'Pelican' Strawberry

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The 'Pelican' strawberry (*Fragaria* × *ananassa* Duch.), resulting from an interregional effort to breed anthracnose-resistant strawberry cultivars for the southeastern United States (Galletta et al., 1993; Smith et al., 1996), was introduced for propagation to nurseries in 1996 by the U.S. Dept. of Agriculture (USDA), Louisiana State Univ. Agricultural Center, and North Carolina State Univ. 'Pelican' was selected for its high plant vigor; attractive, symmetrical, and large fruit with good color and flavor; resistance of the fruit, petioles, stolons, and plant crown to anthracnose (*Colletotrichum acutatum* Simmonds and *C. fragariae* Brooks); and adaptation to the raised-bed plasticulture system used in the southeastern United States. 'Pelican' is also resistant to at least five races of the red-stele root-rot disease (incited by *Phytophthora fragariae* Hickman var. *fragariae*). 'Pelican' produced outstanding yields in southern Mississippi compared with 'Sweet Charlie' and was as productive and produced fruit as large as 'Chandler' in North Carolina. Yields in Louisiana were high, but the fruit was subject to skin

damage by rain or overhead irrigation. In Maryland, 'Pelican' yielded as well as 'Chandler' on raised beds and made a productive matted row, although fruit from matted rows was rated less attractive than that from raised beds. 'Pelican' seems best adapted to the Southern Coastal Plain and lower Piedmont in USDA hardiness zones 8 and 9, especially for fall-planting and winter to early spring fruit production.

'Pelican' is suggested for trial in the southeastern United States for raised-bed culture and in adjacent regions for matted-row culture as a high-quality, early to early-midseason,

shipping and local-market cultivar with resistance to anthracnose fruit rot, stolon infection, and crown rot. 'Pelican' was named after the state bird of Louisiana.

Origin

'Pelican', tested as LAMSUS 87-17-17, resulted from the 1987 Beltsville, Md., cross FL 82-1556P × LA 8311 (LA 2556 × LA 883) made by G.J.G. Seeds from this cross were germinated and the seedlings screened for resistance to the fungus *C. fragariae* in Poplarville, Miss., by B.J.S. (Smith et al., 1990). The seedlings were grown in Hammond, La., and LAMSUS 87-17-17 was selected in 1989 by T.J.D. and R.J.C. 'Pelican' was subsequently tested on raised beds in Louisiana, Maryland, Mississippi, North Carolina, and Alabama and in matted rows in Maryland. 'Pelican' plants were increased by micro propagation from virus-free mother stock plants and were released to nurseries in 1996.

Description

'Pelican' plants are large, vigorous, and erect. Leaves are large, cup upward at the margins, are medium-green on top and light-green beneath. Leaflets are broad ovate; serrations are rounded and tipped; and veins are prominent. Bracts on the petioles are long and whorled, and petioles are flat on the upper surface with very light pubescence.

Flower petals are white, number five to six, and are broad and overlapping. Sepals are in two whorls, narrow to medium and pointed or bifurcate. Stamens are in two whorls and anthers are small to medium and yellow. Sepals and pedicels are downy pubescent. Receptacles are raised and conic. Peduncles branch at their midpoint.

Fruit are very large, medium-firm and are

Fig. 1. Fruit of 'Pelican' strawberry.

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very long and wedge-shaped, with a glossy orange-red exterior (Fig. 1). The calyx is slightly reflexed and achenes are yellow and flush with the fruit surface. Interior flesh is pink and melting (uniform and smooth), juicy with balanced sweet and acid flavor, aromatic, and may have a hollow core. The skin may bruise or crack under some conditions.

Performance

'Pelican' and standard cultivars for each region were established each fall in a double-row, raised-bed system with black plastic mulch and drip irrigation (Poling, 1993) in North Carolina, Alabama, and Maryland, and with overhead irrigation in Louisiana and Mississippi, and also in matted-row culture in Maryland. At each location, plots were fertilized following state experiment station guidelines. Each spring overhead irrigation was used for frost protection when needed.

In Hammond, La., in 1988 through 1990, 1992, and 1993, 'Pelican', 'Chandler', and 'Tangi' were established in annual plantings and compared for total yield. Plants were transplanted in October in double rows on fumigated (70% methyl bromide/30% chloropicrin: Brom-O-Gas; Great Lakes Chemical, West Lafayette, Ind.) Cahaba fine sandy loam soil (Typic Hapludults, fine-loamy, siliceous, thermic), pH 5.5–6.0. Plots were 3.1 m wide and 7 m long, with plants set 30 cm apart. Fertilizer, fungicides, and insecticides were applied following Louisiana Extension Service recommendations (Puls and Pollett, 1986).

