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‘Sweetie Pie’ Thornless Semi-Erect Blackberry

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‘Sweetie Pie’ is a new thornless blackberry (*Rubus* L. subgenus *Rubus* Watson) cultivar developed and released by the USDA-ARS Thad Cochran Southern Horticultural Laboratory (TCHSL). ‘Sweetie Pie’ is a vigorous, semi-erect blackberry that produces moderate yields of sweet high quality fruit having excellent flavor, a mid- to late-ripening season, and resistance to rosette (double blossom) disease. ‘Sweetie Pie’ offers local fresh market growers, U-Pick farm operations, and homeowners a new cultivar adapted to the Gulf Coast region of the United States. ‘Sweetie Pie’ is the first thornless blackberry released from the TCSHL breeding program.

Origin

‘Sweetie Pie’ (see front cover for photo) originated from an F_1 seedling population of a cross between ‘Navaho’ and MSUS29 that was grown at the Thad Cochran Southern Horticultural Laboratory (TCSHL), Poplarville MS (lat 30^0 50’24.88” N, long 89^0 32’3.24” W, elevation 97 m), USDA plant hardiness zone 8b, soil type Ruston silt loam. The selection MSUS29 resulted from a cross of [‘Humble’ x ‘Brazos’] x ‘Navaho’ (Gupton, 1999). ‘Navaho’ was the first among several erect thornless blackberry cultivars released by the University of Arkansas (Moore and Clark, 1989) and is tolerant to rosette disease. Blackberry rosette is caused by the fungus, *Cercosporella rubi* (G. Wint.) and is a serious problem for blackberry growers in the southeastern United States because it severely reduces fruit production. This disease is characterized by two symptoms: rosettes or witches’ brooms and elongated floral buds with reddish sepals and pink, wrinkled petals which gives the disease its other common name “double blossom”. In general thornless cultivars are more susceptible to rosette than thorny cultivars (Gupton and Smith, 1997; Smith and Miller-Butler, 2016).

‘Humble’ was selected from the wild in Texas and was popular in the mid 1900’s for use in the canning industry due to its low acid content and sweetness (Clark, 1992). ‘Brazos’, released by Texas A&M University in 1959, was a productive cultivar for the southeastern U.S., but is susceptible to rosette disease. The cross between ‘Navajo’ and MSUS 29 was made Spring of 1989 by Creighton Gupton (USDA/ARS Research Geneticist). Seed were collected, bulked, and germinated that winter; and seedlings were established in 1991 at the TCSHL. ‘Sweetie Pie’ was selected as MSUS 119 in 1993 and was propagated from leafy stem cuttings. MSUS 119 was observed in an eight plant observation plot from 1996 to 2001 and was determined to be a promising semi-erect thornless blackberry selection for the Gulf Coast region of the U.S.

Performance and Description

Study 1. Replicated trials were conducted at the Mississippi State University Coastal Research and Extension Center, McNeill Unit, McNeill MS (lat $30^0$39’28.13”N, long $89^0$38’07.50”W, elevation 66m), USDA plant hardiness zone 8b, soil type Ruston silt loam. Studies were conducted from 2005 to 2006 to evaluate disease resistance and fruit quality traits. An additional study

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(Study 2) was conducted at this location in 2011-2013 for evaluating plant and fruit quality attributes and productivity. Study 1 was established in 2002 and consisted of five thorny cultivars including 'Chickasaw' (Clark and Moore, 1999b), 'Kiowa' (Moore and Clark, 1996), 'Shawnee' (Moore et al., 1985), 'Choctaw' (Moore and Clark, 1988), and 'Rosborough' (released by Texas A&M University in 1977), and four thornless cultivars including 'Arapaho' (Moore and Clark, 1993), 'Navaho' (Moore and Clark, 1989), 'Apache' (Clark and Moore, 1999a), and 'Sweetie Pie'. Plants of all cultivars, except 'Sweetie Pie', were purchased from a commercial nursery and transplanted in January 2002 into five plots (replications) of each commercial cultivar. Plants for two plant plots of 'Sweetie Pie' were propagated at TCSHL from leafy stem cuttings. Each plot consisted of eight plants set 1.2 m (4 ft) apart with a 2.4 m (8 ft) space between plots. Plants were maintained following standard recommendations for south Mississippi (Braswell and Rasberry, 2006).

