Journal of the American Pomological Society 76(3): 114-124 2022

Five-year Evaluation of Selected Strawberry (*Fragaria* × *ananassa* Duch.) Cultivars for Improved Sustainability of the Strawberry Industries in Alabama and the South Atlantic Region of the United States

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Additional index words: strawberry, cultivar, adapted, sustainability, Southeast

Abstract

Consumer awareness of the health promoting qualities of strawberries has sparked a nation-wide expansion in demand. The Alabama strawberry industry is a part of the South Atlantic Region (SAR), which is the third most productive region in the United States. While strawberry cultivar selection is crucial to the growth of this industry, the most productive cultivars used in SAR are from California breeding programs. Furthermore, there is little documented information concerning the performance and the antioxidant qualities of these strawberry cultivars in Alabama. The objective of this study was to determine the production potential and antioxidant concentration of selected strawberry cultivars produced in Alabama to enhance the sustainability of the strawberry industry in the state and the SAR. A strawberry cultivar evaluation was conducted in Central Alabama over a five-year period. Included in this trial were 'Albion', 'Camino Real', and 'Ruby June', the current market standard 'Camarosa' and the former market standard 'Chandler'. Plant size was smallest for 'Camino Real', offering an opportunity for producers to increase the number of plants per hectare. In contrast, 'Ruby June' produced fewer stolons per plant, thus reducing labor costs. Of the most recently developed cultivars 'Camino Real', 'Ruby June', and 'Albion', 'Camino Real' and 'Ruby June' were the most comparable to 'Camarosa' in both early and total yield. Both cultivars produced a significantly lower number of cull fruits per hectare. 'Albion' produced the largest individual fruit weight during the first season, but all cultivars were similar to the market standard 'Camarosa' in fruit weight in subsequent seasons. Soluble solids concentration (SSC) varied with season and cultivar. 'Ruby June' SSC was significantly higher than all other cultivars in 2018, and similar to 'Camarosa' in 2017. In contrast, 'Albion' and 'Camino Real' had the lowest SSC in 2018 and were similar to 'Camarosa' in 2019. Titratable acidity (Tacid) and SSC:Tacid ratio of 'Camino Real' tended to be numerically lower than other cultivars though differences were not statistically significant at the 5% level. Total monomeric anthocyanin and phenolic concentrations were consistently among the lowest for 'Ruby June' although SSC, pH, and titratable acidity indicate fruit were fully ripe. Plant and fruit qualities and yield potential indicate that 'Camino Real' can serve as a desirable cultivar to replace 'Camarosa' in the SAR.

Strawberries (*Fragaria* × *ananassa* Duch.) are an economically important crop and a valuable component of the human diet (Guerrero-Chavez et al., 2015; Mezzetti et al., 2016). The U.S. value of strawberries was $2.4 to 3.1 billion from 2019-2021. The South Atlantic Region (SAR) is third in fresh market strawberry production among the eight regions in United States (Samtani et al, 2019). The SAR includes Alabama, Georgia, South Carolina, North Carolina, and Virginia and is comprised of 835 hectares and nearly 1,000 strawberry operations (USDA Statistics, 2022). Strawberries in this region are primarily produced using the annual hill plasticulture system. Indications of growth of the strawberry industry include consumption as a whole, and number of households consuming strawberries (Great American Media Services, 2022).

Productivity of the strawberry industry in the SAR depends on cultivars that have adaptability across the wide range of climates in this region (Samtani et al., 2019).

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Cultivar selection is one of the most important decisions farm operators make and it is the most practical means to solve production issues. Region-specific cultivar-environment interactions affected by climate change, combined with the continual loss of chemical controls of economically important insects and disease pests lessen the reliability of a single cultivar and provide the impetus for continued strawberry cultivar development (Hokanson and Finn, 2000; Vinson et al., 2021).

In the SAR 'Camarosa' and 'Chandler' are the dominant cultivars planted in grower fields; 'Camarosa' is the most frequently planted cultivar and is considered one of the most adapted cultivars globally (Handcock, 1999). In Alabama, while most commercial producers plant 'Camarosa', a small number of fields in the northern part of the state continue to use 'Chandler', which was formerly the commercially dominant cultivar. Most of the strawberry cultivars grown in the southeastern U.S. originate from California or Florida breeding programs. Although some of these cultivars respond favorably to a wide range of environments, many cultivars are more sensitive to environment and their cultivation is limited to a narrower environmental range. Gabriel et al. (2018) assessed the phenotypic stability of 18 cultivars and found that 'Camarosa' consistently produced relatively high marketable yields per plant despite occasional unfavorable growing conditions. Included in the same study were 'Albion' and 'Camino Real', which had high genetic stability for commercial production generally, but potential for high yields decreased as conditions became less favorable.

