Takeda and Phillips, 2011). For example, 'Siskiyou' a western trailing blackberry variety Siskiyou developed in Oregon has been reported to suffer winter injury when the temperatures drop below 12 °F. At the Appalachian Fruit Research Station (USDA Plant Hardiness Zone 6), both 'Siskiyou' and 'Black Diamond' have been successfully grown and have produced >12 lbs per plant even after winters with temperatures below 0 °F when they were grown using the RCA trellis and cane training system and a row cover (1.5 oz./yd^2) (Figure 1). For better results we recommend growers to have one side of the rowcover off the ground when extremely low temperatures (< 10 °F for erect blackberries and < 15 °F for trailing blackberries) are forecasted. The rowcover may require lifting on one side in late winter and early spring when the daytime high temperatures (> 55 °F) are in the forecast for three or more consecutive days. If the rowcover is left in the field after budbreak then it can be rolled back over the low-profile plant canopy to the flower shoot in case of spring frost.

Figure 1: *'Black Diamond' blackberry plant, a trailing type developed in Oregon, can produce >10 lb/plant in USDA Plant Hardiness Zone 6 (Kearneysville, WV) when the floricanes are placed close to the ground and covered with a 1.5 oz rowcover in winter. Primocane training has been modified to better utilize its growth habit.*

Relationships between unique canopy architecture and fruit quality: As we have reported previously, the lateral canes are laid horizontally in late winter about 2 feet above the ground to let the flowering shoots develop upward in spring and they are brought up beyond vertical after bloom. This resulted in all berries (e.g. >98%) being positioned on one side of the row and allowed the harvester to engage the fruit from above and the catch plate to be positioned just below the level of the fruit, thus significantly reducing the drop distance (Takeda and Peterson, 1996; 1999).

This canopy configuration provides additional benefits in terms of fruit quality. Fruit positioned on the north side of the row would not be exposed to direct sunlight in the morning or afternoon if the rows were oriented east-west. If the rows are oriented north-south, the fruit would be exposed either to morning or afternoon sun depending on which side the fruit is positioned. In 2010, sunburn injury was reported to have accounted for 30% loss in fresh market pack-out in Georgia. Our findings from the 2011 study (Table 1) indicated that white drupe formation was similar whether fruit was on east or west side of the row. However, exposure to direct sunlight either in the morning or afternoon had a significant effect on white drupe formation in 'Apache' blackberry. The skin temperature was sometimes 15 °F higher in berries exposed to sun than those in the shade. In 2010, a cooperator in California reported that by using the RCA trellis and cane training system, he was able to improve harvest efficiency by 30% and eliminate almost all culls from sunburn damage when he was able to position the fruit on the north side of rows that were oriented east-west.

Technology transfer effort to expand blackberry production: Recent studies demonstrated that the combination of laying lateral canes close to the ground and covering the plants with rowcover during winter protected blackberry plants from freezing temperatures (Takeda and Phillips, 2011). The ease in which the lateral canes can be positioned horizontally and vertically (Figure 2) by using the RCA trellis and cane training system has stimulated blackberry production in the Midwest (OK, KS, IA, MO, IL, IN, OH, Northeast (PA, NY, MD, MA). In addition, cooperative projects are underway in Norway, Uruguay, and Chile.

Figure 2: *Top: A large blackberry farm with the RCA trellis and cane training system was established in Circleville, OH. Bottom: The canes trained to the RCA trellis can be easily lowered to the ground (2-man crew do a 300-ft row in 15 min.) and a rowcover can be applied in winter to protect the plant. Photos are courtesy of Trellis Growing Systems, Ft. Wayne, IN.*

