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Evaluation of Peach and Nectarine Cultivars in Northern Greece

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Abstract

Peach and nectarine cultivars, grafted on the peach-almond rootstock GF677, were evaluated for productivity, fruit quality, susceptibility to Plum pox virus (PPV), mineral absorption efficiency and trunk diameter. Generally, the cultivars Nectaross, Redhaven and Tasty Free could be suggested as the best to be cultivated in northern Greece. These cultivars bloom late in March escaping from early spring frost. In addition, they are productive with quite good fruit quality and show good compatibility with the rootstock GF677. 'Nectaross' showed low tolerance to PPV, in contrast to 'Redhaven' and 'Tasty Free' which were tolerant.

Introduction

In Greece, peach is one of the most important fruit crops. Peach trees are cultivated mainly in northern Greece, where conditions are excellent. The main limiting factor to cultivation in the southern region is lack of chilling (1). Another serious problem in the Greek peach industry is the virus disease "Sharka" caused by Plum pox virus (PPV). PPV-resistant cultivars have been identified in a number of *Prunus* species (6, 9, 10). However, it is well-known that the occurrence and intensity of a disease may vary from place to place (4).

The aim of this study was to evaluate the adaptation of peach and nectarine cultivars in the soil-climatic conditions of Naoussa in northern Greece. In addition, the susceptibility of the studied cultivars to Plum pox virus was examined.

Materials and Methods

The soil analysis data for the orchard are presented in Table 1. Temperatures below 7°C were adequate to satisfy the chilling requirements of all the cultivars. The chilling units accumulated were more than 1000 every year. The mean air temperatures fluctuated from 4.5±0.4°C in January (minimum) to 26±0.5°C in July (maximum). The main rainy periods were October-December and February-May.

The experimental orchard was established in a completely randomized design with three replicates of two trees each. The planting distance was 5 X 5m. The elevation of the orchard was 132m above sea level and the distance from the sea was about 100 km. The collection of 18 cultivars was established at the Pomology Institute Naoussa in 1988. The experimental field was in a location where PPV (strain M) was endemic. The peach orchards around the experimental field were naturally infected with PPV.

There were:

- Seven freestone yellow-flesh peach cultivars: (W2, 'Elberta', 'Redhaven', 'FlameCrest', 'Aurelia', Fla 16-33, and 'Maravilha').
- Four freestone white-flesh peach cultivars: ('Maria Rosa', 'Maria Grazia' (peach), 'Genadix 4', and 'Splendid')
- Seven yellow flesh nectarine cultivars: ('Tasty Free', 'Maria Emilia', 'Sunfre', 'Maria Aurelia', 'Cassiopea', 'Nectaross', 'Maria Grazia' (nectarine)).

All cultivars were budded on GF677 peach-almond rootstock and trees were trained to a vase shape with three to five main branches and three sub-branches each. During experimentation, all cultural practices were carried out as in commercial practice (pruning, spraying, thinning, irrigation).

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Table 1. Soil analysis of the experimental orchard

Depth (cm)	Characterization of soil[z]	Electric conductivity (MMHOS/cm	Organic matter (%)	pH	Free $CaCO_3$ (%)	P ppm	K ppm	Mn ppm	Zn ppm	Fe ppm	Cu ppm
0 - 30	C-SCL	0.567[y]	1.52	8.1	9.68	120	340	9.8	4.76	2.69	13.3
30 - 60	SCL	0.758	-	8.0	18.48	-	-	-	-	-	-
60 - 90	SCL-SL	0.735	-	8.2	22.88	-	-	-	-	-	-

[z]Symbols: C=Clay, SCL= Sand - Clay – Loam, SL= Sand - Loam

[y]Values are the mean of four samples

Table 2. Bloom time, ripening period, and fruit development period of peach and nectarine cultivars in Naoussa, Greece from 1992 to 2000.

