

Vegetative growth of apricot (*P. armeniaca* L.) cultivars and rootstocks

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Abstract: The continuous innovation in point of apricot cultivars and rootstocks requires comparative trials, which can be evaluated by precise measurements. An experiment is established, initiated from the recent trends. 15 scion cultivars were budded on 6 different rootstock cultivars. Apricot seedling, Montclar, Myrobalan 29C, Wavit, Rootpack R and Fehér besztercei were used as rootstock. Scions included traditional Hungarian cultivars (Gönci Magyar kajszai, Ceglédi óriás, Ceglédi szilárd, Pannónia), naturalized cultivars (Bergeron, Roxana) and modern cultivars too (Goldrich, Tardif de Valence, LadyCot, FlavorCot, PinkCot, Spring Blush). The experiment was settled at spring of 2018, with 3 × 5 m spacing. Sprouting was 98%, the deficiency was originated only from fawn damage. The main effect of the different rootstocks can be observed in the growth habit of scions, meanwhile the scion cultivar also has a moderate impact.

Keywords: Apricot, vegetative growth, rootstock, scion

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Introduction

The beneficial properties of a rootstock can predominate in the orchard in two different ways: On the one hand, when the rootstock cultivar (composing the root system and/or the trunk) provides its attributes to the complete engraftment. The rootage of the rootstock is responsible for the water- and nutrient uptake, and for the acclimatization to the different ecological conditions. Capability of growing a stable trunk with good fitness of the trunk-training rootstock pertains here. On the other hand, predomination manifests itself in the stock and scion interaction. The rootstock affects the vegetative and generative performance of the scion, like the productivity, time of fruiting, growth rate, the quality and storability of fruits (Hrotkó 1999; Darikova et al., 2011).

Advantage of the engraftment is securing the phenological phases, and the quicker reach-

ing of productive status. Main benefit of the engraftment is the mass production at a moderate cost (Küppers 1978; Hrotkó 1999).

According to Szani et al. (2006), the most used rootstocks for apricot growing are apricot seedlings selected at Cegléd (C.1301, C.1650 and C.1652). These are fully compatible with all of the scion varieties, but remain between the limits of the species.

At evaluation of monumental rootstock experiments, Southwick and Weis (1998) concluded, that using some myrobalan rootstocks increases the mortality of apricot trees with higher rates, than those from other species. It was considered as latent (incomplete) incompatibility. Though several researches were realized in case of apricot rootstocks, these results cannot be generalized (Milošević et al., 2014, Milatović et al., 2017). We have to find those scion-stock combinations which are suitable in our growing region (Oprita and Gavat, 2018).

Materials and Methods

The trial was situated at the Research Station of Cegléd, Research Institute for Fruitgrowing and Ornamentals, National Agricultural Research and Innovation Center. The region has a temperate, continental climate with a semi-arid microclimate. This area is not optimal for apricot growing, however the one third of Hungarian apricot fields are situated in similar locations. The altitude is 96 meters above sea-level. The surface is plain with some local differences (by 1-2 meters). The experimental orchard can be approached on concrete road, and has a fence around it.

The orchard was planted in spring of 2018 in 3*5 m spacing, living mulch between the rows were sod with grass at the same autumn. The irrigation is not resolved yet. Pruning is performed several times a year, such as foliar fertilization. Plant protection is outstandingly respected. Every scion-stock combination is pleaded by three trees per replicates, two replicates are settled. Replicates are situated at a totally random arrangement, none of the rootstocks, nor the scions have the same neighbor. In case of scions, traditional Hungarian cultivars, French, Spanish, Italian, Canadian and also afghani cultivars are represented. Used cultivars are summarized in Table 1.

Further back Fehér besztercei was used expansively in Hungary as a generatively propagated apricot rootstock, but it shows some incompatibility with the cultivars, therefore Apricot seedling is commonly used. In the last decade, Myrobalan 29C came into use, and Wavit is in raising amongst others. Used rootstock cultivars are summarized in Table 2. All of the 16 scion cultivars were grafted onto every mentioned rootstock cultivar.

