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Evaluations of Parthenocarpy in *Vaccinium virgatum* Aiton (Rabbiteye) Blueberry Cultivars

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Abstract

Under greenhouse conditions, several rabbiteye (*V. virgatum* Aiton) blueberry cultivars regularly set fruit that develop to maturity without pollination. Since self-fruitfulness (or lack of) is a critical issue for rabbiteye blueberry, we undertook a study of the propensity of 48 rabbiteye cultivars to set fruit under greenhouse conditions. For this we measured both fruit set and fruit size, and compiled ranking values across 2 years. A few cultivars stood out as having distinct expressions of parthenocarpy. Several cultivars, 'Suwanee', 'Early May', 'Florida Rose' and 'Ira' had extremely low or no fruit-set, either year, without pollination. Several cultivars had relatively large fruit at maturity (10-12 mm), but modest fruit-set overall, and 'Chaucer', a modern Florida cultivar, had extremely high fruit-set, but its mature fruit were relatively small, typically ~8 mm. Greenhouse rankings were compared to field evaluations (of 20 cultivars common to both studies) that evaluated fruit size and seed number, as indicators of parthenocarpic tendencies. No significant correlations were observed between any of the greenhouse rankings of parthenocarpy (fruit set or fruit size) with any of the field values (fruit weight or seed/g fruit ratios) for either year. The cultivar 'Premier', however, was a superior performer in both studies, and thus may represent a desirable parent to enhance parthenocarpic tendencies and fruit size.

Highbush blueberry (*Vaccinium corymbosum* L.) cultivars are considered, in general, to be reasonably self-fruitful (Merrill, 1936); however, numerous studies have demonstrated the value of cross-pollination to improve fruit set, fruit size, development time, etc. (Coville, 1921; Ehlenfeldt, 2001; Meader and Darrow, 1947). In contrast, rabbiteye blueberry (*V. virgatum* Aiton; syn. *V. ashei* Reade) cultivars are considered generally self-incompatible (Brightwell et al., 1955; El-Agamy et al., 1981) and critically dependent upon cross-pollination (Meader and Darrow, 1944), although some indications of self-fruitfulness in rabbiteye have been noted (Krewer and NeSmith, 2006), and several recent North Carolina cultivars ('Ira', 'Montgomery', 'Yadkin') are considered to be self-fruitful (Ballington and Rooks, 1997).

Additionally, previous researchers have noted tendencies of some breeding selections to produce seedless fruit suggesting some level of parthenocarpic development, either with or without pollination (Austin and Bondari, 1993; Ehlenfeldt and Hall, 1996)

Parthenocarpy is a valuable trait given the declines of pollinators. Even with only partial expression, parthenocarpy may allow cultivars to develop more fruit with less pollination. The essence of successful crop development in rabbiteye in the absence of cross-pollination, is the degree of self-fruitfulness/self-compatability and what may be referred to as parthenocarpic tendency (the ability to develop fruit either without pollination, or the ability to produce fruit with high

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fruit weight to seed ratios (i.e. few seed being needed to produce acceptable-sized fruit).

Under greenhouse conditions, several rabbiteye blueberry cultivars were noted to regularly set fruit that developed to maturity without pollination (Ehlenfeldt, personal observation). This is unlike highbush blueberry, where the occurrence of parthenocarpy under greenhouse conditions is, in our experience, very rare. Among the rabbiteye cultivars initially noted as exhibiting this behavior were 'Baldwin' and 'Premier'. Since self-fruitfulness (or lack of) is a critical issue for rabbiteye, and is also a potential concern for northern-adapted (mixed species) rabbiteye hybrids that we are developing, we undertook a study of the propensity of 48 rabbiteye cultivars to set fruit under greenhouse conditions. In this survey, meant to broadly evaluate rabbiteye parthenocarpy, we rated cultivars for relative fruit set, and we measured size of developed fruit.

