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Field Performance of Micropropagated Plum Cv Počegača

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Abstract: Comparative study on flowering, fruit set, cropping, as well as on biological-pomological characteristics of fruit and a leaf surface in plum cv Požegača propopagated by micropropagation *in vitro* (tissue culture -TC) and standardly (standard culture - SC), i.e. grafted on Myrobalan (*Prunus cerasifera* Ehrh.), has been done. Požegača TC had a higher percentage of fruit set and yield per tree. In addition, a higher fruit and stone mass, coupled with fruit length and width, were recorded with TC plants. The leaf surface was also greater in TC plants. Generally, all the parameters monitored were higher in TC plants, but the difference was not always statistically significant.
Key words: plum, micropropagation, standard propagation, comparison

Introduction

In recent years, massive plant propagation by tissue culture has been on the increase worldwide, however in fruit growing it has mainly been economically justified in terms of the establishment of virus-free mother plantings, cultivar transmission onto its own root, small fruit propagation and fruit rootstock production.

However, more thorough studies on further behaviour of *ex vitro* plants, even of plum, can rarely be found. Phenotypic stability of some strawberry cultivars propagated by tissue culture (Swartz et al., 1981; Damiano et al., 1979), as well as pomological-biochemical characteristics of strawberry fruit (Theiler and Wolfensberger, 1987; Cerović and Ružić, 1989) have mainly been studied. Peach (Rosati and Gaggioli, 1989; Hammerschlag and Scorza, 1991), as well as pear (Sansavani et al., 1985), apple (Webster et al., 1985) and sour cherry (Rosati and

Gaggioli, 1987; Ružić et al., 1991), obtained by tissue culture were also studied comapratively with standardly propagated cultivars under *ex vitro* conditions.

According to Pejkić and Bošković (1988), a series of problems, such as later coming into bearing, extreme vigour, higher demands in terms of manure, occur with Požegača grafted on Myrobalan. On the other hand, vegetative propagation, i.e. on its own root, results in earlier coming into bearing, better fruit quality and lower vigour (Bugarčić et al., 1983). These two views were a starting point for the comparison of the results with Požegača TC and SC under *ex vitro* conditions.

Material and Methods

TC nursery trees of cv Požegača were produced by micropropagation (Ružić and Cerović, 1985) and SC nursery stock by grafting on Myrobalan (*Prunus cerasifera* Ehrh.) Eight nursery trees per combination were planted in the open field (4 x 2 replicates).

The following parameters were monitored: date of full bloom, % of opened flowers, average number of flowers/branch, % of fruits set, % of fruits remained on the branch till harvest, yield/tree, fruit mass, fruit length and width, as well as stone mass. Leaf surface was determined with the application of weight method, the so-called 'leaf contours on the paper' (Sarić et al., 1986).

All the parameters were determined in the third year after planting.

Results and discussion

Common appearances recorded on fruit species obtained by tissue culture were as follows: higher vigour, higher yield, sporadic occurrence of juvenelity and insignificantly higher fruit mass. In terms of micropropagted cv Požegača, a significantly higher number of fruits set, as well as a higher yield per tree (Table 1) (Fig. 1) were also obtained in our trial. The similar results were recorded with sour cherry by Ružić et al. (1991), with peach and apple by Rosati and Gaggioli (1989), whereas Rosati and Gaggioli (1987) reported a lower yield in sour cherry TC trees. Some peach TC cultivars also produced higher yields in the third year after planting as compared to the ones grafted (Hammerschalg and Scorza, 1991). It is assumed that a higher yield resulted from uniformity of micropropagated plants and higher growth (Swartz et al., 1983). Požegača TC trees were also very uniform, with spreading crown (Fig. 2). In terms of flowering, Mišić (1996) described cv Požegača as a late-flowering cultivar, which flowers during April, thus the recorded flowering date, i.e. 1st May, in our trial can be attributed to the effect of higher altitude of the locality in question. Ripening time (14th September) also coincides with cv Požegača ripening at higher altitudes and it may prolong till late Semptember (Mišić, 1996), hence the mentioned two parameters should not be ascribed to the nursery stock origin.

Table 1. Flowering, fruit set and cropping of plum cv Požegača (TC and SC) in the third year after planting

Cultivar	% of opened flowers	Average No of flowers/branch	% offruits set	% of fruits remained on the branch till harvest	*Yield kg/tree*
Požegača TC	50-60	66.7 a*	33.20 a	71.35 a	3.970 a
Požegača SC	70-80	61.5 a	11.38 b	71.43 a	1.231 b

*Means followed by different letter within columns are significantly different at p=0.05 according to Duncan's Multiple Range Test

However, Webster et al. (1985) reported that extreme vigour, later coming into bearing with lower yields and obligatory occurrence of juvenelity were recorded with some fruit species. It is assumed that the signs of juvenelity resulted from the effect of residues of the used hormones or a higher number of subcultures. Ružić (1993) also reported that paclobutrazol residues, which were used for rooting *Aronia melanocarpa in vitro*, were responsible for reduced growth and shortened internodes with this culture *ex vitro*. Nevertheless, all these initial negative phenomena with micropropagtaed fruit species disappear aafter several-year culture under field conditions. The signs of juvenelity were not observed with TC Požegača trees.

