

INFLUENCE OF THE ROOT TYPE ON THE FRUIT QUALITY OF THREE SOUR CHERRY CULTIVARS

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Abstract. The investigations were conducted in the period 2003-2005 at the Institute of Agriculture in Kyustendil /Bulgaria/ with three sour cherry cultivars – Heimanns rubinveichsel, M-15 and Nefris, self-rooted and grafted on IK-M9 mahaleb rootstock. The yield per tree, the fruit weight and the content of dry matter, the total sugars and total acids of the fruits were evaluated. The fruit yield of the self-rooted trees was smaller than that of the grafted ones in all experimental years, but the statistical analysis showed significant differences only for cv. Nefris. The rootstock used or its absence did not have considerable influence on the fruit weight. Significant differences in the fruit chemical composition between the grafted and self-rooted trees were not found and it depended mainly on the cultivar and to a smaller extent on the rootstock or its absence.

Key words: sour cherry, root type, fruit chemical composition, yield, fruit weight

INTRODUCTION

The main rootstocks for grafting sour cherry cultivars used in Bulgaria and other countries are *Pr. mahaleb* L. and *Pr. avium* L. seedlings. Rootstocks influence productivity, precociousness, tree growth, tree architecture, suckering capacity, yield, fruit size, fruit quality and adaptability to different soil and climatic conditions (Dimov, 1990; Hrotko, 1996; Koleva, 1994).

Experiments with three sour cherry cultivars: North Star, Kelleris 16 and English Morelio budded on *Pr. mahaleb* and *Pr. avium* rootstocks as well as own-rooted trees showed that the leaf content of nitrogen /N/, phosphorus /P/, potassium /K/, calcium /Ca/ and magnesium /Mg/ depended upon both cultivar and rootstock (Ugorik and Holubowicz, 1990).

It was established that self-rooted Schattenmorelle trees contained less Mg, Ca and Mn, compared with the trees on *Pr. avium* seedling rootstocks. Self-rooted trees had significantly more N and K than the leaves of sour cherry trees grown on mazzard rootstocks; however in 1991 no effect of root type on leaf N or K was found whereas in 1992 leaf K content of self-rooted trees was reduced (Jadczyk *et al.*, 1995). The results obtained confirmed that the genetic factors and particularly the type of root system can play a more important role in cherry nutrition than fertilization, size of trees and their yielding potential.

Graft incompatibility of a scion and rootstock is one of the causes for premature dying of the cherry trees. Druart (1980) supposed that the lack of a rootstock may solve this problem and improve fruit nutrition, however the production of self-rooted cultivars is limited

yet, because extensive long-term field evaluations of tree performance are needed before recommendations can be made.

The aim of this study was to compare the yield, fruit weight and some chemical characteristics of the fruits from self-rooted and grafted on IK-M9 (mahaleb rootstock) sour cherry cultivars grown in the climatic conditions of Kyustendil region.

MATERIALS AND METHODS

The investigations were carried out in the period 2003-2005 at the Institute of Agriculture, Kyustendil (Bulgaria) on three sour cherry cultivars – Heimanns rubinveichsel, M-15 and Nefris. For the purpose of the study, the cultivars were grafted on IK-M9 mahaleb rootstock (created at the same Institute by Koleva, 1994). Self-rooted trees of the same cultivars were obtained by micropropagation. Twelve trees on each scion/rootstock combination and self-rooted trees were arranged into four repetitions with three trees. The plants were planted at a spacing of 5 x 4 m in the spring of 1996 and cultivated on leached cinnamonic forest soil (luvisol) with moderately acid pH. The trees were trained as freely growing crowns. The experimental plot was not irrigated.

The yearly recorded parameters included: yield per tree, average fruit weight and biochemical composition of fruits - content of dry matter (refractometrically), total sugars (after Shoorl) and total acids (titrimetrically).

RESULTS AND DISCUSSIONS

All trees (grafted on mahaleb rootstock and self-rooted) started bearing in 4th year after planting. The annual yields and average fruit weight for each scion/rootstock combination are presented in Table 1.