	Bloom time				Fruit
Cultivars	Start (10%)	Full	End	First harvest	development period [z]
Aurelia	10-Mar[y]	13-Mar	15-Mar	18-Aug	156
Cassiopea	10-Mar	13-Mar	15-Mar	28-Aug	166
Elberta	23-Mar	27-Mar	30-Mar	22-Jul	117
Fla 16-33	7-Mar	9-Mar	12-Mar	5-Jun	78
FlameCrest	24-Mar	27-Mar	29-Mar	19-Jul	112
Genadix 4	13-Mar	15-Mar	17-Mar	15-Jun	90
Maravilha	1-Mar	4-Mar	6-Mar	12-Jun	98
Maria Aurelia	11-Mar	15-Mar	17-Mar	21-Jul	126
Maria Emilia	9-Mar	13-Mar	15-Mar	23-Jun	100
Maria Grazia (n)	11-Mar	14-Mar	17-Mar	25-Jun	100
Maria Grazia (p)	14/Mar	17-Mar	19-Mar	12/Jul	115
Maria Rosa	10-Mar	14-Mar	16-Mar	16-Jul	122
Nectaross	21-Mar	23-Mar	26-Mar	24-Jul	120
Redhaven	24-Mar	28-Mar	30-Mar	6-Jul	98
Splendid	12-Mar	16-Mar	18-Mar	8-Jul	112
Sunfre	8-Mar	10-Mar	12-Mar	19-Jun	99
Tasty Free	21-Mar	24-Mar	26-Mar	5-Sep	160
W2	11-Mar	14-Mar	16-Mar	28-Jul	134

[z]Number of days from full bloom date to start of harvest.

[y]Values are the mean of eight years

Observations were made on the behavior of different cultivars including bloom time, time of fruit maturity, yield, absorption of nutrients, fruit quality (sample of 50 fruits per tree; mean fruit weight, total soluble solids, titratable acidity-neutralized by NaOH, firmness of flesh), trunk diameter and susceptibility to PPV natural infection (PPV susceptibility was determined with a sample of 50 leaves and 50 fruits per tree; a rating scale of 0-3 was used; 0 = healthy tree and 3 = heavy symptoms appearing in leaves and fruits).

For tissue analysis, fifty randomly selected leaves per tree for each treatment were collected (July-August) around the tree canopy at a height of approximately 1.5m. Only fully expanded, mature, healthy leaves were collected from the middle to top portion of the shoots in the morning, placed in plastic bags and transferred to the laboratory. Minerals

Table 3. Trunk diameter, productivity and fruit quality of peach and nectarine cultivars grown in Naoussa, Greece from 1995 to 2000.

Cultivars	Mean weight of fruits (g)	Productivity (kg)	Flesh firmness (kg/cm^2)	Sugars (brix)	Acids (g/l)	Trunk diameter (cm)
Aurelia	309[z] a[y]	72.9 a	8.5 ab	10.8 d	9.4 a	59.8 bc
Cassiopea	224 bc	29.8 ef	7.9 bc	15.4 a	9.4 a	68.7 ab
Elberta	236 b	43.8 cd	4.6 e	12.4 c	5.7 e	47.8 d
Fla 16-33	144 f	29.1 ef	4.7 e	11.9 cd	9.1 a	63.7 bc
FlameCrest	201 c	37.8 de	7.3 cd	12.1 cd	5.5 e	62.8 bc
Genadix 4	171 de	44.8 cd	7.5 cd	10.7 d	8.5 ab	72.3 a
Maravilha	160 ef	44.7 cd	3.0 f	11.7 cd	9.1 a	56.8 cd
Maria Aurelia	217 bc	45.3 cd	8.2 ab	12.3 c	7.1 cd	53.9 cd
Maria Emilia	168 de	21.1 f	6.5 d	11.8 cd	8.7 ab	51.3 cd
Maria Grazia (n)	179 d	20.6 f	6.8 d	12.3 c	8.1 ab	61.1 bc
Maria Grazia (p)	203 c	29.7 ef	8.7 a	12.4 c	8.3 ab	68.8 ab
Maria Rosa	231 b	46.7 cd	7.4 cd	11.8 cd	9.1 a	61.0 bc
Nectaross	215 bc	54.7 bc	6.8 d	12.6 bc	8.0 ab	60.8 bc
Redhaven	184 d	60.5 ab	4.7 e	11.4 d	7.8 bc	61.9 bc
Splendid	278 a	43.7 cd	6.7 d	11.3 d	6.9 cd	62.6 bc
Sunfre	177 de	56.3 b	5.5 e	12.6 bc	7.1 cd	69.3 ab
Tasty Free	231 b	47.4 cd	6.9 d	13.5 b	9.3 a	67.0 ab
W2	304 a	49.6 bc	7.9 bc	11.1 d	7.2 cd	68.3 ab

[z]Values are the mean of five years .

