Suitability of peach and nectarine cultivars for organic production under pannonic climate conditions in Austria

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Abstract

The suitability of nectarine and peach cultivars for organic production was examined in a field experiment in the experimental orchard of the institute in Vienna. Therefore, fifteen cultivars including Redhaven as standard cultivar were planted in 2003 and cultivated organically.

Characteristics of the cultivars, such as blossom, growth, yield and susceptibility to frost damage and diseases (Taphrina deformans and Monilinia ssp.) were examined. Furthermore, fruit quality characteristics were checked in the laboratory.

The results of growth, yield, susceptibility to damages and diseases and fruit quality showed significant differences among the cultivars. 'Redhaven', 'Sweethaven', 'Redcal', 'Benedikte' and 'Mireille' can be recommended for organic production regarding the results of susceptibility of peach diseases. 'Red Robin', 'Royal Glory' and "Nectared 6' can partly be recommended. 'Weingartenpfirsich Eibesthal', 'Sunglo', 'Diamond Princess', Early Devil' and 'Royal Gem' seem to be unsuitable for commercial organic production.

Keywords: peach, organic, cultivar, quality, *Taphrina deformans*

Introduction

In opposite to conventional production in organic farming systems there are less possibilities of pest and disease management. In organic production of peaches and nectarines in Austria the most important problem is the peach leaf curl, caused by *Taphrina deformans*. The fungus effects leaves and causes loss of leaf mass in May and, in long term, decrease in yield and growth. Therefore, to minimize the risk of infections it is necessary to plant cultivars with a high tolerance to peach leaf curl, but also to other diseases and frost damages, with good yield and fruit quality characteristics. The aim of the project was to find out cultivars which are suitable to organic farming under the climate conditions of Eastern Austria.

Material and Methods

The following cultivars selected on the basis of former studies (SINKOVITS, 2000) and recommendations of tree nurseries were planted on the rootstock 'Cadaman': 'Amsden', 'Benedikte', 'Earliglo', 'Early Devil', 'Diamond Princess', 'Mireille', 'Nectared 6', 'Redcal', 'Redhaven' as standard, 'Red Robin', 'Royal Gem', 'Royal Glory', 'Sunglo', 'Sweethaven' and the local cultivar 'Weingartenpfirsich (WG) Eibesthal' in 2003 in an organically managed orchard of the research station of the institute in the north-east of Vienna. The trees were planted randomly with a minimum replication of three trees per cultivar.

Each year 2-3 plant treatments were made in the infection period of peach leaf curl with low dose of copper (0,2%) in addition to sulphur (0,6%) and soluble glass or with 'Mycosin' (0,5%).

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Between 2004 and 2007 the following characteristics were examined: beginning and length of blossom, frost damages (which occured during the night of May 1st in 2007) on young fruits, ripening time, amount and quality of yield, regarding percentage and categories of damaged fruits. Then, vegetative parameters such as growth rate of the trees, percentage and types of fruit shoots ('real' fruit shoots with fruit and leave buds in opposite to 'false' fruit shoots which only produce fruits of lower size and quality), the colour of a sample of leaves and the maximum volume of the crown were evaluated. The infection with *Taphrina deformans* was examined in May (recording infected leaf clusters) and with *Monilinia ssp.* (percentage of infected fruits) during the harvest.
Furthermore, the quality of fruits was tested immediately after yield. The research concerned colour, weight, shape, firmness of the flesh, content of vitamin c, sugar and titratable acidity and the electrochemical parameter p-value, consisting of pH, electric conductivity and redoxpotential.
All data, from 2004-2007, were analyzed statistically with SPSS 15.0 (Variance analysis with post hoc S-N-K-test, α=5%).

Results and discussion

Besides 'Early Devil' 'Red Robin', 'Royal Gem' and 'Royal Glory' were the first cultivars beginning to bloom. The cultivars that started to bloom last were 'Mireille', 'Diamond Princess', 'Amsden' and 'Weingartenpfirsich Eibesthal'. 'Weingartenpfirsich Eibesthal' and 'Royal Gem' were damaged enormously in 2007. In opposite to them, 'Early Devil' and 'Amsden', 'Diamond Princess' and 'Nectared 6' showed significant lower frost damage (table 1). The results did not show any relation between the time of bloom and the extent of damage of frost.