Rosette incidence (Smith and Fox, 1991) was determined in 2005 as the percent infected tissue by weight. On three separate occasions during late spring, five randomly selected branches were removed from each plot. Healthy plant tissue was separated from rosette infected tissue, weighed, and the percentage rosette infected tissue calculated. In 2006 rosette severity was determined by visually scoring the amount of rosette infection in each plot on a scale of 0 = no visible rosettes to 5 = severe rosette (Smith and Killebrew, 2002). The number of surviving plants in each plot was determined at the same time. At each of seven harvests in 2005, approximately 1 kg of fully ripe fruits were collected from each plot and transported to the laboratory in coolers with ice. Ten fully ripe fruits with no visible signs of disease or injury were selected from each sample and placed in small trays in a moisture chamber and incubated at 21°C and near 100% relative humidity with a 16 hr day length. Fruit rot development was rated after 3 and 5 days incubation on a scale of 0 to 3 for each category: 0 = no symptoms to 3 = fruit totally consumed with rot. Each fruit was rated for "gray mold" (*Botrytis cinerea*), "ripe rot" (*Colletotrichum* sp.), and "other" (any other disease symptom). "Total fruit rot" is the sum of the "gray mold", "ripe rot" and "other" disease scores. "Firmness" was determined on a subjective index based on

Table 1. *Study 1:* Average rosette rating (2005), number of surviving plants per plot, and rosette score (2006) of nine blackberry cultivars established at McNeill, MS in 2002.

	----------2005 ----------		----------2006 ----------		
Cultivar	**N**	**% Infected Tissue**	**N**	**Plant Count[z]**	**Rosette Score[y]**
Sweetie Pie	6	0.6 d[x]	2	6.5 a	0.0 b
Navaho	15	2.4 d	5	4.4 ab	0.0 b
Apache	14	2.6 d	5	2.6 bc	0.0 b
Choctaw	11	2.9 d	5	2.8 bc	0.0 b
Rosborough	15	5.7 cd	5	5.0 ab	0.0 b
Arapaho	13	10.1 bcd	5	1.8 c	0.0 b
Kiowa	15	15.6 bc	5	5.8 a	0.2 b
Shawnee	15	18.0 a	5	5.4 a	2.8 a
Chickasaw	15	30.7 a	5	4.6 ab	3.0 a

[z] Average number of plants surviving within the original eight plant plot.
[y] Rosette severity scored on visual rating of 0 = no symptoms to 3 = most severe symptoms.
[x] Means within a column followed by the same letter do not differ significantly; Fisher's least significant difference (LSD), $\alpha = 0.05$.

Table 2. *Study 1*: 2005 post-harvest fruit evaluation of nine blackberry cultivars from the 2002 blackberry cultivar trial, McNeill, MS, after 3 and 5 days incubation in humidity chamber.