Trellis Growing System (TGS), received a USDA NIFA Small Business Innovation Research Phase II grant (http://www.trellisgrowingsystems.com/resources/RCA Trellis.pdf) for commercializing and marketing the RCA technology. TGS markets the fiberglass-component RCA trellis and reported that from 2010 to 2011 it had sold RCA trellises to commercial blackberry growers (1 to 20-acre size) in more than 20 states, including NC, VA, PA, MA, MD, OH, IA, OK, KS, IN, MI, GA, CA, and KY (Figure 3). ARS is collaborating with North Carolina State University and the University of California to study the effects of row orientations and fruit locations in plant canopy on sun-related injury and whether growing blackberries on the RCA trellis can increase fresh pack-out by reducing sunburn damage in blackberry cultivars such as Natchez and Ouachita that were recently released by the University of Arkansas. Also, ARS has collaborative efforts in Iowa and Pennsylvania to expand the production areas for new blackberry cultivars such as 'Onyx' and soon-to-be-named US-OSU 1939-4 and 1793-1 from the blackberry program at USDA-ARS-Corvallis, OR and improve winter survival of eastern thornless cultivars such as Chester Thornless and Triple Crown in USDA Plant Hardiness Zones 6 and 5 (< –10 °F).

Figure 3: *The position of fruit on blackberry plants can be manipulated by canopy management. Top: A typical hedge-row system. Note the fruit is on both sides of the row. Middle: Plant canopy can be manipulated easily when the primocanes are trained on the RCA trellis. Cross arms held in horizontal position from winter to spring for flower shoots to develop upward (left row). At bloom or just before new primocanes reach the training wire the cross arms are rotated upward (right row). Note a wall of flowering shoots is only on one side of the row. Bottom: This photo was taken in July. Note a wall of green fruit. Photos are courtesy of Bill Jacobs, Owasso, OK and Trellis Growing Systems, Ft. Wayne, IN.*

Alternative blackberry propagation methods: Blackberry has been traditionally propagated using vegetative methods including tip layering, cane (soft and hard) and root cuttings, and tissue culture. Recently, we reported on simple, inexpensive methods for propagating blackberry plants by hardwood or floricane stem cuttings (Takeda et al., 2011). The RCA trellis and cane training system resulted in 3 to 5 times more production of propagation material from stock plants than with traditional methods (Figure 4). A method for root and flower shoot induction in one-

node floricane cuttings has the potential to generate 3200 miniature plants from each stock plant and transplants that will fruit in just 2 or 3 months after delivery. This makes them attractive as house plants and for growing of fresh berries within the confines of controlled environment cropping systems. Collaboration with the University of Arizona Controlled Environment Agriculture is being pursued to develop production systems for growing blackberry miniature plants on Antarctica and even on the moon! Tip-layering is laborious and the ratio of new transplants produced from each stock plant is usually low. With the RCA trellis and cane training system, 50 or more long cane plants to stock plant ratio has been possible (Takeda and Soria, 2011). A patent application (12/887,851) was filed on 9/22/2010. The further refinement for the use of the RCA trellis and cane training system to produce long-cane plants is underway under a confidentiality agreement with a commercial nursery operator to develop new and improved products.

Figure 4: *Top: More than 30 lateral canes that grow >12 feet can develop on plants spaced six-feet apart and managed properly on the RCA trellis. Bottom Left: The tips of these lateral canes can be rooted to produce long-cane plants. A protocol has been developed to produce looped cane plants which have roots at both ends. Bottom Right: Also, the lateral canes can be harvested in winter and made into one-node cuttings. Cuttings produce roots and a flower shoot emerge in 10 to 14 days and afterward transplanted into pots. The miniature blackberry plants (Takeda et al., 2011)) can produce fruit from winter to spring.*

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Table 1: The effect of fruit location (east vs. west side of rows oriented north-south) and exposure to sun (perimeter vs. interior of canopy) on white drupe formation in 'Apache' blackberry. The results are expressed as percentage of mature fruit that was harvested in July with 0, 1-5, 6-10, or over 10 drupes that had become white.

	Date											
	July 14				July 20				July 27			
Fruit location	0	1-5	6-10	>10	0	1-5	6-10	>10	0	1-5	6-10	>10
East	59	35	6	1	51	40	8	2	58	17	5	20
West	51	33	7	8	47	39	9	5	63	23	9	6
Perimeter	29	51	12	8	26	53	15	7	30	31	13	26
Interior	82	18	1	0	72	26	2	0	90	10	0	0

The University of Arkansas Caneberry Certification Workshop

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One of the initiatives of USDA National Clean Plant Network (NCPN) is to develop nursery certification standards for berry crops that would be agreed upon and used in all states. Currently there are considerable differences between state regulations for a given crop, which leads to confusion when shipping plants both nationally and internationally. The program would be voluntary, however the implementation of a national system would unify the standards, with the final product being a higher quality plant for sale to growers.