A natural concern critical to this experiment is whether such greenhouse observations correspond to field observations. To address this, we attempted to compare parameters of field-grown fruit (fruit weight, seed number, and seed/pulp ratios) to determine if cultivars with better parthenocarpic performance in the greenhouse also exhibited a lesser need for pollination (as measured by bigger fruit or fewer seed) to achieve adequate fruit development under field conditions.

Materials and Methods

Greenhouse evaluations (Study 1). Forty eight rabbiteye and mixed background rabbiteye-derived hybrids were evaluated (Table 1). All plant materials used in the screenings were named cultivars that are available either through commercial nurseries or from the USDA-ARS National Clonal Germplasm Repository. All plants were five to six years old and were maintained in 2.84-L pots in a 1:1 mixture (v:v) of sand and peat. Plants were maintained in coldframes, pruned to the crown each winter, and allowed to re-grow

Table 1. Ratings for fruit set for 48 rabbiteye blueberry cultivars evaluated under greenhouse conditions in 2009 and 2010. Rating scale, 1 = most, 3 = least.[z]

Rating	Cultivars (Mean number of fruit set per plant, 2009/2010)			
1	Chaucer (256/194)	Menditoo (99/26)	Pearl River (68/17)	Premier (75/36)
	Powderblue (113/28)	Windy (156/46)		
1.5	Alapaha (59/27)	Bluebelle (61/13)	Brightwell (105/11)	Callaway (217/5)
	Centurion (107/10)	Choice (81/6)	Climax (63/21)	Myers (140/5)
	Ochlockonee (67/19)	Rahi (99/2)	Snowflake (69/7)	Southland (64/14)
	Woodard (30/22)			
2	Aliceblue (31/9)	Baldwin (0/25)	Black Giant (36/4)	Bluegem (60/11)
	Clara (116/0)	Coastal (195/2)	Montgomery (16/18)	Maru (19/53)
	Onslow (54/7)	Satilla (30/9)	Tifblue (26/16)	Walker (168/1)
2.5	Bonita (24/7)	Briteblue (7/4)	Ethel (36/0)	Garden Blue (51/1)
	Hagood (40/0)	Homebell (42/1)	Owen (65/0)	Pink Lemonade (18/2)
	Yadkin (16/4)			
3	Austin (30/1)	Beckyblue (19/0)	Columbus (14/2)	Delite (10/0)
	Early May (1/0)	Florida Rose (2/2)	Ira (1/0)	Suwanee (1/1)

[z] Listings are alphabetical within classes.

several times. Plants used in the study generally had one year of regrowth which produced a plant approximately 1m in height. Under New Jersey conditions these plants were fully deciduous. Detailed background and pedigree information on the cultivars used in this study may be obtained by request from the authors. Additional information on some cultivars is available in the Germplasm Resources Information Network (http://www.ars-grin.gov/npgs) online database.

Cultivars were laid out as five replicates in a 9.1 x 27.4m greenhouse with each cultivar represented by one plant per replicate. Each replicate consisted of 3 adjacent 1.2 x 3.7m tables with plants distributed in approximately equal numbers across tables (approx. 16 per table). Plants were randomized within each replicate. Occasionally, due to winter damage (and usually not visible until floral bud development began), individual plants were replaced to maintain balanced replicates. The numbers of buds across plants was variable. Plants were generally selected which had at least 25 buds (typically with about 10 flowers per bud). Some plants however had many more buds. The experiment was initiated 13 Jan. 2009 and flowering commenced on 2 Feb. Flowering terminated for the latest replacements on 10 Apr. Fruit was harvested three times a week as it developed. Ripening continued for an extended period of time, ultimately being terminated on 10 Aug. As fruit was harvested, the diameter of each fruit was measured across its equatorial dimension by ruler, and the fruit was cut open to verify that it was not the result of accidental pollination. The occasional seeded fruit was discarded. Similar protocols were followed in 2010, with the experiment beginning on 2 Feb., flowering commencing on 8 Feb., and terminating on 10 Mar. Fruit development and ripening continued for an extended period of time, ultimately being terminated on 2 Sept. Fruit was collected and evaluated as in the previous year.

