The Impact of the Training System on the Yield Potential of the “Čačanska Rana” Cultivar in the Second and the Third Years After Planting

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Abstract: The “Čačanska Rana” is a table plum cultivar, with early ripening season and with a vigorous to very vigorous tree, when grafted onto Prunus cerasifera, Ehrh. It is a known fact that more radical wintertime pruning in initial years will contribute to the vigour effect and postpone fruit-yielding when conventional training systems such as the ‘improved pyramid’ or the ‘vase’ are used.

The paper presents the results on the presence of various types of fruit-bearing branches in the second and the third years after planting, with the ‘Čačanska Rana’ cultivar grafted on the wild plum (Prunus cerasifera, Ehrh.) and cultivated in two different training systems:

1. ‘the spindle bush’, with 1250 trees per hectare, and without the wintertime pruning in the initial years after planting, and with the application of adequate operations during the summertime pruning, and
2. ‘the vase’, with 400 trees per hectare, with the wintertime pruning as the only operation used in establishing the training system used.

The results were that with the ‘spindle bush’ training system, the initial yield potential was achieved as early as in the second year after planting (there were 0.40 mixed and 0.80 short flowering, fruit-bearing branches per tree). However, the variation coefficient was rather high (Cv = 50.83%), meaning that the yield potential significantly varied between the trees. With the cultivar grown in the ‘vase’ training system and without summertime pruning in the first growing season, no yield potential whatsoever was recorded in the second year after planting.

During the third year after planting, the ‘Čačanska Rana’ trained to the ‘spindle bush’ system showed a significant yield potential. It had 0.95 mixed-type, 22.25 short flowering fruit-bearing branches, and 3.85 May blossoms per tree. The variation coefficient was significantly reduced, when compared to the second year, amounting to 12.28%. The same cultivar with the ‘vase’-trained tree and with standard wintertime pruning used, recorded the following initial yield potential in the third year after planting: 1.90 mixed and 1.35 short flowering fruit-bearing branches per tree (Cv = 19.80%).

Key words: yield potential, plum, the ‘Čačanska Rana’ cv., fruit-bearing branches, training system.
Introduction

In modern and high-intensity plum plantations, the primary task is the enhancement of fruit yielding. This aim is most easily and most rapidly achieved with low-vigour rootstocks (Hrotko et al., 1998; Micic et al., 2005) and with the use of specific pomotechnical operations in initial years after planting.

However, in our local conditions, the predominating, if not the only rootstock used for grafting plum cultivars on is a *Prunus cerasifera*, Ehrh. seedling, a vigorous rootstock of generative origin. In these conditions, the question is how to redirect the biological predisposition of fruits to predominantly develop vegetative organs in initial years to reproductive development and differentiation of the greatest possible number of fruit-yielding branches. The task is made even more difficult if a vigorous cultivar such as Cacanska Rana is grafted onto a vigorous rootstock.

The aim of the paper was to compare the distribution of fruiting branches in initial years after planting with the Cacanska Rana cultivar grafted on *Prunus cerasifera*, Ehrh. and trained in two different systems: in the vase system, with the use of wintertime pruning only and in the spindle bush system, without wintertime pruning used, but with specific operations applied during the growing season.

Material and Methods

The investigations were conducted in a plum plantation with the two training systems used. The cultivar used for the research was Cacanska Rana, a table cultivar with an early fruit ripening period. It is characterised by a vigorous tree, particularly when grafted on a vigorous rootstock such as the *Prunus cerasifera*, Ehrh. seedling (Ogasanovic et al., 1993; Milosevic, 2002).

In the first part of the plantation, the “vase” training system was used. The planting distance was 5 x 5 m (400 trees per hectare), and at the end of the first and the second growing season, wintertime pruning was used only with the aim of establishing the training system selected.

In the second part of the plantation, the “spindle bush” training system was applied. The planting distance was 4 x 2 m (1,250 trees per hectare). During the first and the second growing season, certain pomotechnical operations were used with the aim of establishing the training system concerned and enhancing early fruit bearing.