On May 24-25, 2012, a Caneberry Certification Workshop funded through APHIS Section 10201 of the 2008 Farm Bill was held in Rogers AR. (Other meetings will be held for the other berry crops, see website listed below for more information). The workshop participants included representatives from three groups: Nurseries, State Nursery Regulators and Research Scientists. I attended the workshop on behalf of the North American Raspberry and Blackberry Association. Drs. Ioannis Tzanetakis, Rose Gergerich, and Robert Martin organized the meeting and drafted a set of nursery standards that were discussed at length during the meeting. The draft standard includes a list of common definitions, abbreviations and acronyms, general and specific requirements and evaluation methods (i.e., procedures for plant maintenance, pathogen testing, sampling, inspection, etc.). The standards will be general for all the country and a series of appendices will be developed for regions within the US. Many of the topics within each of these standards were discussed and agreed to but not all were resolved, although we are optimistic that they will be in the future. One of the key elements that all attendees did agree upon was the use of the "G" terminology to describe the various levels of plant propagation. G stands for generation. More on the G terminology if adopted will appear in a future newsletter.

I was told by the organizations president, Nathan Milburn to convey to the group one message, and that is "Growers want clean plants, clean plants, clean plants." I made that point and several others.

For more information on the NCPN go to their website: http://nationalcleanplantnetwork.org/

Figure 1: Caneberry Certification Workshop Participants
1st row: sitting from left to right: Terry Walker, Arkansas Department of Agriculture. Mansun Kong Driscolls CA, Rose Gergerich University of Arkansas, Rodney Robichaud, Riomann Labs, MI.
2nd row: Zvezdana Pesick Van Esbroeck NCSU, Gina Fernandez NCSU, Judy Johnson Plant Sciences Inc CA, Cindy Cooper WA State Dept. Agriculture
3rd row: Phil Wilson NS Dept. Agriculture, Carol Masters Canadian Food Inspection Services BC, Keith Striegler NCPN, Bob Martin USDA-ARS OR, Yannis Tzanetakis Univ. Arkansas, Yongjian Chang North American Plants WA

Blackberry R&P Efforts Put on Hold

Efforts to create a Research and Promotion program for fresh-market blackberries (similar to those for red raspberries, to left, and that for blueberries), have been put on hold by the Blackberry R&P Working Group and the NARBA Executive Council, after a preliminary review of the draft proposal by the USDA/Agricultural Marketing Service required major revisions to the proposed board structure. In its review, USDA-AMS clarified that it requires that the board represent production as closely as possible. Since more than an estimated 70% (by quantity/weight) of the fresh market blackberry industry is composed of imported berries, a similar proportion of the board would need to be composed of importers and foreign producers. In the draft proposal, domestic producers made up a majority of the board. Although the purpose of an R&P program is to grow the industry and benefit all producers, a number of domestic growers, who had been hoping that the program would give a particular boost to domestic producers, said that they could not now support the program with this structure. As broad support across the industry would be a requirement for proceeding toward a referendum, the effort has been tabled.

There is wide agreement that the process of working on an R&P has already had many positive

effects, bringing different segments of the blackberry industry together and developing dialogue toward common goals. The efforts have certainly helped develop NARBA's connections with the blackberry industry across the country and in Mexico.

Discussions are continuing on other ways the industry can advance these goals outside a R&P program: Can funds be raised through a voluntary program? Would a time-limited program focusing on consumer/buyer education and promotions on the many health benefits of blackberries and/or supporting health benefits research have wide support? Can the existing structures of NARBA and our Research Foundation be vehicles for this kind of effort? Stay tuned for further developments. Contact NARBA if you have comments or ideas.