Using cultivars that are best adapted to the growing environment is an important criterion for sustainable production. Essential to crop sustainability are breeding programs, which release cultivars bred to be suited to the soil conditions and climate characteristic of particular regions. A breeding program for small fruit was initiated in Alabama but adapted strawberry cultivars from this program will not be available soon. California-bred cultivars as well as cultivars bred within the same region will continue to be the source of new plant material.

Strawberry fruit contain high amounts of ascorbic acid, ellagic acid and antioxidants (Maas et al., 1991; Giampieri et al., 2012; Basu et al., 2014). Consumer demand for fresh strawberries depends on quality, color, nutrition, firmness, safety, and shelf life. Among the critically important determinants that influence these attributes is cultivar choice (Akhatou and Recamles, 2013; Cordenunsi, et al., 2002). Antioxidant capacity, anthocyanin content and total phenolic content vary with cultivars, environmental conditions, and harvest date (Tulipani et al., 2011; Wang and Lin, 2000; Winardiantika et al., 2015).

There is a need for more genetic diversity in strawberry production in Alabama and producers need a broader selection of cultivars that adapt well to local climatic conditions. There is little information concerning the performance of the most used strawberry cultivars in the SAR in general, and even less for cultivars in Alabama. The objective of this study was to determine the production potential and phytochemical quality of selected strawberry cultivars produced in Central Alabama in order to enhance the sustainability of the strawberry industry in the state and the SAR.

Materials and Methods

A five-year strawberry cultivar evaluation was established on a Luverne fine sandy loam soil at the Chilton Research and Extension Center (CREC) in Clanton, AL (lat. 32° 55'08" N long. 86°40'23" W). The strawberry plantings for the 2017, 2018, 2020, and 2021 seasons followed a wheat (*Triticum aestivum*) cover crop. In 2019, the planting followed a wheat-watermelon (*Citrullus lanatus*) rotation. Each season, fertilizer was applied prior to bed formation and after planting according to recommendations of the Alabama Cooperative Extension Service

(Himelrick et al., 2002). Fertility applied after planting was injected through the irrigation system with a Hozon siphon fertilizer injector (Phytotronics Inc., Earth City, MO). Beds (rows) were formed using a combination bed former and plastic mulch/drip irrigation layer (Kennco Mfg. Inc., Ruskin, FL). Beds were spaced 1.8 m apart.

As beds were formed, T-Tape irrigation drip tape (Rain-Flo, East Earl, PA) with wall thickness of 6-mil was installed at a depth of 8 cm. The drip tape had an emitter spacing of 30 cm and a flow rate of 0.0032 $L \cdot hr^{-1} \cdot m^{-1}$, which resulted in a supply of 25 $mm \cdot ha^{-1}$ of water per week. Irrigation was installed prior to the application of pre-emergent herbicide so as not to disturb the top layer of the planting bed, which would have compromised the efficacy of the herbicide. A pre-emergent herbicide was applied on top of the planting bed after drip tape installation at required rates according to their respective labels using a pressurized CO_2 backpack sprayer. Rows were covered with black 4-mil very impermeable (VIF) polyethylene mulch (Berry Global, Evansville, IN) immediately after herbicide application. Experimental plots were 6 m long and were separated by 1.5 m alleys when they occurred in the same row.

Strawberry plug plants (Triple J Nursery, Helena, AL) were set in double staggered rows established on each planting bed using a mechanical planter with a double hole-punching wheel. Plants within a row were spaced 30 cm apart and rows were spaced 35.5 cm apart, resulting in a plant population of 34 plants per experimental plot and 30,480 plants per ha. Strawberry plug plants were set on 4 Oct., 17 Oct., 20 Oct., 24 Oct., and 22 Oct. in the year prior to the 2017, 2018, 2019, 2020, and 2021 seasons, respectively.

