

# The effect of rootstock on the tree size of apricot cultivars

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**Summary:** The apricot is propagated on several kinds of rootstocks in Hungary. The main aspects of selecting rootstocks are as follows: adaptability to environmental circumstances, primarily soil conditions, ensuring the tree size that complies with the cultivation method, and compatibility with the grafted cultivar. At advanced, intensive orchards rootstocks ensuring smaller tree size are privileged. For the establishment of the appropriate cultivation system, it is important to be aware of the expected growing vigour and tree size of certain cultivar-rootstock combinations when the orchard is designed. In the course of our experiment the size of 15-year-old trees of 4 apricot cultivars were examined on several rootstocks at an orchard in Siófok. On the basis of the data measured for each cultivar-rootstock combination, it can be stated that trees on wild apricot (*P. armeniaca*) rootstocks are the largest in size. Trees on prune (*P. domestica*) rootstock have 10–15% smaller crown volume than the previous combination. Trees on bullace (*P. insititia*) rootstock have the smallest tree size and their crown volume is 30–50% smaller than that of the trees on *P. armeniaca* rootstock. Thus, the application of prune and bullace rootstocks is beneficial at intensive apricot orchards as the size of trees can be reduced by their usage. However, their compatibility with the cultivars and their adaptability to the ecological conditions of the production site have to be tested before applying them widely. In the course of our research incompatibility was not experienced for any of the cultivar-rootstock combinations examined. Nevertheless, the drought tolerance of the rootstocks examined showed significant differences. Trees on *P. domestica* or *P. insititia* rootstock requires more water than those on *P. armeniaca* rootstock, therefore, they have to be irrigated.

**Key words:** *Prunus armeniaca*, rootstocks, tree size

## Introduction

In Hungary the apricot is mainly grafted on wild apricot or myrobalan rootstocks (Hrotkó, 1999; Hrotkó and Magyar, 2003). The use of these rootstocks results in large trees. At advanced and intensive orchards smaller trees are required, consequently, the use of rootstocks ensuring less vigorous growth is necessary. *Prunus domestica* and *Prunus insititia* used as rootstocks are known to decrease the size of apricot trees. To apply them widely their compatibility with the cultivars produced has to be studied. For the establishment of the appropriate cultivation system, it is important to be aware of the expected growing vigour and the tree size of certain cultivar-rootstock combinations. Data on tree sizes are available for us from experimental orchards and cultivar collections, but we have no sufficient information originating from orchards producing fruit for the market. In Siófok a commercial apricot plantation was established 15 years ago, where the cultivars were grafted on several kinds of rootstocks. The effects of the different rootstocks were examined from several points of view after the trees got to their fruiting age. In this paper we evaluate the effect of rootstock in the combinations of 6 rootstocks and 4 cultivars.

## Material and method

The experiments were carried out at the commercial orchard of Siófok Fruit Growing Ltd. in Siófok. For the examinations 10 trees were selected from each rootstock-cultivar combination. The cultivars examined were as follows: 'Bergeron', 'Ceglédi bíbor', 'Ceglédi Piroska' and 'Mandulakajsi'. The rootstocks examined were the

following: 4 genotypes ('CT 1301', 'CT 1426', 'CT 1650', 'CT 1652') of wild apricot (*Prunus armeniaca*) from Cegléd, the genotype 'C. 83' of bullace (*P. insititia*), and the prune (*P. domestica*) rootstock cultivar called 'Fehér Besztercei' propagated in a vegetative way.

The trees examined have natural crown shape and are maintained by branch pruning every 3rd or 4th year. The stems of the trees are 1 m tall. The orchard was planted 15 years ago. In the course of the experiment the crown of the trees were measured in three directions, and their crown volumes were calculated from these data. Considering the shape of the crown as ellipsoid, the following formula was used:

$$\text{Crown volume} = \frac{4abc\pi}{3}$$

Where the values a, b, c are the radiuses of the ellipsoid in three directions.

Data were evaluated by calculating average values and applying one-way analysis of variance.

## Results and discussion

The size of trees at fruiting age is determined by the cultivar and the rootstock together. The cultivars examined have different growing vigour. The crown size of the fruiting trees of 'Ceglédi Piroska' was the smallest (Table 1). The other three cultivars had approximately 20% larger trees than this. The trees of 'Ceglédi bíborkajsi' grew to the largest size.

The evaluation of the results referring to each rootstock-cultivar combination can be found in Tables 2 and 3. The

**Table 1** Evaluation of the crown volume of rootstock-cultivar combinations by one-way analysis of variance on the average of all the cultivars and all the rootstocks

Crown volume	Cultivars	Averages (m <sup>3</sup> )	SzD5%
On the average of the cultivars	Ceglédi Piroska	64.38 a	5.75
	Bergeron	75.98 b	
	Mandulakajszí	76.71 b	
	Ceglédi bíborkajszí	81.41 b	
On the average of the rootstocks	C. 83	51.73 a	4.46
	Fehér besztercei	69.20 b	
	CT 1650	77.83 c	
	CT 1426	79.41 c	
	CT 1652	79.85 c	
	CT 1301	85.47 d	

results of the analysis of variance are presented in Table 2, while Table 3 demonstrates the ratio of crown volumes compared to each other, taking the average of the four rootstock cultivars (genotypes) of *P. armeniaca* as 100%.