Post-Harvest Weed Management in Blackberry

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Once blackberry harvest ends the effort to remove floracanes begins and the left over weeds will have to be controlled. It is fairly common practice to put on a post-harvest fertilize application in an effort to push floracane development before going into the winter and the last thing needed is competition from escaped weeds. Not only do the weeds compete but they can interfere with granular fertilizer distribution and insecticide applications for cane borer control.

Immediately after floracane removal a directed application of paraquat with non-ionic surfactant should be applied to burn existing weeds (Figure 1). Although paraquat is a non-selective herbicide, it only has activity on the foliage it contacts. Poor spray coverage, or failure to get over the top of tall weeds with spray solution will result in less than desirable herbicide performance. One question I get is "should a preemergence herbicide be applied now?". In my opinion the preemergence application should be delayed until October or November. A late summer preemergence herbicide application will not provide control through the following spring. In order to get preemergence weed control through spring a preemergence herbicide should not be applied before mid-October. The time between Halloween and Thanksgiving is an ideal time to apply a fall preemergence herbicide.

Figure1: *Burndown of weeds with paraquat application after harvest.*

Paraquat has a lot of difficulty controlling horseweed, sowthistle, and prickly lettuce in spring so by applying a fall preemergence herbicide these weeds may be less troublesome in the spring. A fall preemergence herbicide application will prevent winter annual weed emergence and delay the need for a winter/spring herbicide application for several weeks. The delayed need for a spring herbicide (PRE and POST herbicides) application should benefit summer weed control by extending residual control from the spring application later into the summer.

(The following is the final installment of this article that was published in April 2012 SFN.)

Blueberry Industry: A History of the Relationships Between Growers, the Extension Service, and the Agricultural Research Service

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November 20, 2011

In 1955, Dr. Morrow from State College and Dr. Goheen from Washington, D.C. urged the Carolina Blueberry Co-op to send a delegation to State lawmakers to establish appropriations and aids to help support the blueberry industry of North Carolina (Hunter, 2006).

By 1959, the value of the blueberry crop in North Carolina was estimated at $2 million from 1,500 acres under cultivation. At the time, blueberries were second only to tobacco in value in Pender County (Honeycutt, 1959). Pender County Extension Chairman J.N. Honeycutt estimated that production was increasing by 10 to 15 percent per year, or an increase from 1,500 acres in 1959 to 2,000 acres and a change in value from $2 million to $2.5 million in his 1962 Plan of Work. At this point in the growth of the industry, blueberries were on the radar of the County Extension Office, but they were just being reported on from an overview perspective. It was not until later that the Plans of Work actually included tasks related to the research and growing practices associated with the blueberry industry.

During this time, the Horticultural Research Station in Castle Hayne, North Carolina was conducting research on vegetables, flowers, blueberries and grapes. In the 1950s, Carlyle Clayton began work on diseases associated with blueberries and other fruit crops in the southeastern part of the state (Griffith, 2008). "One theme that recurs is that researchers like Dr. Clayton played a large extension role even though they did not have an official extension appointment. In those days the county agents were more likely to remain in place for their entire career, and agents were the conduit for information passing from the university to the grower in those pre-internet times (Cline, 2011)."

Robert Milholland, a Plant Pathologist hired in 1963, followed up Clayton's work and conducted an exhaustive survey of diseases and worked with fungicides as a control for stem canker (Griffith, 2008). In an interview with Bill Cline, current Plant Pathologist at the Horticultural Research Station in Castle Hayne, (previously known as the Castle Hayne Research Station) he discussed the people who worked there over the years. "A number of plant pathologists worked on blueberry diseases in NC. Bob Milholland was the most active and best known in the 70s and 80s. Bob characterized most of the blueberry diseases in NC and published some really good work. He and John Meyer (entomology) produced an excellent publication in 1984, Diseases and Arthropod Pests of Blueberry (ARS bulletin 468) (Cline, 2011)."