		Total Disease Score[z]				Gray Mold Disease Score[z]				Ripe Rot Disease Score[z]				Fruit with No Disease Symptoms (%)				Fruit Firmness[y]			
Cultivar	N	3 day		5 day		3 day		5 day		3 day		5 day		3 day		5 day		3 day		5 day	
Kiowa	30	0.80	f[x]	1.97	e	0.32	e	0.84	d	0.08	c	0.32	cd	60.7	a	29.3	a	1.28	f	1.67	d
Navaho	22	0.95	ef	2.37	de	0.43	de	1.05	cd	0.12	bc	0.36	bcd	56.4	ab	26.4	a	1.36	ef	1.84	cd
Sweetie Pie	12	1.30	de	2.45	cde	0.62	abcd	1.08	cd	0.12	bc	0.28	de	45.8	bc	11.7	bc	1.47	def	1.93	c
Chickasaw	30	1.32	de	2.64	bcd	0.58	bcd	1.13	bcd	0.15	bc	0.39	bcd	46.0	bc	17.0	b	1.46	def	2.02	bc
Arapaho	12	1.50	bcd	2.96	bc	0.63	abcd	1.58	a	0.20	ab	0.13	e	34.2	cd	10.8	bcd	1.58	cd	2.15	b
Apache	17	1.42	cd	3.00	b	0.53	cde	1.20	bc	0.29	a	0.54	ab	32.9	d	8.5	cde	1.51	de	2.16	b
Shawnee	30	1.78	bc	3.85	a	0.77	ab	1.68	a	0.17	bc	0.47	abc	27.3	d	3.3	de	1.86	b	2.61	a
Rosborough	29	1.87	b	3.89	a	0.71	abc	1.47	ab	0.20	ab	0.63	a	28.6	d	4.3	cde	1.76	bc	2.55	a
Choctaw	24	2.50	a	4.03	a	0.82	a	1.43	ab	0.17	bc	0.40	bcd	11.7	e	0.4	e	2.14	a	2.62	a

[z] Disease severity scored on visual rating of 0 = no symptoms to 3 = most severe symptoms. "Total fruit rot" is the sum of "gray mold", "ripe rot" and "other" (data not shown) disease scores.

[y] Berry firmness ratings: 0 = very firm to 3 = very soft.

[x] Means within a column followed by the same letter do not differ significantly; Fisher's least significant difference (LSD), $\alpha = 0.05$.

feel with 0 = very firm to 3 = very soft. Berries with no visible disease symptom were scored as "no symptoms". Fruit quality attributes [fruit mass, soluble solids concentration (SSC), pH, and titratable acidity (TA)] were determined at each harvest date on a second set of 10 fully ripe fruit with no visible disease symptoms. The fruits were weighed, crushed and filtered through cheesecloth. SSC was determined by placing a drop of the filtered juice on a handheld refractometer. Ten grams of the pureed fruit were mixed with 90 ml deionized water, and the pH of the solution was determined. Titratable acidity of the solution was determined by titrating to a pH of 8.2 with 0.1N NaOH while stirring the sample with magnetic stirrer.

Results of Study 1 indicated that 'Sweetie Pie' 'Navaho', 'Apache', and 'Choctaw' had a lower percentage of rosette infected tissue than 'Kiowa', 'Shawnee', and 'Chickasaw' (Table 1). In 2006 'Chickasaw' and 'Shawnee' had higher rosette disease scores than the other seven cultivars in the trial. 'Sweetie Pie', 'Kiowa', 'Shawnee', 'Rosborough', 'Chickasaw', and 'Navaho' had a greater number of surviving plants per plot than the other three cultivars. 'Kiowa' and 'Navaho' had the firmest berries and the most berries with no disease symptoms, and 'Kiowa', 'Navaho', and 'Sweetie Pie' had the lowest total fruit rot disease score after 5 days incubation at 21°C and near 100% relative humidity (Table 2). Berry mass of 'Sweetie Pie' was less than that of 'Kiowa', 'Chickasaw', and 'Apache' but was significantly higher than 'Choctaw' and 'Arapaho' (Table 3). SSC of 'Sweetie Pie' was lower than all cultivars but 'Rosborough', TA was among the lowest, and its pH was intermediate for the nine cultivars (Table 3).

Study 2. Study 2 was established at McNeill, MS in 2009 to evaluate plant and fruit attributes and compare the performance of 'Sweetie Pie' to the thornless blackberry cultivars 'Apache', 'Arapaho', and 'Ouachita' (Clark and Moore, 2005). Plots were arranged in a randomized block design

Table 3. *Study 1:* 2005 fruit quality attributes including soluble solids content (SSC), pH, and titratable acidity (TA) of nine blackberry cultivars, 2005, cultivar trial, McNeill, MS.