[y]Means within a column not followed by a letter in common differ at the 0.05 level by Duncan's multiple range test.

Table 4. Tolerance against Plum pox virus of peach and nectarine cultivars in field trial in Naoussa, Greece from 1992 to 2000.

	Index[z].	
Aurelia	1.04[y]	c[x]
Cassiopea	1.57	a
Elberta	0.80	d
Fla 16-33	0.57	e
FlameCrest	0.35	f
Genadix 4	0.39	f
Maravilha	1.40	ab
Maria Aurelia	0.72	de
Maria Emilia	0.38	f
Maria Grazia (n)	0.26	f
Maria Grazia (p)	0.32	f
Maria Rosa	0.77	de
Nectaross	1.12	bc
Redhaven	0.72	de
Splendid	0.86	d
Sunfre	0.55	de
Tasty Free	0.05	g
2 W	0.75	de

[z]A rating scale of 0-3 was used; 0 = healthy tree and 3 = heavy ymptoms appeared in leaves and fruits

[y]Values are the mean of eight years

[x]Means not followed by a letter in common differ at the 0.05 level by Duncan's multiple range test.

measurements were made with the method of Kjeldahl for N, atomic absorption spectroscopy for Fe, Mn, Zn, molybdophosphoric blue color method for P, flame photometry for K and E.D.T.A. titration for Ca and Mg.

Results and Discussion

This study showed that the cultivars with fewer units of cold requirements such as 'Maravilha' and Fla 16-33 bloomed early (Table 2). These cultivars are possibly very sensitive to spring frost. Because spring frosts are common in Naoussa county, these cultivars should not be cultivated in this area. In contrast, many of the cultivars tested such as 'Redhaven' and 'Elberta' bloomed late (Table 2). These cultivars can be considered as the best where spring frosts are problem.

As early cultivars 'Maravilha', Fla 16-33 and 'Genadix 4', could be considered (Table 2). These cultivars ripened the first fifteen days of June. The latest cultivar was 'Tasty Free' ripening about 5 September. The cultivars Aurelia, Cassiopea and Tasty Free have the longest fruit development period while the Fla 16-33 the shortest. The cultivars Aurelia,

Redhaven, Sunfre, Nectaross had the highest productivity, while the cultivars Maria Emilia and Maria Grazia (peach) the lowest (Table 3). The cultivars Aurelia, W2 and Splendid produced peaches with the largest size (Table 3). In contrast, peaches with the smallest size were produced by 'Maravilha' and Fla 16-33. It is known that early cultivars produce smaller fruits (Tsipouridis, unpublished data).

Plum pox virus (PPV), the causal agent of Sharka disease of stone fruit trees (3), is considered as one of the most destructive fruit-tree viruses. The prospects for resistance in various *Prunus* species against PPV were evaluated (2, 5). Polak (7) found correlation between the relative concentration of PPV determined by ELISA and PPV symptoms on peach cultivars. All trees showed the symptoms of PPV, but in different intensity. The most tolerant cultivar was 'Tasty Free' and the most susceptible were 'Cassiopea' 'and Maravilha' (Table 4). Polak (8) reported that the peach cultivar Maria Emilia is susceptible to PPV. However, this cultivar was quite tolerant in this study. A good explanation is that the susceptibility of peach cultivars to PPV differs from place to place where they are cultivated. Different resistance of peach cultivars to PPV was found by Polak et al. (9).

The tissue analyses showed that the leaf mineral concentrations of all cultivars were in normal levels (data omitted).

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