Fruit size data were used to calculate a weighted-mean fruit size (mm diameter) for the fruit collected from each plant (replicate). Green fruit that dropped prematurely was disregarded. Unripe fruit that remained when the experiments were terminated in each year were tabulated similarly to ripe fruit. (If these were few, and similar in size to normally tabulated fruit, they were added to the total for calculating a weighted mean, since they were representative of potential fruit-set. If unripe fruit were exceedingly numerous and/or abnormally small (undeveloped), they were noted separately, and not incorporated with the values contributing to the weighted mean fruit diameter.

Field fruit harvest (Study 2). Field-grown fruit was collected from a planting at the USDA-ARS Thad Cochran Southern Horticultural Laboratory in Poplarville, MS in both 2009 and 2010 (Table 2). A sample of ripe, open-pollinated, field-grown fruit that weighed as near to 200 grams as possible was collected from each cultivar when it was approximately 30% ripe (typical range 25-35%). Actual ripeness was estimated to the nearest 5% and a bulk weight of the sample to the nearest gram was recorded. The number of fruit in the sample was recorded. Fruit was frozen and shipped to New Jersey for seed extraction and seed counting.

Seed counting (Study 2). Seed counting was done according to the process previously developed by Ehlenfeldt and Martin (2010). Fruit were then gently mashed in a beaker with 1ml of concentrated food-grade pectinase (Pectinase Smash XXL, Novozymes North America, Franklinton, NC). Beakers were then covered with clear plastic wrap and incubated overnight at room temperature to optimize digestion. The next day, the pulp was given a final manual maceration to guarantee that as much seed as possible was freed from the pulp. Seed was then separated by dilution of the pulp with water, and subsequent gentle decanting of the supernatant pulp. Seed remained at the bottom of the beaker, and was repeatedly washed until seed was clean and minimal debris remained. To optimize recovery of the seed, all of the supernatant pulp and water were collected and decanted two additional times and the residual seed from each subsequent decanting was collected. Ultimately, the seed from the initial decanting and the two additional cycles of decanting was combined. This seed was drained of excess water by filtering through coarse filter paper. After draining, the filter paper and seed were placed on aluminum pans, the seed spread shallowly on the filter paper, and air-dried for approximately 2 days before being transferred to vials for storage. Prior to counting, dry seed was sieved using a #26 mesh screen (0.63 mm). This sieve separated seed into two groups, one containing larger and well-developed seed, the other containing poorly developed and unviable seed. Seed counts were made in triplicate on the larger seed that did not pass through the sieve using a Count-a-pak seed totalizer (Seedburo Equipment Co., Chicago, Ill.).

Results and Discussion

Study 1 – Greenhouse evaluations. Responses of cultivars across years and replicates were extremely variable. Within both years, for any given cultivar, some reps might have no fruit, or almost no fruit, while others had moderate levels.

In 2009, parthenocarpic fruit-set was relatively high. The highest mean value for fruit-set, averaged across replicates was 256.4 fruit per plant for 'Chaucer'. The mean across all cultivars was 63.7. There were 10 cultivars with a mean value for fruit-set greater than 100 fruit per plant (Table 1). Much lower set overall was observed in 2010, with the highest cultivar value having 194.8 fruit per plant (again 'Chaucer'). Across both years, 'Chaucer' averaged 225 fruit/ plant/ year despite 2010 being a relatively low set year. In 2010, no other cultivars set more than 100 fruit per plant, and the next lower value from 'Chaucer' was 'Maru' at 53.4. The mean across all cultivars in 2010, however, was only 14.4 fruit, roughly ¼ of that observed in 2009.