Dr. J. Mitchell Jenkins, former Station Superintendent of the Castle Hayne Research Station, wrote a brief history of the station and the surrounding area. In it, he recounts that the agricultural industry in the Wilmington area went into decline after 1955. He attributed much of this to low farm prices, increasing wage costs, and the suburbanization of farmland. Land prices rose sharply, farms were turned into subdivisions and farmers became contractors (Jenkins, 1972). Jenkins also believed that only farms that could successfully mechanize would survive into the future. Griffith, in his book From Laboratory to Field, supports much of what Jenkins believed. He writes, "One of the greatest challenges to the Department came from the changing conditions in North Carolina agriculture, a development that was completely outside their control, but impacted them enormously. The sheer number of agricultural clients demanding attention declined because of the steep decline in the number of farmers in the state. Whereas in 1950 there were more than 300,000 farms in North Carolina, by the 1990s there were fewer than 60,000 and the rate of loss maintained at nearly 2,000 per year (Griffith, 2008)."

In 1967, the North Carolina blueberry industry members created the Southeastern Blueberry Council, a non-profit organization designed for the betterment of the blueberry industry in the state. The Council was incorporated on January 11, 1967 with the stated purpose to promote efficient production, packing, handling, storing, processing, and marketing of blueberries. In addition, it listed a research objective to promote research work for the purpose of discovering and developing better, or new varieties, methods of production, packing, handling, storing, processing, marketing, and disease control (Corbett, 1967). The Council later

changed its name to North Carolina Blueberry Council and is still a strong link between growers, researchers, extension specialists and agents, lobbyists, and marketers associated with the blueberry industry. That same year, the state legislature appropriated funds for blueberry research and Dr. Mainland was hired as the horticulturist at the Horticultural Research Station in Castle Hayne (Hunter, 2006).

By 1970, the North Carolina blueberry industry boasted 4,000 acres in production with an annual value of $5 million. Production centered in 5 southeastern counties with 75 percent of production originating in Pender and Bladen counties (Milholland, 1974). Plans of work for the early 1970s show that the Pender County Extension Office was more actively involved in efforts associated with blueberry production than they had been in previous decades. Namely, they were concerned that growers were not using the recommended fertilizer ratios and they were monitoring the development of mechanical harvesters to help with the labor shortage problem (Honeycutt, Pender County (514) Annual Plan of Work 70-71, 1970). By 1977, Honeycutt was still concerned with fertilization but added to the list developing profitable pick your own and roadside markets (Walker, 1976).

"The big change from this period on is the reduction in personnel that we have seen. You look back at it being utopia in the era when I came [to North Carolina] in '68. Funding was just readily available." recounted Dr. Mainland in our interview. "I don't know whether you know that extension funding for many years was based on how many farms there were in the state. North Carolina funding was quite good because North Carolina had the second largest number of farms to Texas so the formula funds allowed for more agents per county than in most states. And there were counties that had 10 and 12 agents so they were really fortunate in the way it was working (Mainland, 2011)." He remembers that researchers started out being responsible for many areas, then they became specialists, and now it is reverting back to increasing responsibility again. He attributes this to budget cuts and not replacing personnel that leave or retire.

Mainland recounts the protocol for farm visits as they used to be before budget cuts. "I wasn't supposed to go and visit anyone without letting the person [extension agent] in the county know. There were often hard feelings. The pathologist here didn't always want to follow protocol. Then the extension agent or chairman would hear about it and then it would go up to the director's office. So that [making site visits together or with permission of the county agent] was what you were expected to do and if you got caught [not following protocol] you would be in trouble. Bill Jester was one of the more knowledgeable [county] extension agents and he could help growers a bit more. Some of the [county] agents were livestock [agents] and were a waste of time for growers to contact about blueberry production. But they [county agents] wanted to know what their growers [any growers within the county] were asking and what their problems were. And they might just say, if they were busy, to go ahead and tell me what you see and what you tell them (Mainland, 2011)."

"Throughout most of the 20th century, N.C. State Plant Pathology was dominated by an overarching commitment to commodity-based research programs and a vital extension service was necessary for success. Extension plant pathologists raised growers' awareness of research at N.C. State by applying that research to their fields and showing visible disease control results that farmers could take to the bank. This, in turn, created the demand for further research to be delivered to the field through extension (Griffith, 2008)."