Table 1
Reproductive characteristics of trees of self-rooted and grafted on mahaleb rootstock sour cherry cultivars, 2003-2005

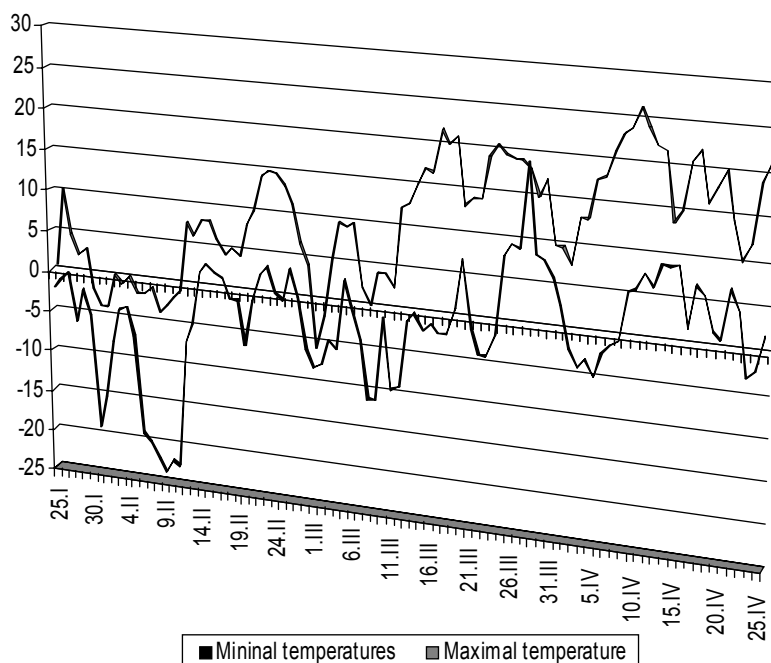
Scion/rootstock combinations	Average yield (kg/tree)				Average fruit weight (g)			
	2003	2004	2005	Mean	2003	2004	2005	Mean
Heimanns rubinveichsel / IK-M9	14.4	29.8	2.8	15.7	4.3	5.2	6.1	5.2
Heimanns rubinveichsel / self-rooted	8.1	15.6	1.0	8.2	4.2	5.0	5.4	4.9
GD 5%	NS	12.9	1.2	NS				NS
M-15 / IK-M9	27.5	52.6	2.3	27.5	4.7	6.0	6.8	5.8
M-15 / self-rooted	10.3	42.0	0.5	17.6	5.6	6.1	6.8	6.2
GD 5%	NS	NS	1.1	NS				NS
Nefris / IK-M9	24.0	50.7	2.8	25.8	4.7	5.1	6.9	5.6
Nefris / self-rooted	6.3	10.7	0.8	5.9	5.0	6.4	6.8	6.1
GD 5% 1% 0.1%	10.6	8.6 15.8 39.9	1.3	5.4 9.8				0.3

The yield from the different combinations varied in the three consecutive years. In 2004 it was higher as compared to the other two years. The highest fruit yield was obtained from the trees of cultivar M-15 grafted on IK-M9 rootstock (52.6 kg/tree) followed by Nefris on IK-M9 (50.7 kg/tree) and Heimanns rubinveichsel on IK-M9 (29.8 kg/tree).

The fruit yield of the self-rooted trees was smaller than the grafted ones in all experimental years, but the statistical analysis showed significant differences only for cv. Nefris. This was probably due to the formed smaller crowns volume (from 1/3 to 1/2) of own-rooted trees compared with those on IK-M9 rootstock (Sotirov, 2004).

The lowest fruit yields were obtained in 2005 because of the very low air temperature. On 31.01.2005 a more significant drop in the temperature started (- 19°C), which (with slight fluctuations of the minimal temperatures) continued until 11.02.2005 (Fig. 1). The lowest temperature (- 23.5°C) for the period 25.01 – 25.04.2005 was registered on 09.02.2005. Critical minimal temperatures were recorded also during the periods 8 – 12 March (- 11° to – 9.5° C); 2 – 6 April (- 5° to - 2° C), and - 3° C on April 23rd.

Fig. 1 Minimal and maximal air temperatures in the region of the Institute of Agriculture, Kyustendil for the period 25.01 - 25.04.2005



The average fruit weight of the investigated combinations ranged from 4.2g (H.rubinveichsel - self-rooted) to 6.9 g (Nefris / IK-M9) over the years and depended mainly on yield and cultivar used (Table 1)

All the cultivars tested had their highest fruit weights (from 5.4 to 6.9 g) in 2005 when the fruit yields were the lowest (from 0.8 to 2.8 kg per tree). The cultivar M-15 had the largest fruits (5.8-6.2 g) compared to Nefris (5.6-6.1 g) and Heimanns rubinveichsel (4.9-5.8 g), on the average for 2003-2005. The rootstock used or its lack did not have considerable influence on the fruit weight.