Harvest Dates	N	Fruit Weight[z] (g)	SSC (°Brix)	pH	TA
1 June 2005	27	5.6 ab[y]	9.02 c	3.26 b	13.68 c
6 June 2005	29	5.8 a	9.69 b	3.28 b	18.49 a
10 June 2005	29	5.1 bc	9.19 c	3.26 b	17.48 ab
14, 17, 22, 28 June 2005	11	4.8 c	11.23 a	3.42 a	15.75 bc
Cultivar					
Kiowa	15	8.4 a	12.42 a	3.50 a	20.15 a
Chickasaw	14	6.9 b	9.71 c	3.13 e	14.62 c
Apache	5	6.2 bc	10.76 b	3.42 ab	16.04 bc
Shawnee	15	5.7 cd	8.81 de	3.29 cd	15.22 c
Sweetie Pie	6	4.8 de	8.75 e	3.25 d	14.08 c
Rosborough	15	4.8 e	7.78 f	3.30 cd	14.48 c
Navaho	6	4.0 ef	12.38 a	3.32 bcd	19.08 ab
Choctaw	13	3.4 f	9.92 c	3.13 e	18.42 ab
Arapaho	7	2.3 g	9.53 cd	3.38 bc	16.04 bc

[z] Average fruit weight of 10 berries.
[y] Means within a column followed by the same letter do not differ significantly; Fisher's least significant difference (LSD), $\alpha = 0.05$.

with five replications of two plants of each cultivar spaced 1.2 m apart. The plants received standard recommended cultural practices for blackberries including training onto a two-wire trellis, pre-and post- harvest herbicide applications, fertilization in the spring, removal of floricanes after harvest, and drip irrigation of 2-4 cm during the growing season as needed depending upon rainfall. Insecticides were utilized to control the spotted-wing Drosophila (*Drosophila suzukii*) during fruit ripening; however, no fungicides were applied. Data were collected in 2011-2013 for season of bloom and ripening, and subjective ratings were made on plant and fruit traits including crop, fruit firmness, flavor, and plant vigor (0 = poor, 10 = excellent). In 2012 yield and fruit quality

Table 4. *Study 2:* plant and fruit characteristics of four thornless blackberry cultivars at McNeill, Mississippi, 2011-2013.

Cultivar	50% Bloom Date (Mean)	50% Ripe Date (Mean)	Crop[z]	Size[z]	Firmness[z]	Flavor[z]	Vigor[z]
Sweetie Pie	5/01	6/14	8.2 b[y]	8.1 a	7.3 a	8.2 a	7.4 b
Apache	5/04	6/15	6.3 c	7.0 b	7.4 a	7.2 b	7.5 b
Arapaho	4/24	6/09	6.5 bc	6.7 b	7.6 a	7.5 b	7.1 b
Ouachita	4/27	6/12	7.7 a	8.1 a	7.7 a	7.4 b	8.2 a

[z] Ratings are based on subjective scores ranging from 0 to 10, with 0 being very poor and 10 being excellent. A value of 6 to 7 is considered to be the minimum acceptable rating for a commercial cultivar.
[y] Means followed by different letters within the same row are significantly different as determined by least significant difference test at $P \leq 0.05$.