In summarizing how he sees the past and the future of these relationships, Dr. Mainland had this to say. "Over the next 20 years I expect to see more varieties that we want to use coming out of private programs than coming out of university programs. I expect there's going to be more consulting types. If you go to other countries there's just nowhere in the world that ever developed anything comparable to our Extension Service. There were the research people and then no one paid a whole lot of attention to the little grower. He just had to fend for himself and learn what he could from his parents. The Land Grant System was just really remarkable. The cost of going to school was just so little that it just gave everybody the opportunity to get a degree, to get a degree in agriculture or engineering or what they really wanted (Mainland, 2011)."

Bill Cline's thought on the industry took a different track as he looks at the trends of today and what the extension delivery mechanisms will be in the future. "Interest in blueberries and blueberry production has exploded since the late 1990's due to the discovery of health benefits associated with

blueberry consumption. There has been a corresponding increase in the demand for information and assistance by growers at all levels (homeowner, small pick-your-own, and large commercial farms). During the course of my career, blueberry acreage in NC has tripled and farm gate value has quadrupled.

Budgets have been shrinking throughout my career. At one time there were operating funds, technician salaries were paid and vehicles were replaced via state appropriated funds. Now all operations are funded by grants, including vehicle purchases. Grants must also support technician salaries. This is a big challenge since grant-writing takes a lot of time and effort. As Mike says, the golden age of extension was the mid-sixties and early 1970s when a lot of university positions were created. Now we are going the other way, and positions are often not re-filled – for instance, I was given Mike's extension responsibilities when he retired in 1995.

Web-based information and email have changed the way growers get production information, but there still has to be someone who knows the crop system and can keep the web-based information current. National and regional web-based information portals are becoming more prevalent. Diagnosis of blueberry problems is often done via email, most can be diagnosed faster and more accurately via email – good pictures allow diagnosis of most problems, and I can ask the grower or county agent to take more photos if I need to view the whole field or undisturbed plants in the field. For instance, when blueberry samples show up at the Plant Disease and Insect Clinic in Raleigh, they photograph the symptoms and email the pictures to me for diagnosis. If something comes in that I cannot diagnose, I can forward it to blueberry pathologists around the country and quickly get a consensus.

Counties where agents have a big impact are those where the agent has been in place long enough to build up their expertise and develop a reputation among their local grower clientele. Agent turnover is a big issue – in 27 years I have worked with a succession of six or seven different horticulture agents in Bladen County alone. This turnover undermines the effectiveness of the local extension office -- if the new, inexperienced agent knows less than the grower, the grower will bypass the agent and find information elsewhere, or seek out the state specialist (Cline, 2011)."

The future of the research, extension, grower relationship sounds like it will be moving toward more online media and less face to face meetings and site visits that those of us with decades of experience in dealing with the extension service have come to expect. This does not mean that the state's growers no longer needed the knowledge and expertise that research and extension can provide. There will always be a place in agriculture, the blueberry industry included, for research and extension. The level and scope of their involvement is the only thing at question.

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SRSFC Sponsored County Extension Training on Post Harvest Handling of Small Fruits Held in Kannapolis, NC

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Coordinator
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An agent training on post harvest handling of small fruits was held June 25-27, 2012 at the NC Research Campus, Kannapolis, NC. Drs. Penny Perkins and Gina Fernandez (Horticultural Science Dept., NC State Univ.) organized the training which consisted of classroom instruction on the morning of June 26, followed by hands on lab exercises early afternoon and a tour of small fruit research on the Piedmont Research Station, Salisbury NC in the late afternoon. The following day a field tour of Kildeer Farm, Kings Mountain, NC provided the group with the opportunity to observe a commercial blackberry operation with harvesting underway including grading, inspecting and postharvest cooling. A total of twenty-four extension personnel from the six member states (VA, NC, SC, GA, TN, AR) and one NC Dept. of Agriculture agronomist participated in the training.