We elected ultimately to simply average across the replicates to derive a value for each cultivar, then categorize cultivars with respect to fruit set as low, medium, or high within any given year, since we were primarily interested in which cultivars exhibited a stronger parthenocarpic response. Once cultivars were ranked based upon these averages, we assigned a numerical value to each third of the cultivars in each given year as 1 = highest set, 2 = intermediate set, 3 = lowest set. We did this similarly with the data from 2010. We then averaged these rankings across both years to produce a composite ranking value reflective of the two years (Table 1). Table 1 lists fruit set numbers for both years parenthetically. In examining this ranking, it is worth recognizing that any cultivar in the Class 1 composite ranking group was in Class 1 both years. Similarly, any cultivar in the Class 3 composite ranking group was in Class 3 both years. Intermediate values, especially those just >1 or just <3, can be inferred as slightly variable, whereas, those in the mid-ranges may be either highly variable (an average of low and high) or steadily mid-range.

Overall, a few cultivars stood out as having distinct manifestations of parthenocarpy when not pollinated. Several cultivars, 'Suwanee', 'Early May', 'Florida Rose' and 'Ira' had extremely low or no fruit-set either year without pollination (i.e. 2 fruit or fewer) (Category 3). Several others were very low in 2010, but somewhat higher in 2009 (remainder of Category 3). Among cultivars ranked as having higher fruit-set in both years, were 'Chaucer' (previously noted), 'Windy', 'Menditoo', 'Powderblue', 'Premier', and 'Pearl River' (Category 1). There were several additional cultivars that had notably high set (>100 fruit) in 2009, that ranked less high in 2010 (Table 1).

For fruit size, individual values ranged from 4 mm to 17 mm. Any fruit that set and subsequently failed to develop to more than 4 mm, always dropped off, failing to complete development. Thus, 4 mm seemed to be a threshold for fruit development. Fruit size was much more consistent from year to year than was fruit set. The better ranking cultivars for fruit size (2-yr. avg. in mm) were 'Florida Rose' (13.6), 'Columbus' (13.3), 'Ochlockonee' (12.2), 'Bonita' (12.1), 'Maru' (11.7), 'Pearl River' (11.6), 'Briteblue' (11.5), 'Tifblue' (11.4), 'Rahi' (11.3), 'Austin' (11.2), 'Premier' (11.1), and 'Powderblue' (10.7) (Table 2). Among these cultivars, several have relatively large fruit at maturity (10-12 mm), but modest overall set. The lowest single 2-yr avg. value was 'Myers' at 4.9 mm. 'Chaucer', the cultivar previously noted as having very high fruit-set without pollination, had relatively small fruit, averaging 7.8 mm.

Fruit size was evaluated using a method similar to that described for fruit set. After calculating weighted averages for fruit-size within each rep, we subsequently averaged these rep values. We then assigned a numerical ranking to each third of the cultivars in each year as 1 = large diameter, 2 = intermediate diameter, 3 = small diameter. We then averaged these rankings across both years to produce a 2-year fruit-size ranking (Table 2). Table 2 lists actual fruit-size averages for both years parenthetically.

To ultimately derive a rating that took both fruit-set and fruit-size components into consideration, we averaged the 2-year fruit-set ratings with the 2-year fruit-size ratings. This averaged-value weighted both factors equally; and although it represents a useful comparison, it may not be reflective of which factor is of greater importance for any given cultivar.

For composite fruit-set/fruit-size value, the highest ranked cultivars were 'Pearl River', 'Premier', and 'Powderblue' (Composite value 1), followed by 'Ochlockonee', 'Rahi', and 'Woodard' (Composite value 1.25) (Table 3).

Field-grown fruit. In Study 2, to compare greenhouse data with field performance, we evaluated parameters of field-grown fruit (fruit weight, seed number, seed/g ratios)

Table 2. Ratings for fruit size for 48 rabbiteye blueberry cultivars evaluated under greenhouse conditions in 2009 and 2010. Rating scale, 1 = largest, 3 = smallest.[z]