In Poplarville, Miss., in 1993, 'Pelican' and 'Sweet Charlie' were established in 1.5-m-long plots with 10 plants set 30 cm apart in double rows and with 1.2 m between beds on fumigated (98% methyl bromide/2% chloropicrin) Ruston fine sandy loam soil (Typic Paleudult, fine-loamy, siliceous, thermic), pH $\approx$ 5.5. Transplanting was done in late October. No fungicides or insecticides were applied during establishment or harvest. Fruit was harvested from mid-March to 1 May, and cultivars were compared for total yield and individual large and mean fruit mass.

In Castle Hayne and Fletcher, N.C., 'Pelican' and several standard cultivars (Caldwell, 1989) were established in 1992 in 1.5-m-long plots with 10 plants set 30 cm apart in double rows and with 1.2 m between beds on Lynchburg fine sandy loam soil (Aeric Paleaquults, fine-loamy, siliceous, semiactive thermic), pH 6.2 in Castle Hayne and Bradson gravelly loam soil (Typic Hapludults, fine, oxidic mesic), pH 5.8, at Fletcher. In Castle Hayne, cultivars were compared in 1993 for harvest season, total and percent marketable fruit yield, and mean individual fruit mass. In Fletcher, each plant was inoculated several times with conidia of *C. acutatum* during the bloom-green fruit stages to ensure field infection of fruit. In addition, stolons were inoculated with conidia of *C. acutatum* isolate CA-1 and were incubated in a moist chamber under a 12-h photoperiod at 28 °C in a temperature-controlled growth chamber (Ballington and Milholland, 1993). Three plants of each geno-

type were inoculated, and tests were repeated three to four times. Disease development was evaluated 7 d after inoculation.

In Clanton, Ala., 'Pelican' was established with 'Chandler' on fumigated (70% methyl bromide/30% chloropicrin) Ruston sandy loam soil, (Typic Paleudult, fine-loamy, siliceous, thermic), pH 6.2, in Oct. 1991, 1992, 1993, and 1995. Plots consisted of 14 plants set 30 cm apart in double beds with 1.2 m between beds. Total yield, mean individual fruit mass, fruit appearance, color, and flavor data for each cultivar were compared in the spring following each planting year.

In Beltsville, Md., in Aug. 1995, 'Pelican' and 'Chandler' plug plants were transplanted in double rows on raised beds mulched with black plastic. Plants were spaced 30 cm apart with 30 cm between rows in each bed. Plots consisted of six plants as double rows of three plants each. Cultivars were compared in 1996 for harvest season, total and percent marketable yield, and individual large and mean fruit mass. 'Pelican' also was established in nonreplicated, matted-row plots in May 1995 in Beltsville to determine its performance in this culture system. Plants were set 30 cm apart and drip-irrigated as needed. In both plantings, the Rumford series, coarse-loamy, siliceous, thermic Typic Hapludults (pH $\approx$ 6.0) soil was not fumigated. No fungicides were applied. Azinphos-methyl (Guthion; Bayer, Kansas

City, Mo.) was used prior to blossom opening for control of the strawberry bud weevil, or strawberry clipper, *Anthonomus signatus*.

All raised-bed plantings were established in a randomized complete-block design with four replications (five in Fletcher, N.C., and six in Clanton, Ala.) of each entry. In most instances, comparisons were made in a larger test containing other cultivars and/or advanced selections. Due to the varying number of cultivars, harvests, and sites represented, separate analyses of variance (ANOVAs) were performed for each set of plant-season-location data. Absolute yields were analyzed, then converted to kg·ha⁻¹ for site and year comparisons. Fruit mass was the average of 10 (Maryland, Mississippi) or 25 (Alabama, Louisiana, North Carolina) randomly selected fruit per plot per harvest over the season.

In Louisiana, fruit yields of 'Pelican' were similar to those of 'Chandler' and 'Tangi', producing 5-year mean yields of 7624, 5771, and 6292 kg·ha⁻¹, respectively (data not shown). However, frequent and hard rains during the ripening period caused skin cracking of 'Pelican' fruit. In Mississippi, 'Pelican' produced greater yields and heavier fruit than did 'Sweet Charlie', although there were no cultivar differences in individual large fruit masses (Table 1).