Before the beginning of the second and third growing seasons (the “balloon” phase), the total number of different categories of fruiting branches (mixed fruiting branches, short (flowering) fruiting branches and May blossoms) were recorded by counting.

The experiment was conducted in four replications with 5 trees per replication.
The data were analysed by calculating the mean value (\( \bar{X} \)), its accuracy being defined by calculating standard mean errors (\( S_x \)), and the relative data dispersion was determined by calculating the variation coefficient (V\%).

The LSD test was used to establish the significance of differences in the distribution of fruiting branches in different training systems.

**Results and Discussion**

**The distribution of fruiting branches in the second year**

The distribution of different categories of fruiting branches in the Cacanska Rana cultivar in the second year after planting depending on the training system used is presented in tab. 1.

<table>
<thead>
<tr>
<th>Fruiting branch category</th>
<th>Growing system</th>
<th>Spindle bush</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vase</td>
<td></td>
</tr>
<tr>
<td></td>
<td>( \bar{X} )</td>
<td>( S_x )</td>
</tr>
<tr>
<td>Mixed fruiting branch</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Short (flowering) f. b.</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>May blossom</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

No fruiting branches were recorded on the Cacanska Rana trees trained to the vase system in the second year after planting. During the first growing season an intensive shoot growth was registered. The shoots were not bent into open angle during the growing season, but only wintertime pruning and shortening were used before the beginning of the second growing season. This resulted in the absence of flowers and fruiting branches in the trees in the second year.

As regards the spindle bush system, during the first growing season, pomotechnical operations were used with the aim of establishing the training system and enhancing early fruit bearing (bending of young shoots at an open angle from the leader, twisting of young shoots, pinching of young shoots which are too vigorous...). The wintertime pruning before the beginning of the second growing season was not carried out. This all resulted in the development of a certain number of fruiting branches and in initial fruit bearing as early as in the second year. As seen from tab. 1., in the second year, 0.40 mixed and 0.80 short (flowering) fruiting branches per tree were registered. However, a rather high coefficient of variation (54.19 and 46.50\%) was recorded, meaning that the distribution of fruiting branches in the second year significantly varied between the trees.
Distribution of fruiting branches in the third year

The distribution of different categories of fruiting branches in Cacanska Rana in the third year after planting depending on the training system used is presented in tab. 2.

Tab. 2. The distribution of different categories of fruiting branches in Cacanska Rana in the third year after planting depending on the training system used

<table>
<thead>
<tr>
<th>Fruiting branch category</th>
<th>Growing system</th>
<th>Vase</th>
<th>Spindle bush</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>X</td>
<td>Sx</td>
<td>V(%)</td>
</tr>
<tr>
<td>Mixed fruiting branch</td>
<td>1.90</td>
<td>0.33</td>
<td>15.40</td>
</tr>
<tr>
<td>Short (flowering) f. b.</td>
<td>1.35</td>
<td>0.27</td>
<td>23.10</td>
</tr>
<tr>
<td>May blossom</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

LSD 0.05 1.07
0.01 2.02

In the trees of the Cacanska Rana trained to the vase system the initial yield potential was achieved in the third year after planting. There were 1.90 mixed fruit-yielding branches and 1.35 short (flowering) fruit-yielding branches per tree.

As regards the Cacanska Rana in the spindle bush system, it achieved a significant yield potential as early as the third year. 0.95 mixed fruiting branches per tree were recorded, which did not significantly differ from the number of the said branches in the vase-trained trees. However, a considerable number of short (flowering) fruiting branches was recorded in bent shoots which were not cut back. There were 22.25 of them per tree on average, which was a highly significant difference compared to the number of the branches in the vase training system. In the spindle bush training system a certain number of May blossoms in the third year after planting was also recorded. There were 3.85 of them per tree, which even more contributed to an increase in the yield potential of the cultivar grown in the spindle bush system in the third year.

The difference in the number of fruiting branches in the third year after planting between the two training systems mentioned is even more pronounced if the number of fruiting branches is calculated per unit of area.

In this respect, in the third year after planting in plantations where the vase training system was used, 760 mixed and 540 short (flowering) fruiting branches were recorded on 1 ha.