Rating	Cultivars (Mean fruit diam. in mm, 2009/2010)			
1	Austin (10/12)	Bonita (12/12)	Briteblue (11/12)	Columbus (13/13)
	Florida Rose (13/14)	Maru (12/12)	Ochlockonee (12/13)	Pearl River (11/12)
	Powderblue (11/10)	Premier (11/11)	Rahi (12/10)	Tifblue (12/10)
	Woodard (10/10)			
1.5	Brightwell (9/11)			
2	Alapaha (9/12)	Aliceblue (9/9)	Beckyblue (11/6)	Centurion (9/9)
	Choice (9/8)	Clara (8/12)	Coastal (9/9)	Hagood (10/-)
	Southland (9/9)	Menditoo (9/8)	Montgomery (9/9)	Onslow (12/7)
	Pink Lemonade (9/10)	Suwanee (9/8)	Walker (9/8)	Yadkin (9/8)
2.5	Baldwin (-/10)	Bluegem (6/9)	Chaucer (9/7)	Homebell (8/8)
	Ira (9/-)	Satilla (9/7)	Snowflake (8/8)	
3	Black Giant (8/4)	Bluebelle (7/5)	Callaway (8/4)	Climax (9/7)
	Delite (8/-)	Early May (7/-)y	Ethel (8/-)	Garden Blue (7/6)
	Myers (5/5)	Owen (7/-)	Windy (8/8)	

[z] Listings are alphabetical within classes.
[y] A "-" among the fruit size values indicates the cultivar set no fruit that year.

Table 3. Ratings for fruit set-fruit size composite value for 48 rabbiteye blueberry cultivars evaluated under greenhouse conditions in 2009 and 2010. Rating scale, 1 = most*largest, 3 = least*smallest.[z]

Composite Ratings	Cultivars			
1	Pearl River	Powderblue	Premier	
1.25	Ochlockonee	Rahi	Woodard	
1.5	Brightwell	Menditoo	Maru	Tifblue
1.75	Alapaha	Bonita	Briteblue	Centurion
	Chaucer	Choice	Southland	
2	Aliceblue	Austin	Clara	Coastal
	Columbus	Florida Rose	Montgomery	Onslow
	Snowflake	Walker	Windy	
2.25	Baldwin	Bluebelle	Bluegem	Callaway
	Climax	Myers	Satilla	Hagood
	Pink Lemonade	Yadkin		
2.5	Beckyblue	Black Giant	Homebell	Suwanee
2.75	Ethel	Garden Blue	Ira	Owen
3	Early May	Delite		

[z] Listings are alphabetical within classes.

across 2 years to determine if cultivars with stronger parthenocarpic responses under greenhouse conditions also exhibited parthenocarpic tendencies under field conditions (i.e. larger fruit size, less seed, lower seed/g ratios) (Table 4). These three parameters do not specifically measure parthenocarpy, but bear some relation to it, and thus may be considered proxies for parthenocarpy. These field evaluations differed from the greenhouse variables which evaluated the propensity to set parthenocarpic fruit in that the field-grown fruit had a pollination trigger and field-grown plants presumably set fruit to the fullest extent possible. Thus values of fruit size and seed number correspond to fruit development once triggered by pollination. Although these values may tell us something about parthenocarpic tendencies, they may not correspond to yield or relative fruit set.

Little commonality was observed between field-grown fruit in 2009 and 2010 (Table 4). In 2009, the cultivars with the largest fruit were ‘Premier’ (2.31g), ‘Maru’ (2.17 g), ‘Beckyblue’ (2.14 g), ‘Prince’ (2.09 g), and ‘Bluebelle’ (2.06 g). In that year, the plants with larger fruit often had better (lower) seed/g of fruit ratios ($r = 0.44$, $P=0.040$). Among the larger fruited plants, ‘Prince’, ‘Maru’, and ‘Beckyblue’ had the 5 highest ranked values (among the 22 cultivars) for both large fruit size and low seed number. In 2009, seed/g of fruit ranged from 10.6 (‘Beckyblue’) to 55.8 (‘Climax’). Thus there was a greater than five-fold difference in seed/g values.

In 2010, the cultivars with the largest fruit were: ‘Austin’ (2.44 g), ‘Brightwell’ (2.24 g), ‘Ira’ (2.17 g), ‘Rahi’ (2.15 g), and ‘Yadkin’ (2.13 g). In 2010, however, fruit size and

Table 4. Fruit weight and seed number of 23 rabbiteye cultivars evaluated under field conditions in Poplarville, Mississippi in 2009 and 2010.