To prevent soil from eroding from the planting beds during rain events, 'Gulf' annual ryegrass (*Lolium multiflorum*) was seeded at a rate of 34 $kg \cdot ha^{-1}$ between rows. After establishment, ryegrass was managed by mowing at two-week intervals. Pests were managed according to the recommendations of the Southeast Regional Strawberry Integrated Pest Management Guide for Plasticulture Production (www.smallfruit.org). Spun bond floating row covers at a thickness of 26 $g \cdot m^{-2}$ (Agriculture Solutions, Kingfield, ME) were used to protect plants and developing fruit from frost during all seasons except 2020.

Within-row and between-row plant widths and heights were recorded for the five most central plants within each experimental plot on 21 Feb. 2020 and 26 May 2021. Stolons were counted within each experimental plot on 20 May 2020 and 4 Mar. 2021 and divided by the number of plants per plot.

Harvest data collected were early marketable yield, total marketable yield, cull weight, and individual fruit weight. Fruits were considered unmarketable if they were damaged by weather related events, insects, or disease, or if they were less than 12 g. A fruit with a mass of 12 g was weighed and used as a visual guide for fruit size. During the 5-year period, harvests began on 24 March at the earliest and 7 Apr at the latest. Harvests ended on 18 May at the earliest and 29 May at the latest. Number of harvests per season ranged from 12 to 18.

From each plot, a sample of 25 marketable fruits was collected, weighed, and divided by 25 to calculate individual fruit weight. A sub sample of five marketable fruits from these samples was placed in individual freezer bags in 2020 and 2021, frozen, and held at -80 °C until shipping to PHHI, Kannapolis, NC. Frozen strawberry samples were thawed, and puree obtained by adding two stainless steel balls (9 mm) to fruit in 50 ml disposable tubes and grinding with a genogrinder (SPEX 2010) for 2 min at 1200 strokes per minute, followed by a 30 sec rest and an additional 2 min grind. Soluble solids concentration (SSC) was determined by placing about 0.5 ml of the puree onto a refractometer (Pal-1, Atago, Bellevue, WA). Titratable (Tacid) acidity was determined by adding 0.5 g puree to 24.5 g distilled water, mixing, and placing an aliquot on a F5 acid refractometer (Atago, Bellevue, WA), set for strawberry mode. Puree pH was determined using a pH electrode. The sugar: acid ratio (SSC/Tacid), used to gauge flavor and maturity, was calculated by dividing SCC by Tacid. Plot replicates were used for each cultivar.

Total anthocyanin and phenolics concentrations were determined by weighing an aliquot of 0.03 to 0.04 g puree into 2-ml microtubes and adding 1.5 ml of solvent (methanol, distilled deionized water, and formic acid [60:37:3 v:v:v]). Samples were vortexed for 30 sec and held at room temperature for 1 h. Samples were then centrifuged for 8 min at 13,500 x *g* at 4 °C. Supernatants were used to determine total monomeric anthocyanin and total phenolic concentration. Total monomeric anthocyanin was determined at 500 and 700 nm using the pH differential method (Lee et al., 2002) and a microplate reader (Biotek Powerwave35, Winooski, VT, USA). Methods for anthocyanin and phenolic concentration were adapted to the microplate system following the method of Heredia et al. (2006). Monomeric anthocyanin was expressed as mg pelargonidin-3-glucoside equivalents per kg fruit weight, using the molar absorption coefficient ε=15600 $M^{-1} \cdot cm^{-1}$ and molecular mass of 433.4 $g \cdot Mol^{-1}$ (Tonature et al., 2014). Total phenolic concentration was determined according to the Folin-Ciocalteu method (Singleton et al. 1999). A standard curve of gallic acid (25 to 150 mg/kg) was used to calculate total phenolics as mg gallic acid/100 g fresh weight.

Data collected from experimental units in the randomized complete block design were analyzed with linear mixed models using the GLIMMIX procedure of SAS (version 9.4; SAS Institute, Cary, NC). Least squares means comparisons were made using the Shaffer-Simulated method at α = 0.05. Random variables included in the statistical models were block and experimental unit (in cases where subsample data were collected from the experimental units).