Presentations on June 26 included “Post harvest handling of small fruits” by Penny Perkins, “Food safety, GAPS, FSMA: Coping with new regulations for fresh produce” by Diane Ducharme (GAPS Program Coordinator, NC State Univ.) and “Post harvest diseases of small fruits” by Bill Cline (Plant Pathology Dept., NC State Univ.). Later in the morning Penny Perkins took the group outside to view a portable hand wash station and a portable refrigerated system (Figure 1). Following lunch agents participated in lab exercises to learn how to do field screening and postharvest trouble shooting of small fruits (Figure 2). Later in the day the group was transported to the Piedmont Research Station to tour small fruit research plots. Dr Hannah Burrack, Entomology Dept. NC State Univ. presented information on the spotted wing drosophila which has become a major pest in small fruit crops.

Wednesday morning the group was transported by charter bus from the Holiday Inn Express, Kannapolis to Kildeer Farm, Kings Mountain. Kildeer Farm is one of the oldest commercial blackberry operations in NC. Mr. Ervin Lineberger (Figure 3) owner, provided a guided tour of his operation which was in the process of harvesting blackberries. Agents had the opportunity to observe the chain of events involved in blackberry

harvest directly into clam shells in the field and the inspection and sorting (Figure 4) prior to packing and placement in the cooler(Figure 5). Kildeer Farm is Euro Gap certified and all visitors had to sign in a log book prior to touring the farm.

The Wednesday tour ended with a visit to the Dole Distribution Center in Lawnsdale, NC. Dole Foods purchased the Sunnyridge operation which originally initiated blackberry production in Lincolnton and Cleveland Counties. The blackberries are still packed under the Sunnyridge label. (Figure 6).

Powerpoint presentations and handouts will be posted on the SRSFC website at http//www.smallfruits.org/CoAgentTraining/index.htm

Figure 1: *Portable refrigeration system (cool bot). Photo:GEF*

Figure 2: *Lab exercise for post harvest troubleshooting of small fruits. Photo:GEF*

Figure 3: *Ervin Lineberger owner and operator of Kildeer Farm, Kings Mountain, NC. Photo:GEF*

Figure 4: *Inspection and sorting of field harvested blackberries. Photo:GEF*

Figure 5: *Blackberry packs in cooler prior to shipment to Dole distribution center. Photo:GEF*

Figure 6: *Sunny Ridge label on clam shells and shipping boxes. Photo:GEF*

Blackberry and Raspberry Summer 2012 Checklist

This list was developed by Dr. Gina Fernandez, Small Fruit Specialist at NC State University, and reviewed and revised with the assistance of Dr. Marvin Pritts at Cornell. Chores and timing may be somewhat different in your area or for your cropping system. For recommendations for the Pacific Northwest, subscribe to The Small Fruit Update (contact smallfruitupdate@peerbolt.com)

Plant growth and development

- Fruit development
- Rapid primocane growth
- Floricanes senesce after fruiting

Pruning and Trellising

Floricane-fruiting raspberries:

- May need to adjust primocane numbers if canes are too thick (i.e. remove less vigorous primocanes at their base)
- Train primocanes to the trellis centers
- Pinch black raspberry primocanes at 2 to 3 ft. to promote lateral growth.

Primocane-fruiting raspberries:

- Train primocanes within a trellis to hold canes erect

Erect blackberry types:

- In warm climates with a long growing season, tip the new primocanes when they are about 6-12” below the top wire of the trellis to encourage lateral branching. Continue tipping at monthly intervals to maintain desired branching and height of canopy (laterals should reach top wire)
- In colder climates, tip primocanes once when they are about 2–3 ft. tall to encourage lateral branching
- Prune out spent floricanes after they have produced fruit, do not thin out primocanes until mid-to late winter
- Train primocanes to trellis to minimize interference with harvest. Shift trellises or V trellises make this relatively easy

Trailing blackberry types:

- Train new primocanes to middle of trellis, or on the ground in a weed-free area or temporarily to trellis outside of fruiting area (depends on trellis type)
- Cut back side shoots to 18” (after dormancy in cold climates)
- Remove spent floricanes after harvest

Primocane-fruiting blackberries

- Canes should be tipped at 3-4 ft to increase branching and fruiting potential.

Weed management

- Mow along side of row to maintain the width of the bed to 3 to 4 ft.
- Weed growth can be very vigorous at the same time as the bramble crop peaks.
- Weed control is best done earlier in the season before harvest commences.
- Mow middles regularly to allow pickers to move through rows easily.

