'Guadajira' and 'Gevora': Open-pollinated, Processing Tomato Cultivars Resistant to Root-knot Nematodes and Fusarium Wilt

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Growers of processing tomatoes must reduce costs as much as possible because of limited yields and tight market prices. The average price per kilogram for seed of processing tomatoes in California, Italy, Argentina, and Spain is U.S. \$50, \$120, \$45, and \$107, respectively, for open-pollinated cultivars and \$700, \$1300, \$1050, and \$1400, respectively, for hybrid cultivars (J. Valencia, M. Dadomo, C. Argerich, personal communication, for California, Italy, and Argentina, respectively). Fruit yields of F_1 hybrid cultivars are no higher than those of open-pollinated cultivars (Cuartero et al., 1986), but combine dominant genes of resistance to diseases. Open-pollinated cultivars, such as 'UC-92', 'Rio Grande', 'UC-204', 'H-324-1', and 'FM-6203', were widely grown in California, Italy, Argentina, Spain, and other growing areas, but are now being replaced by nematode-resistant hybrids. The objectives of our breeding program were to develop open-pollinated cultivars that would reduce production costs, and to introduce genes of resistance to *Fusarium oxysporum* f. sp. *lycopersici* [FOL races 0 and 1 *sensu* Gabe (1975), genes *I* and *I-2*, respectively] and to nematodes of the *Meloidogyne* genus (*Mi* gene). The impending ban of methyl bromide makes the development of cultivars resistant to soil pests and diseases especially important.

Origin and Methodology

The F_1 hybrid 'Centurion' was backcrossed to the recurrent parent, 'FM-6203'. 'FM-6203' is resistant to FOL race 0 (gene *I*), and 'Centurion' was the source of resistance genes *Mi*, *I*, and *I-2*. Both 'FM-6203' and 'Centurion' were once widely grown worldwide; 'Centurion' is still grown in Spain and both are well adapted to Spanish conditions (Rodríguez et al., 1995a). A 'FM-6203' × 'Centurion' F_1 hybrid was generated and individuals at the seedling stage were propagated via in vitro culture of cuttings to obtain at least 10 propagules of each seedling. Three of these clones were used to evaluate root-knot nematode resistance, three for resistance to FOL, and four were cultivated in the field to observe their horticultural characteristics. Nematode resistance conditioned by the *Mi* gene was evaluated by inoculating plants at the four-leaf stage with 1500 eggs/root of a mixture of a *M. incognita* and *M. arenaria* populations. An F_1 individual was classified susceptible after 45 d when at least one of its three inoculated propagules had >5% of its roots infested or >10 galls. The three clones of all resistant individuals were reinoculated to eliminate escapes. Fusarium

wilt resistance conditioned by the *I-2* gene was tested by inoculating propagules with FOL race 1 as described by Rodríguez et al. (1995b).

The F_1 plants selected for resistance and horticultural acceptability were crossed, using the female as the recurrent parent, to produce the BC_1 , BC_2 , and BC_3 generations. We self-pollinated resistant BC_3 progenies to produce BC_3S_1 lines. Resistant BC_3S_1 plants were self-pollinated to produce BC_3S_2 lines. Those BC_3S_2 lines that did not segregate for resistances were homozygous for the resistance genes and were grown under field conditions. Two of these lines, 'Guadajira' and 'Gevora', were promising horticulturally, and were compared with commercial cultivars in a randomized complete-block design with four replications (50 m² per cultivar and block) at one location in 1995. 'Guadajira' and 'Gevora' lines were then tested at five commercial farms (one plot of 500 m² per cultivar per farm) in 1996 and 1997.

Description

'Guadajira' and 'Gevora' are suitable for mechanical harvesting; the main stem is determinate and stops growing after the fourth or fifth truss. The foliage protects the fruits satisfactorily from sunscald. The fruits of both cultivars are round to elongated; the polar and equatorial diameters, respectively, are 56 ± 4 and 48 ± 4 mm for 'Guadajira' and 53 ± 4 and 47 ± 4 mm for 'Gevora'. The fruits of both cultivars have three locules and the mean pericarp thickness is 8 ± 1 mm for 'Guadajira' and 7 ± 1 mm for 'Gevora'. 'Guadajira' fruit (87 ± 7 g) is heavier than that of 'Gevora' (72 ± 7 g). Both 'Guadajira' and 'Gevora' are resistant to root-knot nematodes and to FOL race 0; 'Gevora' is resistant to FOL race 1.

Fruit yields of 'Guadajira' and 'Gevora' were similar to those of the hybrids (Table 1). 'Soprano' (52 t·ha⁻¹) and 'Suan' (48 t·ha⁻¹) produced the largest ranges in yield averaged over the 3 years; the range between the highest and lowest yield was 31 t·ha⁻¹ for 'Guadajira', 34 t·ha⁻¹ for 'Gevora', 34 t·ha⁻¹ for 'FM-6203', and 25 t·ha⁻¹ for 'Centurion'. Consequently, 'FM-6203' and 'Centurion' showed more yield stability under field conditions in 1995, 1996, and 1997.

'Guadajira' and 'Gevora' had °Brix >4.8 in all 3 years (Table 1); this is important in the European Union because the price of processing tomatoes is reduced when °Brix are <4.8. Consequently, the prices of 'Guadajira' and 'Gevora' would not have been reduced in any

Table 1. Fruit yield and fruit quality of tomato cultivars Guadajira and Gevora, of their parents, 'FM-6203' and 'Centurion', and of the commercial hybrids 'Soprano' and 'Suan'. Averages of the 1995, 1996, and 1997 trials.

Cultivar	Yield (t·ha ⁻¹)	°Brix	Color (a/b)	pH
Guadajira	85 ± 16 a ^z	5.3 ± 0.2 ab	2.3 ± 0.1 b	4.22 ± 0.10 a
Gevora	71 ± 18 a	5.5 ± 0.4 a	2.4 ± 0.1 a	4.22 ± 0.11 a
FM-6203	83 ± 17 a	5.3 ± 0.3 ab	2.4 ± 0.1 a	4.20 ± 0.12 a
Centurion F_1	87 ± 13 a	5.4 ± 0.6 ab	2.4 ± 0.1 ab	4.23 ± 0.07 a
Soprano F_1	89 ± 27 a	5.1 ± 0.4 ab	2.3 ± 0.1 b	4.20 ± 0.14 a
Suan F_1	89 ± 27 a	5.1 ± 0.5 b	2.3 ± 0.1 b	4.24 ± 0.21 a

^zMean separation within columns by the Student–Newman–Keuls multiple range test at $P \leq 0.05$.

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year of the study and 'Gevora' would have received a price advantage (>5.4 °Brix) in 1996 and 1997 (data not shown). 'Gevora' and 'FM-6203' were the two cultivars with best average color (Table 1). The mean pH of 'Guadajira' and 'Gevora' were identical (Table 1) and pH values were below the 4.5 maximum set by producers of concentrates (data not shown).

Both 'Guadajira' and 'Gevora' are open-pollinated cultivars competitive with the presently available commercial hybrids.

'Guadajira' has higher yields than 'Gevora', but 'Gevora' has better color and °Brix than does 'Guadajira'.

Availability

Requests for trial seeds and inquiries about stock seed should be sent to A.R.

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