Early and total marketable yields as well as cull fruit weight were summed for all harvests in each year. Unavailability of 'Ruby June' in 2019 precluded analysis using a complete factorial treatment design. However, preliminary analysis without data from 2019, which was absent 'Ruby June' indicated a significant interaction between cultivar and year; therefore, analysis of yield response variables was performed by year and included data from all cultivars grown in that year. Due to a significant cultivar×year interaction for number of stolons per plant, simple effects were examined by comparing cultivar means within each year using data collected in 2020 and 2021. For plant size, elliptical area was calculated using the two width measurements. As the interaction between cultivar and year was not significant, the main effects means for cultivar (averaged across years) and year (averaged across cultivars) are presented. Soluble solids, pH, total monomeric anthocyanin, and total phenolic acid concentration were collected in 2021 and analyzed with cultivar as the explanatory variable.

Results and Discussion

Plant characteristics. 'Camarosa', 'Ruby June', and 'Chandler' frequently produced the largest plants in this study. Plant size data (area) of strawberry plants (Fig. 1) collected during the 2020 and 2021 seasons showed no significant difference in size with year. Plant sizes of 'Ruby June' and 'Chandler' were similar to the market standard cultivar 'Camarosa'. Size of 'Albion' and 'Camino Real' plants were similar and were both smaller than 'Camarosa', 'Chandler', and 'Ruby June'.

In 2020, 'Chandler' and 'Camino Real' had more stolons than all other cultivars, while 'Albion' produced a similar number of stolons as 'Camarosa' (Fig. 2). 'Ruby June' produced fewer stolons than all other cultivars. In the 2021 season, all cultivars produced less than one stolon per plant, and cultivars were not different. Management of the pick-your-own style strawberry market

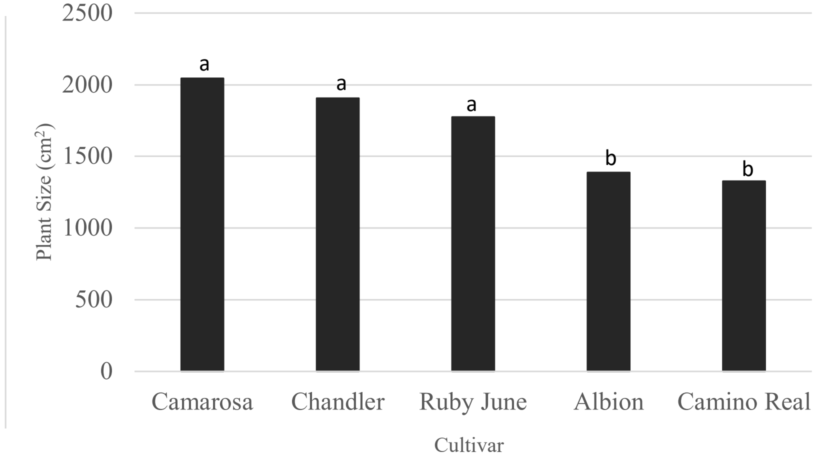

Figure 1. Plant size of selected strawberry cultivars measured in 2020 and 2021 at CREC in Clanton, AL. Since the year x cultivar interaction was not significant, cultivar main effect means are presented. Columns with letters in common are not significantly different at the 5% level.

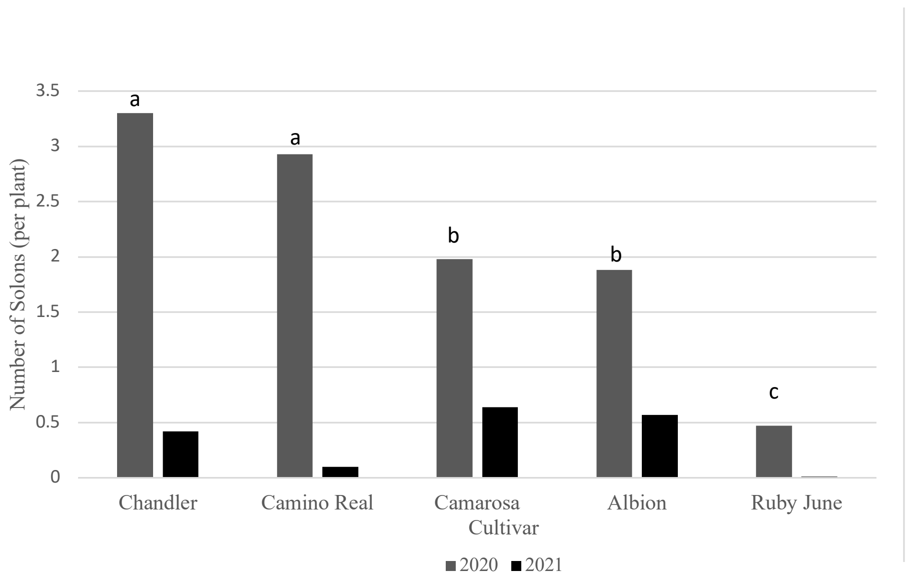

Figure 2. Number of stolons per plant for five strawberry cultivars grown in CREC, Clanton, AL 2020 and 2021. Columns within years with common letters within years are not significant at the 5% level.

