‘Marina’ Strawberry

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‘Marina’ is a remarkable short-day strawberry (*Fragaria ×ananassa* Duch.) cultivar due to its high production and excellent flavor. Its harvest season is early, which is extremely important for economical production on the southwestern coast of Spain and other similar temperate regions.

Suitable weather, good quality water, and sandy soils, together with the incorporation of advanced technology, have led Huelva, located on the southwestern Spanish coast, to become the most important production area in Europe for fresh-market strawberries. Currently, there is ≈7,500 to 8,000 ha of strawberries grown in Huelva, which produce ≈300,000 to 350,000 t of fresh fruit annually (Bartual et al., 2002; López-Aranda et al., 2003).

In 1990, due to economical and social significance of strawberry, public institutions including the Spanish National Agricultural Research Institute (INIA), the Andalusian Government (Junta de Andalucía), and the Instituto Valenciano Investigaciones Agrarias (IVIA), in cooperation with a private partner, Viveros California, S.L., began a breeding program to develop new strawberry cultivars well-adapted to growing conditions in Huelva and other Spanish areas, such as Valencia on the eastern Spanish coast. New cultivars released from the program include ‘Andana’ (Bartual et al., 1997) in 1999 and ‘Carisma’ (Bartual et al., 2002) in 2000, and now ‘Marina’.

Origin

‘Marina’ strawberry was selected in 1998 from a ‘Cartuno’ × ‘Camarosa’ cross made in

IVIA, Moncada (Valencia), and tested as selection RB-975. ‘Cartuno’, developed in Spain by Planasa (Plantas de Navarra, S.A.), was used as the female parent (U.S. Plant Patent no. 8623). Fruit from this parent is medium to large, red in color, and moderately firm. ‘Cartuno’ is vigorous and produces fruit uniformly throughout the fruiting season. ‘Camarosa’, a popular release from the University of California (U.S. Plant Patent no. 8708), was used as the male parent. ‘Camarosa’ is a vigorous, early, short-day variety that produces large to very large fruit throughout most of its fruiting cycle. The fruit have uniform brilliant red color and are very firm. ‘Camarosa’ is well-adapted to the Huelva area and is currently the predominant cultivar grown in the region.

‘Marina’ was propagated for performance evaluations at high-elevation nurseries in Arévalo, Spain.

Description

‘Marina’ is a short-day strawberry cultivar. It is vigorous and compact. It has a globose growth

habit and a tendency to produce numerous runners with low anthocyanin coloration and medium pubescence. The leaves are slightly concave and blistering with three green to dark-green glossy leaflets. The terminal leaflet is longer than wide with an acute base and crenate margins. Inflorescences are produced on long peduncles and are positioned at the foliage level. Flower size is small to medium and the calyx diameter is larger than the corolla. The corolla has five white petals, as long as broad, that overlap. Fruit are moderately firm, almost cylindrical in shape, and slightly longer than broad. Fruit size is medium and constant throughout the fruiting season, except during the last month when it decreases. External color of fully mature fruit is dark red and highly glossy (Fig. 1). Inside the fruit, flesh color is medium red and the internal cavity is fairly conspicuous. The fruit surface is generally even; achenes are inserted below the surface. The calyx is firmly attached to the fruit and is larger than the diameter of the fruit. Fruit flavor at full ripeness is excellent and pleasantly aromatic.

Flowering and ripening of ‘Marina’ occur early in the season, coinciding with the economic needs of south European growers. In Huelva, Spain, the fruits have fairly large internal cavities and are often a deep dark red color, which may somewhat limit the use of the cultivar in some fresh markets. However, high productivity and excellent flavor and aroma may increase its acceptance overall. The cultivar may also be suitable for processing due to its outstanding color and high soluble solids level (nearly 10° Brix).

Isozyme characterization of ‘Marina’ through polyacrylamide gel electrophoresis (PAGE) with PGI, LAP, and PGM isozyme systems gave the following banding patterns (according to nomenclature by Bringham et al. 1981)—PGI: A2; LAP: B3; and PGM: C3.