There were significant differences among the cultivars in yield. 'Redhaven', 'Mireille' and 'Benedikte' were the most productive cultivars (figure 1). The nectarines 'Early Devil' and 'Nectared 6' produced a high number of fruits, which were relatively small (data not shown).
It must be added, that the trees of the cultivars 'Amsden', 'Earliglo' and 'Sunglo' showed heavy chlorosis symptoms and were very weak in growth. Probably the planting material of these cultivars was infected by a virus. The obtained results of yield are not typical for these three cultivars and have to be interpreted carefully.

'Nectared 6' showed the highest percentage of Monilinia-infected fruits of all cultivars.

'Benedikte' showed a significant higher average fruit weight than 'Amsden', 'Diamond Princess', 'Earliglo', 'Early Devil', 'Nectared 6', 'Red Robin', 'Redcal', 'Redhaven', 'Royal Gem', 'Sunglo', 'Sweethaven' and 'Weingartenpfirsich Eibesthal'.

There was only one cultivar that was not infected by *Monilinia ssp.* on leaves at all ('Weingartenpfirsich Eibesthal'). Low percentages of infected shoots were recorded at 'Amsden', 'Earliglo', 'Nectared 6', 'Redhaven' and 'Royal Glory'. 'Benedikte' showed more than 7% and 'Early Devil' more than 5% of Monilinia-infected shoots (data not shown).

24,5% of the leaf clusters of 'Diamond Princess' were infected by *Taphrina deformans*. 'Sunglo' was infected heavily, too (23,5% of the brunches). The amount of infected brunches of 'Amsden', 'Weingartenpfirsich Eibesthal', 'Benedikte' and 'Nectared 6' was significantly lower (figure 2).

The growth rate of the trees was significantly influenced by the cultivar, too. There was no relation between the growth rate and the rate of leaf clusters infected by *Taphrina deformans*.

There were significant differences among the cultivars concerning fruit quality (table 2). 'Nectared 6' contained the highest amount of soluble dry matter and 'Weingartenpfirsich Eibesthal' the highest content of vitamin C.

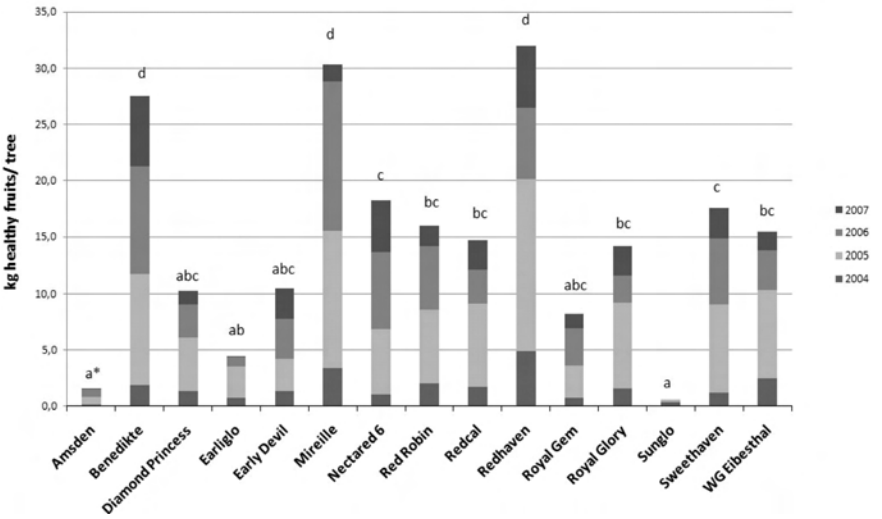

Figure 1: Accumulated yield of healthy fruits (kg/tree) (means of 2004-2007)

Table 1: Percentage of frost damage, accumulated yield efficiency, percentage of *Monilinia*-infected fruits, average fruit weight and circumference of the stem

Cultivar	Frost damage (%)**		Accumulated yield efficiency (kg/cm²)		Fruits infected by monilinia ssp. (%)***		Average fruit weight (g)		Circumference (cm)	
	May 18th 2007		1st to 4th year		2004-2007		2004-2007		2007	
Amsden	23,5	a*	0,1	ab	23,7	abc	70,4	a	14,2	a
Benedikte	41,4	abc	0,6	d	44,1	cd	166,5	e	25,5	b
Diamond Princess	23,5	a	0,3	bc	20,0	ab	129,8	cd	20,1	b
Earliglo	-	-	0,3	bc	14,3	a	72,6	a	13,4	a
Early Devil	13,8	a	0,3	bc	34,7	abcd	79,8	a	22,0	b
Mireille	46,7	abc	0,8	e	32,4	abcd	155,6	de	22,9	b
Nectared 6	24,6	a	0,5	cd	47,3	d	93,6	ab	22,1	b
Red Robin	36,0	abc	0,6	cd	18,5	a	83,7	a	20,2	b
Redcal	34,5	abc	0,4	bc	22,1	ab	129,8	cd	22,4	b
Redhaven	28,8	ab	1,0	e	21,1	ab	137,7	cd	21,4	b
Royal Gem	62,1	bc	0,2	ab	27,1	abc	131,9	cd	22,1	b
Royal Glory	41,1	abc	0,3	bc	40,3	bcd	148,8	de	25,2	b
Sunglo	-	-	0,0	a	33,3	abcd	74,7	a	14,8	a
Sweethaven	41,0	abc	0,6	d	15,2	a	94,2	ab	20,0	b
WG Eibesthal	67,6	c	0,3	bc	25,9	abc	115,9	bc	24,9	b
* ANOVA, S-N-K test, values with different letters differ significantly at alpha=5%										
** referring to 40 young fruits/tree										
*** referring to total number of fruits harvested										