depends largely on customers being able to find ripe fruit, so that fruits are not left on the plants to serve as inoculum for plant diseases. The large plant size of 'Camarosa' has prompted strawberry growers to plant strawberries at wider spacing to improve the visibility of the fruit. Some studies found a correlation between plant size and yield (Bartczak et al., 2010; Menzel and Smith, 2012; Takeda et al., 2004), but Cocco et al (2010) found that larger plants do not necessarily translate into higher yields. This was seen in the present study where 'Camino Real' produced significantly smaller plants than 'Camarosa', 'Ruby June' and 'Chandler', yet total marketable yields were similar or higher. Strawberry cultivars with smaller plants and yields similar to the cultivars with larger plants may be more desirable. Although we did not count the number of branch crowns, this parameter is thought to be a better indicator of plant yield than plant size (Hytönen et al, 2008).

Although strawberry cultivars that produce more stolons are useful in matted row production systems, where stolons produce daughter plants, production of many stolons and daughter plants is a hindrance in annual hill plasticulture management. In 2020, stolon counts were delayed due to COVID-19. 'Camino Real', 'Albion', and 'Chandler' produced the most and 'Ruby June' the fewest stolons. In 2021, as counts were made earlier in the season, the number of stolons was much lower, with no differences noted among cultivars.

Early yield for all cultivars was at least twice as high in 2017 and 2018 than in 2020 and for most cultivars early yield was intermediate in 2019 and 2021 (Table 1). 'Camarosa' was the only cultivar that was in the top statistical group for early yield all five years and 'Chandler' was in the lowest group for three years.

The dramatic reduction in early yields in 2020 corresponds to a relatively high rainfall in Feb. and March and large swings in high and low temperatures during the same period (21 °C and 11 °C, respectively). Rainfall events can disrupt the transfer of pollen through pollen degradation, delayed pollinator foraging, diluted nectar, and diseased flowers (Lawson and Rands, 2019; Bajiya and Abrol, 2017). Hodgkiss et al (2018) state that 45% of the strawberry crop is a result of insect pollinators and fruit set and fruit quality are higher in strawberries that have received pollination services from a variety of pollination sources (Abrol et al., 2019).

Total marketable yield varied greatly with year and for some cultivars yield was more than twice as high in 2017 than in 2019 (Table 1). Total marketable yield of 'Camino Real' and 'Camarosa' were always in the highest statistical group. These findings are similar to those of Flanagan et al., (2020) who reported marketable yield of 'Camino Real' was similar to or higher than 'Camarosa' at three different locations in Virginia.

Average fruit weight of 'Albion' (26 g) was among the largest produced each season and was higher than all other cultivars in 2017. In 2017, average fruit weights of 'Ruby June' and 'Camino Real' were similar, but greater than both 'Camarosa' and 'Chandler'. 'Chandler' consistently had the smallest fruit.

'Chandler' and 'Camarosa' consistently had the most cull fruit each season and were always statically greater than 'Albion'. When calculated as the average percentage of cull fruit relative to total marketable fruit, 'Camarosa' was 18.5%, while the percentage of 'Chandler' cull fruit was 36.6%. 'Ruby June' and 'Albion' produced the lowest percentage of cull fruit at 11% and 10.5%, respectively. 'Camino Real' had 12% cull fruit and produced among the highest yields. Removal of cull fruit in pre-pick or U-Pick operations is time consuming and can increase the cost of production. Furthermore, high cull fruit production rate increases the chances of cull fruit being left in the field exacerbating disease management. Additionally, 'Chandler' most consistently produced the smallest fruit, similar to the findings of Gu et

Table 1. Early marketable yield, total marketable yield, average fruit weight, and cull fruit weight of five strawberry cultivars.