There were not significant differences with respect to the fruit weight of the grafted and self-rooted plants in H. rubinveichsel and M-15. Only for Nefris were observed statistically confirmed differences between the micropropagated and grafted trees at GD 5%.

The chemical composition was analyzed each year since 2003.

The influence of the different root system type on the medium content of dry matter, total acids and total sugars in the fruits of the investigated cultivars is presented in Table 2.

Table 2

Average Chemical composition of sour cherry fruits for the period 2003-2005

Scion/ rootstock combinations	Dry matter (%)				Total acids (%)				Total sugars (%)			
	2003	2004	2005	Mean	2003	2004	2005	Mean	2003	2004	2005	Mean
H.rubinveichsel / IK-M9	15.9	15.1	17.5	16.2	1.38	1.79	1.89	1.69	8.79	9.46	8.25	8.83
H.rubinveichsel/ self-rooted	15.6	15.3	17.4	16.1	1.40	1.90	1.96	1.75	7.96	9.89	8.14	8.66
M-15 / IK-M9	14.3	13.0	11.5	12.9	0.86	0.74	0.69	0.76	6.89	6.86	6.61	6.79
M-15 / self-rooted	15.0	13.5	12.5	13.7	1.08	0.90	0.83	0.94	7.84	6.97	7.77	7.53
Nefris / IK-M9	15.5	15.6	15.6	15.6	1.73	1.57	1.61	1.63	8.11	8.16	8.14	8.14
Nefris / self-rooted	15.6	16.0	16.5	16.0	1.68	2.15	1.63	1.82	8.79	8.87	8.03	8.56

The chemical composition varied significantly from year to year. The obtained results showed that the concentration of dry matter, total acids and total sugars in the fruits depended mainly on the cultivars and to a lesser extent on the rootstock or its lack.

With respect to the dry matter content, higher values were registered with the self-rooted trees of M-15 and Nefris than the grafted ones for the three-year period of investigation. For the cultivar H. rubinveichsel such a trend was not found.

Soluble acids content was higher in all cultivars on own-rooted trees compared to those grafted on mahaleb rootstock.

Total sugars content were also higher on self-rooted trees of M-15 and Nefris, but differences were not significant. H. rubinveichsel had the highest three-year mean of total sugars content of the fruit juice (8.66-8.83%).

CONCLUSION

The fruit yield of the self-rooted (micropropagated) trees was smaller than that of the grafted ones in all experimental years, but the statistical analysis showed significant differences only for cv. Nefris.

The average fruit weight of the investigated combinations depended mainly on yield and cultivar used. All the cultivars had their highest fruit weights in 2005 when the fruit yields were the lowest. The rootstock used or its lack did not have considerable influence on the fruit weight.

No significant differences between the grafted and self-rooted trees were found in chemical composition of sour cherry fruits. The obtained results showed that the

concentration of dry matter, total acids and total sugars in the fruits depended mainly on the cultivars and to a lesser extent on the rootstock or its lack.

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REZUMAT

INFLUENȚA PORTALTOIULUI ASUPRA CALITĂȚII FRUCTELOR LA TREI SOIURI DE VIȘIN

În perioada 2003-2005 au fost efectuate studii la Institutul de Agricultură de la Kyustendil, Bulgaria, asupra a trei soiuri de vișin Heimanns rubinveichsel, M-15 și Nefris, pe rădăcini proprii și pe portaltoiul de mahaleb IK-M9. S-au făcut evaluări asupra producției de fructe pe pom, greutatea fructelor, conținutului în substanță uscată, zahăr total și aciditate totală. Recolta de fructe pe pomii pe rădăcini proprii a fost mai mică decât pe cei altoiți în toți anii de experimentare, dar diferențe asigurate statistic s-au obținut numai la soiul Nefris. Portaltoiul utilizat or absența portaltoiului nu au influențat considerabil mărimea fructelor. Nu s-au înregistrat diferențe semnificative pentru compoziția chimică a fructelor recoltate de la pomii altoiți și conținutul chimic în aceleași substanțe a fructelor provenite de la pomii pe rădăcini proprii. Conținutul chimic al fructelor a fost influențat în principal de soi și într-o măsură mai mică de portaltoiul utilizat sau de lipsa portaltoiului.