	2009		2010	
Cultivarz	Fruit wt. (g)	Seed/g fruit	Fruit wt. (g)	Seed/g fruit
Premier	**2.31**	25.6	1.83	**17.8**
Maru	**2.17**	**25.5**	2.11	20.6
Beckyblue	**2.14**	**10.6**	1.79	**10.7**
Prince[y]	**2.09**	**11.3**	-	-
Bluebelle	**2.06**	25.9	-	-
Vernon[y]	2.06	28.6	-	-
Yadkin	1.99	40.0	**2.13**	35.3
Rahi	1.97	36.9	**2.15**	27.0
Delite	1.93	**20.8**	2.08	**19.9**
Ira	1.89	36.3	**2.17**	30.7
Briteblue	1.83	43.3	1.51	47.9
Woodard	1.76	37.0	1.68	32.3
Austin	1.67	40.5	**2.44**	25.7
Montgomery	1.66	32.2	1.74	20.2
Brightwell	1.60	37.7	**2.24**	27.2
Tifblue	1.53	**14.3**	1.63	**8.4**
Columbus	1.46	37.3	-	-
Baldwin	1.43	29.3	1.69	20.4
Homebell	1.38	35.3	1.48	22.8
Climax	1.34	55.8	1.86	24.8
Alapaha	1.24	32.9	-	-
Gardenblue	1.19	33.9	-	-
Powderblue	-	-	1.52	**18.2**

[z] Cultivars are ranked by fruit size in 2009. The 5 best values in each column are in boldface. A low seed/g ratio is considered desirable. The best value in each column is enclosed in a box.
[y] Not in Greenhouse study (Study 1).

seed/g of fruit ratio were not significantly correlated (r = 0.109, P=0.678), and among the top 5 ranked cultivars for size, none had top values for low seed numbers as well. Seed/g of fruit ranged from 8.4 ('Tifblue') to 47.9 ('Briteblue').

Among the 21 cultivars common to the two studies, no significant correlations were observed between any of the greenhouse rankings of parthenocarpy (fruit set, fruit size, or composite value) with any of the field values (fruit weight or seed/g ratios) for either year. Despite this lack of relationship, a few cultivars are worth noting among the two studies. Also interesting to note is the commonality of certain parents among these selections.

Cultivars of interest were:

'Premier' – 'Premier' is a common denominator among the two studies. In the field study it held top rank for fruit size in 2009, and was among the best for low seed numbers in 2010. In the greenhouse study it had a composite value = 1. Its pedigree is 'Tifblue' × 'Homebell' (U.S.D.A. and N.C. Ag. Exp Sta., 1975). 'Premier' is a desirable cultivar in terms of fruit quality, fruit size, and flavor, as well as having plant hardiness, vigor, and low suckering. 'Premier' is an early ripening rabbiteye.

'Maru' – Among the best for fruit size in the field study, and also low in seed number in 2009. In the greenhouse study it had a fruit-size value = 1; however, it was not notable for fruit set. Interestingly, 'Maru' is an O.P. seedling of 'Premier' (Lyrene, 2002).

'Beckyblue' – The best in field study for low seed number in 2009, and among best for low seed number in 2010. It was also among the best for fruit size in 2009. In the greenhouse study it had a fruit-size value = 2.

'Austin' – The best for fruit size in the field study in 2010. In the greenhouse study, its fruit-size value = 1; however, it was not notable for fruit-set. The release notice of 'Austin' says it has fewer s/f than 'Climax', and a generally larger berry size (Hall and Draper, 1997).

'Tifblue' – Among lowest for seed number in the field study in 2009, and lowest for seed number in 2010. In the greenhouse study, it had a fruit-size value = 1. In a previous study by one of the authors, it had parthenocarpic fruit (Ehlenfeldt. and Hall, 1996).

'Bluebelle' – Among the better cultivars for fruit size in the field study in 2009. In the greenhouse study its fruit-size value = 1.5. Its release notice describes its fruit as large (Brightwell and Draper, 1975).