Performance

Fruit production and quality of ‘Marina’ was compared to 10 other strawberry culti-

Fig. 1. ‘Marina’ strawberries.

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vars at four sites: Moguer, Cartaya, Lucena del Puerto, and Almonte, in Spain's Huelva region. To reduce the presence of soil pathogens at each site, soil at Moguer was solarized prior to planting, while soils at the other sites were fumigated with 67% methyl bromide and 33% chloropicrin at a rate of 60 g·m⁻². In October 2001, each cultivar was planted in three completely randomized plots of 100 plants each on two-row raised beds covered with black plastic. Plants were spaced 0.25 × 0.30 m apart and covered by large plastic tunnels (6.6 m wide × 3.5 m high × 70 m long) at Moguer and small plastic tunnels (0.7 m wide × 0.6 m high × 70 m long) at the other

sites. Marketable fruit were harvested and weighed 24 times from 15 Jan. to 23 May 2002. Individual fruit weight was calculated (at Moguer only) by dividing the total yield by the total number of harvested fruits. Three to six fruit per plot were evaluated at each harvest for external and internal color, internal cavity size, and firmness. Color and cavity size were subjectively rated on a visual scale (see Table 1). Fruit firmness was measured using a penetrometer with a 3.5-mm tip. Data from each site were subjected to analysis of variance using Statistix 8.0 software (Analytical Software, Tallahassee, Fla.) and means were separated at the 0.05 level using Fisher's least

significant difference test or the Kruskal-Wallis comparison test (for subjective data).

A comparison of yield and fruit quality from 'Marina' to other strawberry cultivars is shown in Table 1. 'Marina' produced nearly 50 t·ha⁻¹ of marketable fruit and was one of the most productive cultivars grown at all four sites. Its average fruit size was significantly smaller than 'Camarosa', 'Gemstar', and 'Tudnew', but the same size or larger than the remaining cultivars. External color of mature fruit from 'Marina' was fairly stable at each location ranging from red to dark red, while internal color tended to be more variable ranging from medium red to red. The size of the internal cavity in the fruit was quite conspicuous, particularly at Moguer and Cartaya. 'Marina' fruit firmness ranged from 262–313 g·mm⁻¹ of deflection and was often lower than firmness observed in fruit from other cultivars.

'Marina' and 'Camarosa' were also compared at Moguer in 2000–01. Results indicated that marketable yields were statistically similar between 'Marina' and 'Camarosa' over the course of the fruiting season and total yields were comparable to those found in 2001–02 (data not shown).

Susceptibility of 'Marina' to powdery mildew (*Sphaerotheca macularis* Walls ex Fr.) was low at each field site during both growing seasons. However, when 'Marina' was inoculated artificially in the laboratory, fruit were susceptible to the pathogen, which indicates the cultivar is not resistant to the disease (B. de los Santos, personal communication).

Availability

Junta de Andalucía, IVIA, INIA, and Viveros California, S.L. have jointly applied for an inscription in the Register of Strawberry Commercial Varieties (Spanish Plant Variety Office, application number 2002/365) and for a Community Plant Variety Right (CPVO) in the EU territory. Parties interested in propagating this cultivar should contact Viveros California, S.L., Paseo de las Delicias 5-4º, 41001 Sevilla, Spain.

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Table 1. Marketable yield and fruit quality of 'Marina' and 10 other strawberry cultivars grown at four locations in Huelva, Spain during 2001–02.