In the plantation where the Cacanska Rana was grown in the spindle bush system in the third year after planting there were 1,187.5 mixed, 27,812.5 short (flowering) fruiting branches and 4,812.5 May blossoms per 1 ha.

Similar results were obtained by Blazek et al. (2004) who analysed 14 plum cultivars grafted on two rootstocks (Prunus cerasifera, Ehrh. seedling and Wagenhaim plum) in initial years after planting. In their investigations, the Cacanska Rana cultivar grafted on the Prunus cerasifera, Ehrh. seedling achieved its first major yield potential in the third year after planting.
Conclusion

Based on the results presented, the following conclusions may be drawn:

In the second year after planting there were no fruit-yielding branches recorded in the trees of the Cacanska Rana cultivar trained to the vase system with the wintertime pruning only used. As opposed to that, the same trees in the spindle bush system and with certain pomotechnical operations used during the first growing season and without wintertime pruning achieved a certain number of fruiting branches (0.40 mixed and 0.80 short (flowering) fruiting branches per tree) as early as the second year after planting.

In the third year after planting in the vase-trained trees the initial yield potential reached was 1.90 mixed and 1.35 short (flowering) fruiting branches per tree. In the spindle-bush-trained trees, with the use of the operations during the growing season only (without wintertime pruning), as early as in the third year after planting, a considerable yield potential was achieved with 0.95 mixed, 22.25 short (flowering) fruiting branches and 3.85 May blossoms per tree.

In the Cacanska Rana cultivar grafted on the *Prunus cerasifera*, Ehrh. seedling, the use of wintertime pruning only in initial years after planting postponed fruit bearing and enhanced the vegetative growth. However, in the spindle bush training system with adequate pomotechnical operations used during the growing season, and without the use of wintertime pruning, a significant yield potential can be achieved as early as in the third year after planting.

References


Čačanska rana je stona sorta rane epohe zrenja ploda sa bujnim do vrlo bujnim stablom ukoliko se kalemi na džanarici. Poznato je da se uz primenu oštire zimske rezidbe u početnim godinama još više potencira bujnost i odlaže plodonošenje pri upotrebi klasičnih uzgojnih oblika kao što su poboljšana piramida ili vaza.

U radu su prikazani rezultati zastupljenosti različitih vrsta rodnih grančica kod sorte Čačanska rana u drugoj i trećoj godini po sadnji, kalemljene na džanarici i gajene u vidu dva različita uzgojna oblika:

1. „vretenasti žbun“ sa 1250 stabala po hektaru i bez učešća zimske rezidbe u početnim godinama po sadnji, a uz primenu odgovarajućih zahvata u toku letnje rezidbe, i
2. „vaza“ sa 400 stabala po hektaru, uz primenu samo zimske rezidbe u formiranju uzgojnog oblika.

Rezultati su pokazali da je kod uzgojnog oblika „vretenasti žbun“ već u drugoj godini po sadnji ostvaren početni rodn potencijal (0,40 mešovitih i 0,80 kratkih cvetnih rodnih grančica po stablu). Međutim, koeficijent varijacije je bio dosta veliki (Cv = 50,83%), što znači da se rodn potencijal značajno razlikovao od stabla do stabla. Kod sorte gajene u uzgojnom obliku „vaza“ i bez učešća letnje rezidbe u toku prve vegetacije, u drugoj godini po sadnji rodn potencijal je u potpunosti izostao.

U trećoj godini po sadnji Čačanska rana gajena u obliku „vretenasti žbun“ je ispoljila značajan rodn potencijal. Imala je 0,95 mešovitih, 22,25 kratkih cvetnih rodnih grančica i 3,85 majskih buketi po stablu. Koeficijent varijacije je bio značajno manji nego u drugoj godini i znosio je 12,28%. Ista sorta sa stablom u obliku „vaza“ i uz primenu klasične zimske rezidbe u trećoj godini je ostvarila početni (inicijalni) rodn potencijal sa 1,90 mešovitih i 1,35 kratkih cvetnih rodnih grančica po stablu (Cv = 19,80%).