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Effect of the length of the interstock on the growth and reproductive aspects of sweet cherry cultivar Biggareau Burlat

P. Kaymakanov*

Department of Fruit Growing, Faculty of Viticulture and Horticulture, Agricultural University Plovdiv, 12 Mendeleev, 4000 Plovdiv, Bulgaria

Abstract. In the period 2012 - 2013 the influence of 3 interstocks on growth and fruit bearing of the sweet cherry cultivar Biggareau Burlat grafted on Prunus mahaleb L. – P1 seedling rootstock was tested. As interstocks were used Gisela 5, the sour cherry cultivar North Star and the Hybrid 2/10, each of them with length 10 and 30 cm. The trees were planted in March 2006 with planting distance 6.0 x 4.5 m and were grown without irrigation and training. The sweet cherry cultivar Stella which was planted in adjacent rows was used for pollination of Biggareau Burlat. It was established that under the influence of the longer interstock the trunk size was reduced in the area of the rootstock and the interstock itself. The trunk size was bigger in the area of the scion. The differences were more pronounced where Gisela 5 was used. The longer interstock induced weaker growth of the trees grafted on Gisela 5 and reduced the crown volume. The trees with the longer interstock have larger number of blossoms per linear metre of two-year-old wood, but with lower percent of fruit set. Despite the lower fruit set the trees with the longer interstock have higher cumulative yield compared to the crown volume and the differences to Gisela 5 are proved.

Keywords: interstocks, cherry, growth, yield

Introduction

Cherry fruit production in Bulgaria is almost of an extensive type, with the use of vigorous rootstocks. Under the influence of those rootstocks the trees go later in fruit bearing – in the 4th to 6th year after planting (Baumann, 1994; Balmer, 1996; Lang, 2001) and reach heights of 8 – 10 m, which complicates fruit picking (Perry, 1987; Lang, 2000, 2001). Many research teams throughout the world are trying to solve those problems, their work is aimed in many different directions, one of which is the use of dwarfing interstocks. This was the subject of studies done by teams in Bulgaria (Koleva, 2001; Lichev et al., 2012) and abroad (Hrotko and Simon, 1996; Grzyb et al., 2004), also with different lengths of the interstock. According to Gersbach (1975), increasing the length of the interstock reduces the growth of the scion. As we had a research field available in which along with the controls (trees only with rootstock and scion), trees with different interstock lengths were tested, we set as our goal to research more thoroughly the effects of the interstock length on the growth and fruit bearing of one standard sweet cherry cultivar. The first results from our work were published earlier (Lichev et al., 2012), and in this article we present the results from the 7th and 8th vegetation after planting.

Material and methods

The studies were held during the 2012 – 2013 period at the educational and experimental field of the Agricultural University of Plovdiv. According to Pepelyankov et al. (1998), the soil in the experimental field is Chromic cambisols. The experimental trees are of sweet cherry cultivar Biggareau Burlat with rootstock Prunus mahaleb L. - P1. For interstocks (with length of 10 and 30 cm) were used shoots of Gisela 5, Prunus cerasus North star and the 2/10 hybrid (obtained at the Agricultural University of Plovdiv by crossbreeding Gisela 5 and Prunus mahaleb – P1). The trees (in 7 replications per variant in a random block design) were planted in March 2006 with planting distance 6.0 x 4.5 m, grown without irrigation and training. The sweet cherry cultivar Stella which was planted in adjacent rows was used for pollination of Biggareau Burlat. The trees were pruned at 90 cm height above the ground and after that were left without training to express their vegetative and reproductive characteristics. The obtained data were processed statistically by dispersion analysis.

Results and discussion

By the end of 2013, with all three tested interstocks (Gisela 5, North star and Hybrid 2/10), the trees with short interstock have thicker trunks (in the rootstock area), than those with longer interstock, but the differences are insignificant (Table 1). As for the thickness of the interstock, with the increase of the length their thickness is decreasing. The opposite tendency is observed for the scion thickness – with the increase of the length of the interstock its thickness decreases. The differences were more pronounced where Gisela 5 was used. The more intensive growth at the basis of the scion of the trees with longer interstock can be caused by difficulties in the assimilate flow from the scion to the root system which results in thicker trunks in this area.

Table 2 contains data about the size of the trees by the end of 2013. The height of the trees with Gisela 5 and Hybrid 2/10 was not influenced by the length of the interstock. Only where North star was used the longer interstock resulted in reduced height. Regarding the crown spread, the size is decreasing under the influence of the longer interstock; this is statistically proved where Gisela 5 was used. This results in considerably smaller crown volume of the trees grafted on Gisela 5 as opposed to the other variants in which the influence of the length of the interstock is negligible. In 2013 the trees grafted on North star showed signs of delayed incompatibility with the cultivar Biggareau Burlat, expressed by too weak vegetative growth.
growth, gum exudate and decay, so it should be noted that we cannot make categorical conclusions based on the results from the biometrical measurements from this variant. Reduced growth of the trees with North star interstock is reported during the 5th and 6th vegetation (Lichev et al., 2012). Incompatibility between the North star interstock and the grafted sweet cherry cultivar Biggareau Burlat is also observed by other authors (Rozpara et al., 2011).