In Castle Hayne, N.C., 'Pelican' ripened with 'Chandler' and earlier than 'Sweet Charlie'. In Fletcher, N.C., 'Pelican' ripened with 'Sweet Charlie', earlier than 'Chandler', and later than 'Apollo' (Table 2). In Castle Hayne, 'Pelican' yielded less than 'Chandler', but its marketable yield was greater because of frequent anthracnose infection of 'Chandler' fruit. In Fletcher, 'Pelican' yielded more total and marketable yields than did 'Chandler', but less than 'Apollo'. The individual mean fruit mass of 'Pelican' was less than that of 'Chandler' but greater than that of 'Sweet Charlie' in Castle Hayne. In Fletcher, the individual mean fruit mass of 'Pelican' was similar to that of 'Chandler' and 'Sweet Charlie', but less than that of 'Apollo'. In Castle Hayne, 'Pelican' fruit were rated as high as 'Chandler' and 'Sweet Charlie' fruit for firmness, symmetry, skin color, skin toughness, and flavor, and similar to 'Chandler' fruit for appearance (data

Table 1. Comparison of fruit production and mass of 'Pelican' and 'Sweet Charlie' strawberries grown in double-row raised-bed plasticulture. Replicated cultivar and selection test in Poplarville, Miss., 1994.

Cultivar ^a	Total yield (kg·ha ⁻¹)	Fruit mass (g) ^b	
		Large	Mean
Pelican	11,530 a ^c	26.0 a	16.2 a
Sweet Charlie	5,400 b	21.1 a	13.4 b

^aLarge fruit mass = largest mean mass of 10 randomly selected fruits from an early harvest of each plot replication for each cultivar. Mean mass = mean mass of 10 randomly selected fruits per plot per harvest over the season of 12 harvests for each cultivar.

^bn = 16 for cultivar/selection test entries.

^cMean separation by Duncan's multiple range test, $P \leq 0.05$.

Table 2. Comparison of fruiting season, total and marketable yields, and mean individual fruit mass of 'Pelican' and several standard strawberry cultivars grown under plasticulture in replicated cultivar/selection tests in Castle Hayne and Fletcher, N.C., 1993.

Cultivar ^a	Fruit (%) harvested after six harvests	Fruit yield (kg·ha ⁻¹)		Mean individual fruit mass (g)
		Total	Marketable ^b	
<i>Castle Hayne</i>				
Chandler	96	20,710 a ^c	10,874 b	18.2 a
Sweet Charlie	55	11,905 c	10,593 b	15.6 c
Pelican	83	18,116 b	14,391 a	16.9 b
<i>Fletcher</i>				
Apollo	58	12,536 a	8,151 a	13.6 a
Chandler	18	3,893 c	2,728 d	12.3 ab
Sweet Charlie	33	7,124 b	6,534 b	12.2 ab
Pelican	30	6,446 b	4,607 c	11.5 b

^an = 9 and n = 12 for cultivar/selection test entries at Castle Hayne and Fletcher, respectively.

^bMarketable yields low because of fruit loss due to anthracnose and other fruit rots and small and misshapen fruit.

^cMean separation within locations and columns by Duncan's multiple range test, $P \leq 0.05$.

not shown). 'Pelican' was rated lower than 'Chandler' and 'Sweet Charlie' for flesh color. In Fletcher, 'Pelican' fruit were rated as high as 'Apollo' and 'Chandler' for appearance and as firm as the standard cultivars for firmness, symmetry, skin color, and flesh color (data not shown). 'Pelican' fruit were rated similar to 'Chandler' in skin toughness, and similar to 'Apollo' and less than 'Sweet Charlie' and 'Chandler' for flavor.

In Alabama, yields of 'Pelican' were high but less than those of 'Chandler' in each test year (Table 3). In most years, the mean individual fruit mass over the harvest season was similar for each cultivar. Fruit of 'Pelican' were subjectively rated as high or better than those of 'Chandler' for appearance, color, firmness, and flavor (data not shown).

In annual plasticulture in Maryland, 'Pelican' and 'Chandler' had fruit ripe at the same harvest dates; however, a greater percentage of 'Pelican' fruit were harvested at the second and third harvests (Table 4). There were no significant differences in total and marketable yields and individual large and mean fruit mass. 'Pelican' was productive, but the fruit was less desirable in appearance in matted-row culture than on raised beds (data not shown).