Location	Cultivar	Marketable yield (g/plant)	Individual fruit wt (g/fruit)	External fruit color ^a	Internal fruit color ^a	Internal cavity size ^b	Fruit firmness (g·mm ⁻¹)
Moguer	Andana	820 ab ^c	24.0 d ^c	7.0 ^w	5.3 a ^w	3.0 b ^w	382 ab ^c
	Camarosa	767 abc	27.0 bc	7.2	5.3 a	6.0 ab	349 c
	Carisma	709 abc	25.7 cd	6.7	3.7 ab	4.3 ab	362 bc
	Chiflon TM	657 bc	24.8 cd	6.5	4.7 ab	5.0 ab	309 d
	Gemstar	854 a	29.4 ab	6.2	4.0 ab	5.0 ab	310 d
	Marina	799 abc	23.6 d	7.5	5.0 ab	7.0 a	307 d
	Ruby	394 d	24.6 d	7.5	5.0 ab	4.0 ab	400 a
	Treasure	654 bc	24.8 cd	7.7	4.3 ab	5.7 ab	357 bc
	Tudla TM	635 c	23.5 d	7.0	5.7 a	5.3 ab	259 e
	Tudnew TM	706 abc	31.1 a	7.2	6.0 a	4.0 ab	362 bc
	Whitney	288 d	20.8 e	6.2	1.3 b	6.3 a	297 d
	Andana	1002 a	---	6.3	7.0 a	3.0	348 abc
	Camarosa	763 cd	---	6.0	7.0 a	5.0	372 a
	Carisma	853 bc	---	5.7	3.0 a	4.3	346 abc
Cartaya	Chiflon TM	635 def	---	6.0	6.3 a	4.3	325 abc
	Gemstar	707 cde	---	5.0	3.7 a	4.3	353 abc
	Marina	969 ab	---	7.0	6.3 a	7.0	278 c
	Ruby	577 f	---	6.3	6.3 a	4.3	324 abc
	Treasure	594 ef	---	6.7	3.0 a	6.3	357 ab
	Tudla TM	854 bc	---	5.7	5.7 a	3.7	294 bc
	Tudnew TM	596 ef	---	6.0	5.7 a	3.7	332 abc
	Whitney	413 g	---	5.3	1.7 b	5.7	285 bc
	Andana	822 ab	---	6.0	5.0 a	3.7	363
	Camarosa	710 bc	---	6.0	3.7 ab	5.0	350
	Carisma	774 ab	---	6.0	2.3 ab	5.0	417
	Chiflon TM	740 ab	---	5.3	3.0 ab	5.0	349
	Gemstar	594 de	---	5.0	2.3 ab	5.0	331
	Marina	862 a	---	6.0	3.0 ab	5.0	313
L. Puerto	Ruby	454 ef	---	5.7	3.0 ab	5.0	310
	Treasure	620 d	---	5.3	3.0 ab	5.0	321
	Tudla TM	686 cd	---	5.3	4.3 ab	5.7	330
	Tudnew TM	606 d	---	5.7	4.3 ab	3.0	362
	Whitney	326 f	---	5.0	1.0 b	5.7	313
	Andana	612 ab	---	5.3	5.0 a	4.3	291 cd
	Camarosa	688 a	---	6.0	5.0 a	5.0	311 bcd
	Carisma	597 b	---	5.7	5.0 a	5.0	277 d
	Chiflon TM	608 b	---	6.0	5.0 a	5.0	308 bcd
	Gemstar	575 bc	---	5.0	4.3 a	3.0	439 a
	Marina	613 ab	---	6.3	5.0 a	5.0	262 d
	Ruby	548 bc	---	6.0	4.3 a	5.0	416 ab
	Treasure	516 c	---	6.0	4.3 a	5.0	352 abcd
	Tudla TM	610 b	---	5.7	5.0 a	5.0	306 cd
Almonte	Tudnew TM	598 b	---	6.0	5.0 a	3.7	301 cd
	Whitney	299 d	---	5.0	1.0 b	5.7	392 abc

^aRated on a scale from 1 to 9, where 1 = light red and 9 = deep red.

^bRated on a scale from 1 to 9, where 1 = absent and 9 = large internal cavity along the fruit.

^cWithin columns for each location, means followed by different letters are significantly different at $P \leq 0.05$, as determined by Fisher's least significant difference test.

^wWithin columns for each location, means followed by different letters are significantly different at $P \leq 0.05$, as determined by the Kruskal-Wallis comparison test.