In Table 3 the data about the number of blossoms per linear meter of two-year-old tree and the percentage of fruit set is presented. The data shows that with all three interstocks (Gisela 5, North star, Hybrid 2/10) the trees with the longer length of the interstock have larger number of blossoms than the ones with shorter interstock and in some cases the differences are statistically proved. In 2012 the meteorological conditions for pollination and fertilization during the first ten days of April, when the flowering phenophase mainly takes place, were very unfavorable. The almost daily precipitation resulted in very poor fruit set in all of the tested variants. Despite of the poor fruit set, the trees with longer interstocks had even lower percent of fruit set, although the differences were not significant. In 2013 the fruit set was

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**Table 1.** Trunk size of the trees, grafted on interstocks with different length

<table>
<thead>
<tr>
<th>Variant</th>
<th>Diameter, cm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rootstock</td>
</tr>
<tr>
<td>Gisela 5 – short interstock</td>
<td>15.37</td>
</tr>
<tr>
<td>Gisela 5 – long interstock</td>
<td>14.55</td>
</tr>
<tr>
<td>North star – short interstock</td>
<td>16.19</td>
</tr>
<tr>
<td>North star – long interstock</td>
<td>16.08</td>
</tr>
<tr>
<td>Hybrid 2/10 – short interstock</td>
<td>17.03</td>
</tr>
<tr>
<td>Hybrid 2/10 – long interstock</td>
<td>16.12</td>
</tr>
<tr>
<td>GD P=5%</td>
<td>1.30</td>
</tr>
<tr>
<td>GD P=1%</td>
<td>1.75</td>
</tr>
<tr>
<td>GD P=0.1%</td>
<td>2.32</td>
</tr>
</tbody>
</table>

**Table 2.** Size of the trees, grafted on interstocks with different lengths by the end of 2013

<table>
<thead>
<tr>
<th>Variant</th>
<th>Tree height, m</th>
<th>Crown spread, m</th>
<th>Crown volume, m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gisela 5 – short interstock</td>
<td>5.09</td>
<td>3.69</td>
<td>15.99</td>
</tr>
<tr>
<td>Gisela 5 – long interstock</td>
<td>5.09</td>
<td>3.09</td>
<td>10.93</td>
</tr>
<tr>
<td>North star – short interstock</td>
<td>5.05</td>
<td>3.46</td>
<td>14.10</td>
</tr>
<tr>
<td>North star – long interstock</td>
<td>4.55</td>
<td>3.6</td>
<td>14.45</td>
</tr>
<tr>
<td>Hybrid 2/10 – short interstock</td>
<td>5.08</td>
<td>3.70</td>
<td>16.15</td>
</tr>
<tr>
<td>Hybrid 2/10 – long interstock</td>
<td>5.00</td>
<td>3.46</td>
<td>14.21</td>
</tr>
<tr>
<td>GD P=5%</td>
<td>0.28</td>
<td>0.38</td>
<td>3.84</td>
</tr>
<tr>
<td>GD P=1%</td>
<td>0.38</td>
<td>0.51</td>
<td>5.17</td>
</tr>
<tr>
<td>GD P=0.1%</td>
<td>0.51</td>
<td>0.67</td>
<td>6.85</td>
</tr>
</tbody>
</table>

**Table 3.** Some reproductive aspects of the trees, grafted on interstocks with different length in the period 2012 – 2013

<table>
<thead>
<tr>
<th>Variants</th>
<th>Number of blossoms per linear metre</th>
<th>Percent fruit set</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2012</td>
<td>2013</td>
</tr>
<tr>
<td>Hybrid 2/10 - short interstock</td>
<td>34.53</td>
<td>105.03</td>
</tr>
<tr>
<td>GD P=5%</td>
<td>46.91</td>
<td>35.39</td>
</tr>
<tr>
<td>GD P=1%</td>
<td>63.17</td>
<td>47.67</td>
</tr>
<tr>
<td>GD P=0.1%</td>
<td>83.76</td>
<td>63.20</td>
</tr>
</tbody>
</table>

**Table 4.** Cumulative yield of trees, grafted on interstocks with different length

<table>
<thead>
<tr>
<th>Variants</th>
<th>Yield per tree, kg</th>
<th>Yield per tree to crown volume, kg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2012</td>
<td>2013</td>
</tr>
<tr>
<td>Hybrid 2/10 - short interstock</td>
<td>1.18</td>
<td>4.35</td>
</tr>
<tr>
<td>GD P=5%</td>
<td>1.59</td>
<td>5.86</td>
</tr>
<tr>
<td>GD P=0.1%</td>
<td>2.10</td>
<td>7.78</td>
</tr>
</tbody>
</table>
considerably better due to the favorable conditions during the flowering period. The advantage of the trees with shorter interstock which was observed in 2012 was preserved in 2013. The differences were more pronounced in trees where Gisela 5 was used as an interstock. It is noticeable that the variants with longer interstock had better yield to crown volume ratio, than those with shorter interstock, and the differences in Gisela 5 in 2013 were statistically proved.

In 2012 the fruit bearing was very poor (Table 4) which was caused by the low percent of fruit set and the fact that during 2nd, 3rd and 11th of April the daily minimum of air temperature in the region of the experimental field reached respectively -2°C, -2.8°C and -1°C which resulted in partial frost damage of the blossoms. In 2013 the fruit bearing was significantly better. The obtained results show that with both Gisela 5 and North Star the trees with longer interstock have higher cumulative yield per tree than the ones with shorter interstock, although the differences are not statistically proved.

**Conclusion**

Under the influence of the longer interstock the trunk size was reduced in the area of the rootstock as well as in the area of the interstock. The differences were more visible where Gisela 5 was used. The longer interstock affects positively the trees on Gisela 5 by reducing the crown volume. The trees with longer interstock have larger number of blossoms per linear metre of a two-year-old tree, but lower percent of fruit set. Despite the lower fruit set the trees with the longer interstock have higher cumulative yield compared to the crown volume and the differences with Gisela 5 are statistically proved.

**References**


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