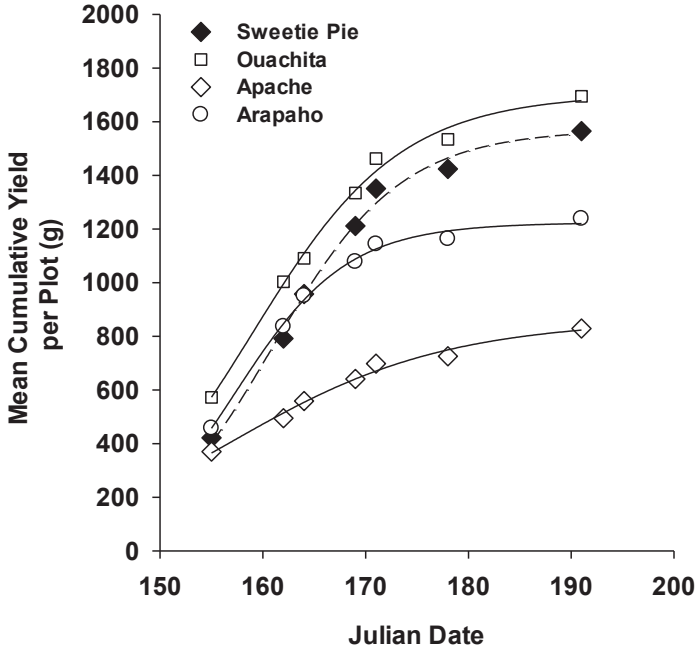

Fig. 1. Cumulative yield for 'Sweetie Pie' (solid diamond and dashed line) compared with yields of three other thornless blackberry cultivars: Ouachita (open squares), Arapaho (open circle) and Apache (open diamonds).

evaluations were conducted; marketable fruits (berries that were firm and shiny black) were harvested from three replications on seven dates from 5 June to 12 July, placed into plastic bags, cooled and transported to the laboratory the same day. Data were recorded for total marketable yield, SSC_s, pH, and TA utilizing the methods previously described.

Plant vigor of 'Sweetie Pie' was comparable to that of 'Apache' and 'Arapaho', but lower than that of 'Ouachita' (Table 4). Both fruit ripening interval and yield of 'Sweetie Pie' was between that of 'Ouachita' and 'Arapaho' (Fig. 1). Visual comparisons of fruit size suggested that 'Sweetie Pie' was similar to 'Ouachita' but was significantly greater than that of both 'Apache' and 'Arapaho' (Table 4), and in 2012, the average fruit mass of 'Sweetie Pie' was significantly greater than 'Arapaho' but did not differ from 'Ouachita' or 'Apache' (Table 5). Subjective rating values of flavor were consistently higher for 'Sweetie Pie' than those of the other cultivars. In contrast to Study 1, SSC values were greatest for 'Sweetie Pie', but neither SSC, pH nor TA differed among these cultivars. Additionally, measurements of SSC from samples taken at two commercial farms from 2012 – 2016 ranged from 12.0 to 13.0 (data not shown).

Although 'Sweetie Pie's fruits are likely too soft for commercial purposes, outstanding characteristics of 'Sweetie Pie' are it's thornless canes, productivity, and excellent flavor. 'Sweetie Pie' will complement other thornless blackberry cultivars by providing a long harvest season for high quality berries for homeowners and U-pick growers, and is expected to perform well in areas where thornless blackberry cultivars are adapted. Like other thornless blackberry cultivars, 'Sweetie Pie' has shown susceptibility to orange rust caused by two fungi

Table 5. *Study 2:* laboratory evaluations of fruit and plant charactertistics of four thornless blackberry cultivars at McNeill, Mississippi, 2012.

Cultivar	Fruit weight (g)[z]	pH	SSC (Brix°)	TA
Sweetie Pie	4.15 a[y]	3.61 a	11.42 a	1.32 a
Apache	3.74 a	3.64 a	11.02 a	1.25 a
Arapaho	2.81 b	3.73 a	10.55 a	1.07 a
Ouachita	3.81 a	3.57 a	10.59 a	1.32 a

[z] Average weight of thirty berries

[y] Means followed by different letters within the same row are significantly different as determined by least significant difference test at $P \leq 0.05$.

(*Arthuriomyces peckianus* and *Gymnoconia nitens*) (Kleiner and Travis, 1991) and to cane and leaf rust caused by *Kuehneola uredinis)* (Ellis, 1991), thus the use of fungicides may be necessary to maintain plant health.

Availability

'Sweetie Pie' is a public domain blackberry cultivar developed and released by the USDA-ARS Thad Cochran Southern Horticultural Laboratory. A limited supply of 2-year old potted succulent plants is available to nurseries and will be prorated to nurseries if demand exceeds supply. Written requests for plants should be sent to Dr. Stephen Stringer, USDA-ARS Thad Cochran Southern Horticultural Laboratory, P.O. Box 287, Poplarville, MS 39470. Genetic materials of this release will also be deposited in the National Plant Germplasm Repository at Corvallis, OR, where it will be available for research purposes and commercial development.

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