'Prince' – Among the best for both fruit size and low seed number in the field study in 2009, but, not in the greenhouse study. The release notice for 'Prince' describes it as only medium-sized (U.S.D.A., 2008).

'Powderblue' – Only 1 year of data from the field study were available, and 'Powderblue' was not notable. However, in the greenhouse study 'Powderblue' had a composite value = 1. 'Powderblue' is an offspring of 'Tifblue' × 'Menditoo'. 'Powderblue' is noted for its light fruit color, mid-late ripening, and for not being too seedy. (U.S.D.A. and N.C. Ag. Exp Sta., 1975).

'Pearl River' was not in the field study; however, in the greenhouse study it had a composite value = 1. 'Pearl River' arose from the cross G-136 × 'Beckyblue' (U.S.D.A., 1994), and thus is another offspring of 'Beckyblue'. 'Pearl River' is a pentaploid, and perhaps owes a measure of its success to its parthenocarpic tendencies, a critical issue for pentaploids.

'Chaucer' – 'Chaucer' was not in the field study; however, in the greenhouse study it was truly remarkable for its fruit set, although unremarkable for size. 'Chaucer' is an O.P. seedling of 'Beckyblue' (Lyrene, et al., 1985).

Conclusions

Evaluation of rabbiteye parthenocarpy under greenhouse conditions produced highly variable results. Thus, greenhouse evaluation without further refinements is not an adequate way to evaluate parthenocarpy. Unknown environmental influences appear to affect fruit-set. In contrast, the field study suggested a different set of cultivars that might be inclined towards parthenocarpy. Many factors affect fruit size and development under field conditions, including pollination levels, source/sink relationships, and environmental stresses. The lack of correlation between the two studies may be due to such factors and their interactions, and also due to the fact that the field evaluations represented an indirect measure of parthenocarpy. The greenhouse study broadly discerned which cultivars consistently ranked better for fruit set across two years. The greenhouse evaluation particularly highlighted the cultivar 'Chaucer' which exhibited a unique performance profile. 'Chaucer's performance suggests that it may have the propensity to set high quantities of fruit. How this might interact with fruit size/ development is unclear. This trait may however be of value when considering crosses for processing or high net antioxidant values (i.e. large amounts of pigmented skin). The behavior of the 'Chaucer' genotype is being further evaluated by crosses of 'Chaucer' with larger-fruited genotypes with parthenocarpic tendencies.

In our studies, field performance of rabbiteye cultivars for fruit weight and seed/g fruit was evaluated, and cultivars were ranked for these traits which were considered to be proxy values for parthenocarpic tendency. Fruit size and seediness are important to understand, simply as potential improvements in organoleptic fruit quality. However, they may also translate into knowledge regarding which cultivars are more likely to set fruit with only limited pollination. These evaluations calculated only an aggregate fruit weight and seed ratio, and did not examine the composition of individual fruit to evaluate frequency of true parthenocarpy on an individual berry basis.

What can be taken away from these studies? Fruit-set in greenhouse and our parthenocarpic proxy values from the field were not correlated. Nonetheless, the cultivar 'Premier' ranked well in both studies. This suggests it may be a desirable cultivar for use in new germplasm development, such that hybrid offspring may be more likely to set fruit and have desirable fruit size. The propensity for fruit set on 'Premier' may also encourage fruit set in difficult-to-achieve breeding hybridizations.

Greenhouse fruit-size and field fruit-size across cultivars also were not correlated. The greenhouse plants had a low fruit load and hence were not source-limited. These fruit were examined to assure they were seed-free, and thus their size depended only upon parthenocarpic impetus. In contrast, the field-grown plants had a natural fruit load largely resulting from pollination, and may have had source/ sink factors at work in their development.

Ultimately, our major success was identifying clones that distinguished themselves in either one study or the other. Hopefully, this will represent a starting point for further evaluations of blueberry parthenocarpy. We continue to adhere to the belief that for practical purposes, parthenocarpy does not have to be a perfect all-or-nothing, system. Incremental improvements in fruit set and development may be of value to growers facing uncertain pollination conditions, and such improvements may partially compensate for issues that may arise from pollinator declines.