Disease resistance

'Pelican' was determined to be resistant to *C. fragariae* (anthracnose crown rot) when screened for anthracnose resistance as a seedling (Smith et al., 1990). Further evaluation in the field in Louisiana confirmed the resistance of 'Pelican' to *C. fragariae*. Stolon inoculation under controlled environment conditions in North Carolina (Milholland and Ballington, 1993) showed that 'Pelican' plants are also resistant to an aggressive strain of *C. acutatum* from North Carolina, whereas stolons of 'Sweet Charlie' were susceptible to infection (Table 5). Inoculation of plants in the bloom to green fruit stages in Castle Hayne and Fletcher, N.C., showed 'Pelican' and 'Sweet Charlie' fruit to be resistant to infection by *C. acutatum* isolate CA-1 with 3% or less anthracnose fruit rot at either location. By comparison, 'Chandler' had 34% anthracnose fruit rot in Castle Hayne and 6% in Fletcher. 'Pelican' was also determined to be resistant to five eastern U.S. races of *P. fragariae* var. *fragariae* (Galletta et al., 1994). Resistance to red-stele root rot may be important to growers in production areas at higher elevations and to nursery-plant producers in northern regions. There were no differences in the occurrence of foliar diseases of 'Pelican' and 'Chandler' in Fall 1995 or Spring 1996 in Beltsville, Md.

Table 3. Total yield and mean individual fruit mass of 'Pelican' and 'Chandler' strawberries at the Chilton Area Horticulture Substation, Clanton, Ala., 1992 through 1994 and 1996.

Cultivar	1992		1993		1994		1996	
	Yield ^a (kg·ha ⁻¹)	Fruit mass (g)	Yield (kg·ha ⁻¹)	Fruit mass (g)	Yield (kg·ha ⁻¹)	Fruit mass (g)	Yield (kg·ha ⁻¹)	Fruit mass (g)
Chandler	29,492 a ^b	22.4 a	33,322 a	19.5 a	21,652 a	16.9 a	24,595 a	12.7 a
Pelican	19,768 b	21.8 a	16,001 b	18.2 b	13,375 b	16.8 a	18,588 b	12.8 a

^aYields based on 43,000 plants/ha.

^bMean separation in columns within years by Duncan's multiple range test, $P \leq 0.05$.

Table 4. Comparison of fruit ripening period, yields, and individual fruit mass of 'Pelican' and 'Chandler' strawberries in a replicated cultivar/selection test planted on raised beds in Beltsville, Md., in 1995 and fruited in 1996.

Cultivar ^a	Ripe fruit (%) after harvest number:			Fruit yield (kg·ha ⁻¹)		Individual fruit mass (g) ^c	
	2	3	4	Total	Marketable	Large	Mean
Chandler	14 a ^x	31 b	47 b	8,342 a	72 a	20.6 a	12.3 a
Pelican	17 a	53 a	70 a	8,855 a	78 a	17.5 a	10.6 a

^aLarge fruit mass = largest mean mass of 10 randomly selected fruits from an early harvest of each plot replication for each cultivar. Mean mass = mass of 10 randomly selected fruits per plot per harvest over the season of 12 harvests for each cultivar.

^bn = 33 for cultivar/selection test entries.

^cMean separation within columns by Duncan's multiple range test, $P \leq 0.05$.

Table 5. Comparison of stolon and fruit infection of 'Pelican' and standard strawberry cultivars by *Colletotrichum acutatum* isolate CA-1 in replicated cultivar/selection tests in Raleigh, Castle Hayne, and Fletcher, N.C., 1993.

Cultivar	Raleigh		Fruit rot (%) ^c	
	Mean stolon disease index ^b	Disease reaction	Castle Hayne	Fletcher
Apollo	3.1	S	---	13.5
Chandler	4.2	S	34.0	6.3
Sweet Charlie	3.3	S	2.0	1.0
Titan	3.8	S	1.2	---
Pelican	1.8	R	3.0	1.8

^aPercentage by mass of total fruit lost due to infection by *Colletotrichum acutatum*. Each plant at each location was sprayed with a conidial suspension (10^6 spores/mL) several times during the bloom to green fruit stages to insure infection. Mean of four replications of 10 plants each at each location.

^bDisease index based on lesion length 7 d following inoculation; 0–1.9 mm = resistant (R), 2.0–2.9 mm = intermediate, and 3.0–5.0 mm = susceptible (S). Mean of two to three stolons inoculated per plant, three plants per test and each test replicated at least twice.

Availability

The U.S. Dept. of Agriculture does not have plants of 'Pelican' for general distribution. Contact B.J. Smith, USDA/ARS, Small Fruit Research Station, Box 287, Poplarville, MS 39470, for nursery-plant sources.

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