Fig. 1. Detail on the branch with TC Požegača fruits set

Fig. 2. TC plum cv Požegača trees in the third year after planting

Fruit and stone mass were also significantly higher with TC plants, whereas fruit dimensions, width and length, did not differ significantly as compared to SC plants (Tab. 2). Fruit mass in TC Požegača plants was higher in relation to the average fruit mass in SC plants, which, according to Mišić (1996) accounted for 17 g. Stone mass in TC plants was also higher than the average mass in SC plants, which according to Mišić (1996) totalled 0.65 g and according to Janda and Gavrilović (1984), 0.78 g.

Differences in terms of fruit mass and size in TC and SC plants are mainly insignificant and frequently beneficial for TC plants, which was proved by Ružić et al. (1991), Rosati and Gaggioli (1987).

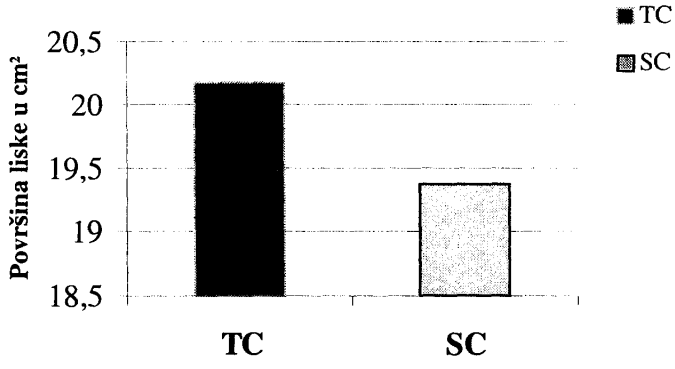
Tab. 2. Biological-pomological fruit and stone characteristics in plum cv. Požegača (TC and SC)

Cultivar	Fruit mass (g)	Fruit length (mm)	Fruit width (mm)	Stone mass (g)
Požegača TC	18.01 a*	37.83 a	27.41 a	0.98 a
Požegača SC	13.37 b	33.78 a	24.43 a	0.79 b

*Means followed by different letter within columns are significantly different at p=0.05 according to Duncan's Multiple Range Test

Nevertheless, a higher vigour, a year later coming into bearing, somewhat smaller fruits and lower yield were recorded with micropropagated plum cv Stanley. These results relate to the second year after planting, which is assumed to be an insufficient period for drawing conclusions (Popov, 1993). Lower yield and smaller fruits in dependence on the cultivar were also registered in TC propagated strawberry cultivars (Theiler-Hedtrich and Wolfensberger, 1987).

Leaf surface in plum approximated 17 cm^2 (Mišić, 1996), whereas in our trial, the stated parameter was higher, in particular with TC Požegača trees (20.17 cm^2) (Graph. 1).



Graph 1. Leaf surface (in cm^2) in TC and SC cv Požegača

Conclusions

The major characteristics of the micropropagated plum cv Požegača as compared to standardly propagated one were as follows: uniform trees, higher yield, larger fruits, larger leaf surface, whereas the onset of flowering, coming into bearing and the date of ripening were within the normal limits for ecological conditions under which the trial had been established. Lack of phenotypic changes and any other malformations in fruits of TC Požegača testifies to the stability of the material propagated in such a way. However, the increase in the application of this method for cultivar propagation and transmission onto its own root necessiates a long-term *ex vitro* culture monitoring, since some experiences prove that after a few years, pomological characteristics which were benefical for TC plants equalize with those in SC plants.

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MIKRORAZMNOŽENA ŠLJIVA CV POŽEGAČA U POLJSKIM USLOVIMA

- originalan naučni rad -

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Rezime

U radu je komparativno praćeno cvetanje, zametanje plodova, rodnost, kao i biološko-pomološke karakteristike ploda i lisne ploče šljive cv Požegače razmnožene mikropropagacijom *in vitro* (tissue culture-TC) i standardno (standard culture-SC), odnosno okalemljene na džanariku (*Prunus cerasifera* Ehrh.). Požegača TC je imala veći % zametnutih plodova i prinos po stablu. Kod TC biljaka takođe je utvrđena veća masa ploda i koštice, kao i visina i širina ploda. Površina lisne ploče je bila takođe veća kod TC biljaka. Generalno, svi praćeni parametri su bili veći kod TC biljaka, ali ta razlika nije uvek bila statistički značajna.

Nepostojanje fenotipskih promena i bilo kakvih deformiteta plodova TC Požegače daju potvrdu o stabilnosti ovako razmnoženog materijala. Međutim, da bi se ova metoda šire koristila u razmnožavanju sorti i prevođenju na sopstveni koren, potrebno je pratiti *ex vitro* kulture duži niz godina.