	2017	2018	2019	2020	2021
			Early Marketable Yield (g/plant)[z]		
Camarosa	108.1 a[y]	95.1 ab	74.50 a	33.6 ab	75.0 a
Camino Real	106.0 a	77.4 ab	62.14 a	18.6 c	67.0 a
Albion	96.1 a	104.5 a	6.77 b	14.1 c	52.0 a
Ruby June	75.0 b	103.3 a	-	35.6 a	46.0 a
Chandler	57.0 b	65.1 b	50.5 a	20.7 bc	56.0 a
			Total Marketable Yield (g/plant)		
Camino Real	608.4 a	360.0ab	209.0 ab	126.3 ab	165.0 a
Camarosa	596.2 a	438.1 a	249.0 a	182.0 a	181.0 a
Ruby June	528.0ab	379.0 ab	-	120.6 ab	104.5 b
Albion	432.0 b	288.2 b	83.3 c	103.0 b	98.0 b
Chandler	268.3 c	240.5 b	158.0 b	144.4 ab	150.5 ab
			Average Fruit Weight (g)		
Albion	25.66 a	19.46 a	20.00 ab	20.20 a	21.07 ab
Ruby June	23.50 b	19.88 a	-	20.20 a	21.16 a
Camino Real	23.11 b	18.76 a	22.88 a	19.25 a	19.60 b
Camarosa	19.94 c	19.60 a	20.52 ab	18.60 a	21.00 ab
Chandler	15.82 d	15.08 b	18.64 b	16.73 b	18.00 c
			Cull Fruit Weight (g/plant)		
Chandler	293.2 a	134.0 a	56.0 a	40.0 a	35.3 a
Camarosa	203.4 b	71.4 b	54.0 a	26.0 b	22.3 b
Camino Real	102.1 c	36. cb	34.2 b	15.4 c	17.0 cb
Ruby June	82.3 c	37.0 cb	-	14.4 cd	7.0 c
Albion	55.0 d	25.1 c	17.4 b	8.1 d	13.0 cb

[z] Early marketable yield was calculated using the first four harvests.
[y] Numbers within columns with letters in common are not significantly different at $\alpha = 0.05$

al. (2017). The high cull rate and smaller fruit size of 'Chandler' indicates that more labor may be needed with this cultivar than with other cultivars used in this experiment.

Soluble solids concentration, used as an indicator of sweetness, was not different among cultivars in 2017 (Table 2). In 2018, SSC of 'Ruby June' was similar to 'Camarosa' and was higher than the other cultivars. 'Albion' and 'Camino Real' fruit were lowest in SSC. In 2019, SSC of 'Camino Real' were similar to 'Camarosa' but lower than 'Chandler'.

The pH values of strawberry purees from 'Camarosa', 'Camino Real', 'Ruby June' and 'Albion' were similar for each year of harvest

Table 2. Organoleptic qualities of five strawberry cultivars produced in central Alabama over three years.[z]

Cultivar	2017	2018	2019
	Soluble Solids Concentration (%)		
(%)			
Albion	6.5	6.7 c[y]	8.7 b
Camarosa	6.8	8.2 ab	11.0 ab
Camino Real	6.4	6.6 c	8.4 b
Chandler	7.3	7.5 b	12.6 a
Ruby June	7.6	8.7 a	na[x]
	pH		
Albion	3.69 ab	3.62 ab	3.70
Camarosa	3.70 ab	3.61 ab	3.68
Camino Real	3.77 a	3.70 a	3.67
Chandler	3.63 b	3.56 b	3.56
Ruby June	3.71 ab	3.64 ab	na
	Titratable acidity (Tacid) (% citric acid equivalents)		
Albion	0.49	0.57	0.52b
Camarosa	0.62	0.62	0.79a
Camino Real	0.54	0.66	0.61b
Chandler	0.60	0.61	0.84 a
Ruby June	0.56	0.66	na
	SSC/Tacid		
Albion	13.2	11.8	16.7
Camarosa	11.0	13.2	13.9
Camino Real	11.7	10.0	13.5
Chandler	12.2	12.3	15.0
Ruby June	13.7	13.2	na
	Total Monomeric Anthocyanin Concentration (mg Pelargonidin 3-glucoside equivalents•kg^{-1})		
Chandler	621a	421ab	715
Camino Real	598 a	569 a	572
Camarosa	493 ab	513 ab	536
Albion	436 ab	331 b	553
Ruby June	377 b	290 b	na
	Total Phenolic Concentration (mg gallic acid equivalents•kg^{-1})		
Chandler	2,223	2,122 ab	2,625
Camino Real	1,926	1,938 ab	2,710
Camarosa	1,896	2,200 a	2,361
Albion	1,884	2,166 ab	2,550
Ruby June	1,854	1,870 b	na

[z] Values represent means of 5 fruit/rep/ number of harvests and separated using Tukey's HSD.
[y] Numbers within columns with letters in common are not significantly different at $\alpha = 0.05$.
[x] An na indicated cultivar was not available.