Literature Cited

Austin, M.E. and K. Bondari. 1993. Fruit quality characteristics of five rabbiteye blueberry cultivars and clones. Acta Hort. 345:133-140.

Ballington, J.R. and S.D. Rooks. 1997. Three new rabbiteye blueberries from North Carolina (abstract). HortScience 32:595.

Brightwell, W.T. and A.D. Draper. 1975. The 'Bluebelle' and 'Climax' rabbiteye blueberries. Fruit Var. J. 29:44.

Brightwell, W.T., O.J. Woodard, G.M. Darrow, and D.H. Scott. 1955. Observations on breeding blueberries for the Southeast. Proc. Amer. Soc. Hort. Sci. 65: 274-278.

Coville, F.V. 1921. Directions for blueberry culture. U.S. Dept. of Agr. Bul. 974.

Ehlenfeldt, M.K. 2001. Self- and cross-fertility in recently released highbush blueberry cultivars. HortScience 36:133-135.

Ehlenfeldt, M.K. and Hall, M.R. 1996. Metrical analysis of a putative source for semi-seedlessness in rabbiteye blueberry, *Vaccinium ashei* Reade. HortScience 31:272-274.

Ehlenfeldt, M.K. and Martin Jr., R.B. 2010. Seed set, fruit weight and yield in highbush blueberry cultivars (*Vaccinium corymbosum* L.) 'Duke' and 'Bluecrop'. J. Amer. Pomol. Soc. 64:161-170.

El-Agamy, S.Z.A., W.B. Sherman, and P.M. Lyrene. 1981. Fruit set and seed number from self- and cross-pollinated highbush (4x) and rabbiteye (6x) blueberries. J. Amer. Soc. Hort. Sci. 106:443–445.

Hall, M.R. and A.D. Draper. 1997. 'Austin' rabbiteye blueberry. HortScience 32:1295-1296.

Krewer, G. and D.S. NeSmith. 2006. Blueberry cultivars for Georgia. Revised Oct. 2006, <http://www.smallfruits.org/Blueberries/production/06bbcvproc_Nov0206.pdf>.

Lyrene, P.M. (ed.). 2002. Blueberry, In: Register of

New Fruit and Nut Varieties, List 41, W.R. Okie (ed.). HortScience 37:251-272. (Maru).

Lyrene, P.M., W.B. Sherman, and T.E. Crocker. 1985. Chaucer, a high-yielding pick-your-own blueberry for northern Florida. Fla. Ag. Exp. Stat. Circ. S-321, 3p.

Meader, E.M. and G.M. Darrow. 1944. Pollination of the rabbiteye blueberry and related species. Proc. Amer. Soc. Hort. Sci. 45:267-274.

Meader, E.M. and G.M. Darrow. 1947. Highbush blueberry pollination experiments. Proc. Amer. Soc. Hort. Sci. 49:196-204.

Merrill, T.A. 1936. Pollination of the highbush blueberry. Mich. Agr. Exp. Sta. Tech. Bul. 181. 34 p.

U.S.D.A. 1994. Notice to nurserymen of the naming and release for propagation of Pearl River, Magnolia, and Jubilee, three new southern highbush blueberry cultivars, Beltsville, MD.

U.S.D.A. 2008. Notice to nurserymen of the naming and release for propagation of Prince, a new rabbiteye blueberry cultivar, Beltsville, MD.

U.S.D.A. and N.C. Ag. Exp Sta. 1975. Notice to blueberry growers and nurserymen relative to the naming and release of Premier, Powderblue, and Centurion, three new rabbiteye blueberries, Beltsville, MD.

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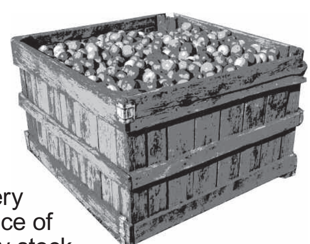

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