Insect and disease scouting (these will vary by region)

Scout for insects

- Spotted wing drosophila
- Raspberry crown borer (canes girdled and wilt)
- Psyllid
- Two-spotted spider mite
- June beetle
- Japanese beetles
- Stink bugs
- Fire ants

Scout for diseases

- Botrytis
- Rusts
- Orange felt (orange cane blotch) (blackberry)
- Sooty blotch (blackberry)
- Orange rust
- Powdery mildew
- Double blossom (blackberry)
- Cane blight (blackberry)
- Powdery mildew
- Antracnose

Water management

- Bramble plants need about 1-2 inches of water/week; this amount is especially critical during harvest
- For blackberries (not raspberries) in warmer climates only, consider installing an overhead system for evaporative cooling to reduce sunscald. Turn on once or twice a day from 10 am to 3 pm for short periods of time (approx. 15 minutes)
- Give plants a deep irrigation after harvest

Nutrient management

- Take leaf samples after harvest and send to a clinic for nutrient analysis, apply nutrients if recommended

Harvest and marketing

- The busiest time of the year for a blackberry or raspberry grower is the harvest season. Each plant needs to be harvested every 2-3 days. For larger plantings, that means fruit is picked from some part of the field every day of the week.
- Pick blackberries when shiny black for shipping. Those that are dull black are fully ripe and suitable for PYO only.

- Red raspberries can be picked pink, and will turn red after harvest and will have a longer shelf life (see http://teamrubus.blogspot.com/2011/09/can-raspberries-be-picked-pink.htm
- Pick directly into clamshells with absorbent pads, or for PYO use clean cardboard flats, take-home baskets, or sanitized re-usable containers.
- Keep harvested fruit in shade and move into coolers as soon as possible to lengthen the shelf life of the fruit.
- Use forced-air precoolers for best removal of field heat.
- Store at 32 to 34°F and 95% relative humidity.

Freeze excess fruit for jam, juice, or wine.

Strawberry Seasonal Checklist

E. Barclay Poling
Professor Emeritus & Small Fruit Specialist
North Carolina State University

This checklist was originally developed for growers in North Carolina. You will have to adjust your work activities either earlier or later depending on your location. For more detailed information, check the Southern Region Integrated Strawberry Management Guide and the Southeast Regional Strawberry Plasticulture Production Guide at: http://www.smallfruits.org/SmallFruitsRegGuide/index.htm

July/August
Growers Checklist

- ✓ Destroy plants when harvest (finally) ends.
- ✓ Remove and recycle plastic if not double-cropping.
- ✓ Critique your 2012 season. What changes do you want to make for 2013? Do you need to adjust your plant order to better manage production peaks in 2012?
- ✓ Consider a possible rotation to another site. Rotating strawberry production fields can improve overall yields.
- ✓ Carefully evaluate your choices of variety. Can a different selection of varieties give you more weeks of fruiting, and not so much fruiting in just a 2-3 week period?
- ✓ In preparing your plant order, consider the potential water situation for the season ahead – plugs are far more efficient in water utilization than fresh dugs.
- ✓ Don't wait until the last minute to order plants or tips – tips need to arrive one month prior to planting.
- ✓ Soil test in early July. Lime early in the summer to raise pH to 6.0 to 6.2. Incorporate lime when existing beds are bro- ken down.
- ✓ Use overhead irrigate to soften soil as needed and subsoil completely.
- ✓ Get mist system set up if growing your own tips.

Also order soil, trays, and fertilizer.

- ✓ Stick tips by mid-to-late August, de- pending on location.
- ✓ For planting in mid-Sept (Western NC), apply preplant fertilizer in mid August.
- ✓ Make a fumigation plan, set a schedule, acquire necessary materials. Be sure to allow appropriate plant-back intervals and an additional cushion in case of bad weather.
- ✓ Check out your fumigation rig and do any adjustments and repairs well in advance of fumigation.
- ✓ Renew respirator fit testing (must be current within one year of fumigation.)
- ✓ Attend the Strawberry Preplant Meeting for your area.

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