(Table 2). The puree pH of 'Camino Real' in 2017 and 2018 was higher than that of 'Chandler'.

Titratable acidity was not significantly different among cultivars in 2017 and 2018. Titratable acidity ranged from 0.49 to 0.62 an in 2019 and 0.57 to 0.66 in both years, respectively. In 2019, 'Chandler' and 'Camarosa' had higher titratable acidity than 'Albion' and 'Camino Real'. For all years, cultivars did not differ in SSC: Tacid. Ratios ranged from 11-13 for 2017 and 2018 and from 13-17 for 2019. Some samples from 2019 experienced irregularities during freezer storage and exhibited off colors and a desiccated appearance. These storage conditions may be responsible for the noticeably higher SSC overall from fruit harvested in 2019. While the generally lower fruit pH may help enhance sweetness, it is also possible that volatiles that contribute to a perception of sweetness (Du et al., 2011) are higher in these cultivars. 'Camarosa' values for SSC, Tacid, and pH were similar to those reported for 'Camarosa' grown in North Carolina (Perkins-Veazie et al., 2016).

In 2017 and 2018 the total anthocyanin concentration was lower for 'Ruby June' than for 'Camino Real' and the other cultivars were intermediate, but cultivars did not differ in 2019. The dominant anthocyanins in strawberry include pelargonidin 3-O-glucoside, pelargonidin 3-O-rutinoside and cyanidin 3-O-glucoside and provide the bright red and darker red shades of strawberries, respectively (Dzhanfezova et al., 2020; Lopez da Silva et al., 2007). Consumers associate a bright red color with fresher strawberries (Dzhanfezova et al., 2020; Thill et al., 2013). 'Camarosa' and 'Chandler' values for total anthocyanin in strawberries grown in North Carolina were slightly lower (41 to 48 mg per 100 g) to those found in this study (Perkins-Veazie et al., 2016).

Total phenolic concentration among the strawberry cultivars differed only in 2018, when 'Camarosa' had significantly higher TPC than 'Ruby June'. The total phenolic content of 'Camarosa' and 'Chandler' has been reported to be 155-157 mg/100 g (Perkins-Veazie et al., 2016).

Plugs of 'Ruby June' strawberry plants were not available in 2019, but total marketable yields were similar to 'Camarosa' for three of the five seasons of the study. 'Ruby June' was consistently earlier than other cultivars in seasons when grown and could provide a means of starting the strawberry season for Alabama growers. While 'Albion' and 'Ruby June' were highest across seasons in individual berry weight, 'Ruby June' was more consistent in producing higher overall yields.

A shortage of 'Camarosa' plants for the 2021 season forced local growers to explore the potential of 'Camino Real'. Most growers found the production and quality of 'Camino Real' similar to or surpassing that of 'Camarosa' and elected to grow 'Camino Real' in place of 'Camarosa' for the following season. In addition, growers and their clientele found the taste of 'Camino Real' to be comparable to 'Camarosa'. 'Camino Real' often lacks sweetness, although there have been conflicting opinions as more growers include this cultivar in their production systems (personal communications). Conversely, researchers and growers remark on the desirable flavor of 'Albion' and 'Ruby June' even when soluble solids are low.

Conclusions

In this five-year cultivar evaluation, both 'Camino Real' and 'Ruby June' offer potential alternatives to 'Camarosa' for SAR. 'Camino Real' was more comparable to 'Camarosa' in terms of total marketable yield. The amount of cull fruit tended to be lower in both 'Camino Real' and 'Ruby June' compared to 'Camarosa'. 'Ruby June' offers the advantage of fewer stolons, saving maintenance labor. The more compact, but productive plants of 'Camino Real', could be manipulated to increase plant density and fruit yield per acre. A suggested approach to increase yields would be to plant both cultivars in a production field, thus utilizing the earliness and flavor of ‘Ruby June’ while keeping the majority of the field in ‘Camino Real’.

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