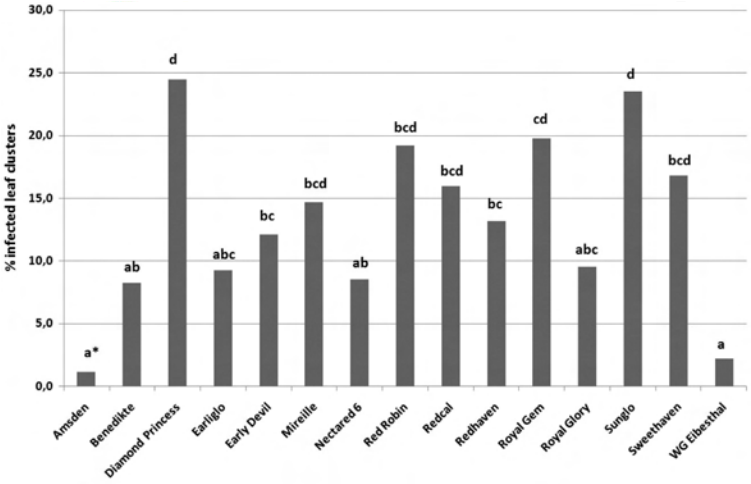

Figure 2: Infestation with *T. deformans* (means of 2005 and 2007)

Table 2: Content of soluble dry matter and vitamin C and fruit firmness

Cultivar	% Brix		Vitamin c (mg/L)		fruit firmness with skin (kg/cm²)		fruit firmness without skin (kg/cm²)	
	2005 and 2007		2007		2005 and 2007		2005 and 2007	
Benedikte	13,4	bcd*	160,0	cd	3,0	cd	1,3	bcde
Diamond Princess	14,6	d	152,0	cd	2,3	bcd	1,4	bcde
Earliglo	10,4	a	104,3	abc	1,5	ab	0,6	a
Early Devil	13,8	cd	133,0	bcd	4,7	f	1,3	abcd
Mireille	14,0	d	86,3	ab	2,0	bc	1,3	abcd
Nectared 6	14,8	d	93,0	ab	3,5	de	1,1	abc
Red Robin	12,5	bc	88,1	ab	2,6	bcd	0,6	a
Redcal	14,0	d	160,7	cd	4,1	ef	1,7	cde
Redhaven	12,1	b	137,0	bcd	4,0	ef	0,9	ab
Royal Gem	12,3	b	91,3	ab	2,7	cd	1,8	de
Royal Glory	13,4	bcd	60,7	a	3,2	de	1,7	cde
Sweethaven	10,4	a	85,0	ab	1,0	a	0,9	ab
WG Eibesthal	13,8	cd	178,3	d	2,3	bcd	2,0	e
* ANOVA, S-N-K test, values with different letters differ significantly at alpha=5%								

Conclusion

'Amsden', according to SINKOVITS (2000), and 'Weingartenpfirsich Eibesthal' showed good results in susceptibility of *Taphrina deformans*. As a consequence of the low fruit quality 'Weingartenpfirsich Eibesthal' cannot be recommended for commercial production as well as 'Early Devil'. 'Royal Gem and 'Diamond Princess' showed relatively good fruit quality but also high susceptibility of *Taphrina deformans* and *Monilinia ssp*. and cannot be recommended. 'Redhaven', 'Sweethaven', 'Redcal', 'Benedikte' and 'Mireille' showed good cumulate yield efficiency and good fruit quality and were less susceptible of *Monilinia ssp*. and can be regarded as suitable for organic production. 'Royal Glory', 'Red Robin' and 'Nectared 6' can partly be recommended for organic production.

References

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