All the cultivars examined grew the largest trees on wild apricot rootstocks. If we consider the average of the four grafted cultivars, three out of the *P. armeniaca* rootstocks developed nearly the same crown size, while the crowns of trees on CT 1301 rootstocks were slightly larger (Table 1). The four genotypes of wild apricot behaved differently in their combinations with the cultivars. The crown sizes of the trees on these four rootstocks were about the same in the case of the cultivar 'Mandulakajszí'. However, significant differences were found in the case of the other cultivars (Table 2). The behaviour of the four *P. armeniaca* rootstocks differed most in the case of the cultivar 'Ceglédi bíborkajszí'. The trees on the rootstock CT 1301 developed crowns larger than 100 m<sup>3</sup>. The largest tree sizes on this rootstock were observed in the case of 'Ceglédi Piroska' as well, while the other cultivars developed the largest crowns on other rootstocks.

The trees on *P. domestica* rootstocks had 10–15% smaller crowns than those on *P. armeniaca* rootstocks (Tables 1 and 3). Our results demonstrate that this rootstock can exert its size-reducing effect more on cultivars with lower growing vigour, while this effect manifests to a lesser degree in the case of cultivars with higher growth potential. The tree sizes of the cultivars 'Ceglédi bíborkajszí' and 'Bergeron', which have high growing vigour, on 'Fehér besztercei' (*P. domestica*) rootstock was only slightly smaller than that of those on wild apricot (*P. armeniaca*) rootstock. In the case of 'Mandulakajszí' larger differences

**Table 3** Crown volume of apricot cultivars on different rootstocks

Cultivar	Crown volume (m <sup>3</sup> )					
	On wild apricot ( <i>P. armeniaca</i> ) rootstock*		On Fehér besztercei ( <i>P. domestica</i> ) rootstock		On C. 83 ( <i>P. insititia</i> ) rootstock	
	m <sup>3</sup>	%	m <sup>3</sup>	%	m <sup>3</sup>	%
Ceglédi Piroska	71.3	100	58.2	82	36.3	51
Mandulakajszí	81.6	100	69.1	85	57.3	70
Bergeron	82.2	100	72.4	88	50.2	61
Ceglédi bíborkajszí	85.2	100	70.9	83	66.2	78

\* Averages of the results of measurements on the four genotypes (rootstocks) of *P. armeniaca*

**Table 2** Evaluation of the crown volume of rootstock-cultivar combinations by one-way analysis of variance on the average of the rootstocks

Cultivars	Bergeron	Ceglédi bíborkajszí	Ceglédi Piroska	Mandulakajszí
	Crown volume (m <sup>3</sup> )			
C. 83	50.18 a	66.23 a	36.31 a	57.32 a
Fehér besztercei	72.41 b	70.91 ab	58.23 b	69.12 b
CT 1301	75.39 b	71.30 ab	66.13 c	78.21 c
CT 1426	81.74 bc	76.17 bc	68.64 c	81.19 c
CT 1650	86.01 c	81.59 c	68.95 c	83.31 c
CT 1652	86.57 c	111.74 d	81.87 d	83.54 c
SzD <sub>5</sub> %	7.62	7.73	5.95	9.22

were measured, while the largest differences were recorded in the case of 'Ceglédi Piroska' (Tables 2 and 3).

All of the cultivars developed the smallest trees on the C. 83 genotype of bullace (*P. insititia*) (Tables 2 and 3). The size-reducing effect of this rootstock manifested to a greater extent in the case of cultivars with lower growth potential, while it was not so expressed in the case of cultivars with higher growing vigour. The trees of the cultivar 'Ceglédi bíborkajszí', which has the highest growing vigour, were 22% smaller on *P. insititia* rootstock than on *P. armeniaca* rootstock. On *P. insititia* rootstock the reduction in size was 30% in the case of 'Mandulakajszí', and 39% in the case of 'Bergeron', comparing to the wild apricot rootstock. The crown volume of the cultivar 'Ceglédi Piroska' on C. 83 bullace rootstock was half of the crown volume of the cultivar on *P. armeniaca* rootstock.

Thus, the application of *P. domestica* or *P. insititia* rootstocks is beneficial at intensive apricot orchards as the size of trees can be reduced and the required crown shape can be created by their usage. However, their compatibility with the cultivars, their adaptability to the ecological conditions of the production site and their effect on fruit quality have to be tested before applying them widely.

In the course of our research incompatibility was not experienced for any of the cultivar-rootstock combinations examined. However, there are some cultivars, such as 'Ceglédi óriás' and 'Ceglédi arany', that show incompatibility with *P. domestica* or *P. insititia* rootstocks. These two cultivars can also be found at the orchard where our examinations were carried out but we had to exclude them from the experiment because only some or no trees were alive on these two rootstocks at the age of 15 years. The trees on *P. armeniaca* rootstock were healthy at that age.

The drought tolerance of the rootstocks examined showed significant differences. Trees on *P. domestica* or *P. insititia* rootstock requires a lot more water than those on *P. armeniaca* rootstock, therefore, they have to be irrigated.

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