Data collected at the autumn of the first growing season (2018) is represented in this study. Trunk perimeter and shoot length were measured by measuring-tape (mm accurately), crown diameter and total height

were specified by measuring-rod (dm accurately). The angles of the shoots were calculated from the crown diameter and shoot length by the following equation:

$$\sin^{-1}\left(\frac{\text{crown diameter}}{2 \times \text{shoot length}}\right)$$

Results and Discussion

In this experiment the perimeter of trunks at 35 cm height, the length and angles of shoots, the diameter of crowns and the total height of the trees were investigated. Average of two replicates presented, each replicate contained three individuals. Figure 1. shows the average of trunk perimeter by scion and rootstock cultivars.

The averages of trunk perimeters were between 6.2 and 8.8 cm one year after plantation, their average was 7.1 cm. The highest value belonged to the Gönci Magyar kajszai (8.8 cm), followed by PinkCot and Bergarouge. Roxana, LilyCot and Spring Blush had the smaller perimeter, evenly 6.2 cm. In the aspect of rootstock cultivars, data of trunk perimeter ranges from 4.2 cm (Wavit) to 7.7 cm (Montclar), with a total average of 6.7 cm. Figure 2. shows the average shoot lengths.

In case of shoot lengths, higher differences were observable. At the first season Harogem (137 cm) Goldrich (133 cm) and Ceglédi óriás (118 cm) had the largest growth. The smallest enlargement belonged to Bergeron (79 cm), followed by PinkCot (81 cm) and Ceglédi szilárd (83 cm). Average shoot length was 100 cm. Per rootstocks, Wavit had the smallest growth (54 cm). Fehér besztercei (81 cm), Apricot seedling (94 cm), Myrobalan 29 C (95 cm), Montclar (108 cm) and Rootpack R (111 cm) was the ranking. Average shoot length of the rootstocks was 91 cm. Figure 3. shows the angles of the shoots.

To establish of a good income with a more intensive apricot orchard, it is essential to know the space demand of the different scion

Table 1. Used scions and their state of origin

Scion cultivar	State of origin
Ceglédi óriás	Hungary
Ceglédi szilárd	Hungary
Gönci Magyar kajszai	Hungary
Pannónia	Hungary
FlavorCot	USA
Goldrich	USA
LillyCot	USA
Spring Blush	USA
TomCot	USA
Bergeron	France
Bergarouge	France
LadyCot	France
PinkCot	France
Tardif de Valence	Italy
Harogem	Canada
Roxana	Afghanistan

Table 2. Used rootstock cultivars, their species and propagation

Rootstock cultivar	Species	Propagation
Fehér besztercei (Fb)	<i>Prunus domestica</i> L.	generatively/vegetatively
Montclar (MC)	<i>Prunus persica</i> L.	vegetatively
Myrobalan 29C (My)	<i>Prunus cerasifera myrobalana</i> Ehrh.	vegetatively
Rootpack R (RR)	<i>P. cerasifera myr.</i> × <i>P. dulcis</i> Mill.	vegetatively
Apricot seedling (As)	<i>Prunus armeniaca</i> L.	vegetatively
Wavit (Wv)	<i>Prunus domestica</i> L.	vegetatively

and rootstock cultivars (Glišić et al., 2014). Highest angles were observed at Pannónia (52°), LillyCot (50°) and Goldrich (50°). Steepest shoots were grown on Bergarouge (35°), LadyCot (36°) and Bergeron (37°). Average angle of shoots was 43° to vertical after the first season. When data was observed by rootstock cultivars, major differences remarked. Regressive sequentially the following angles were calculated: Rootpack R (47°), Montclar (45°), Myrobalan 29 C (44°), Apricot seedling (44°), Fehér besztercei (32°), Wavit (22°). Average shoot-angle

of the rootstock cultivars 39° to the vertical. Figure 4. shows the diameter of crowns of the combinations.

Crown diameters had a very large range after the first year, when the average of the scions was 87 cm. LillyCot (117 cm), TomCot (113 cm), Pannónia (112 cm) was the ranking. The narrowest cultivars were Bergeron (64 cm), Gönci Magyar kajszai (66 cm) and LadyCot (67 cm). In the aspect of rootstock cultivars, even larger differences were observable. The widest crown belonged to Rootpack R (102 cm), followed by Montclar

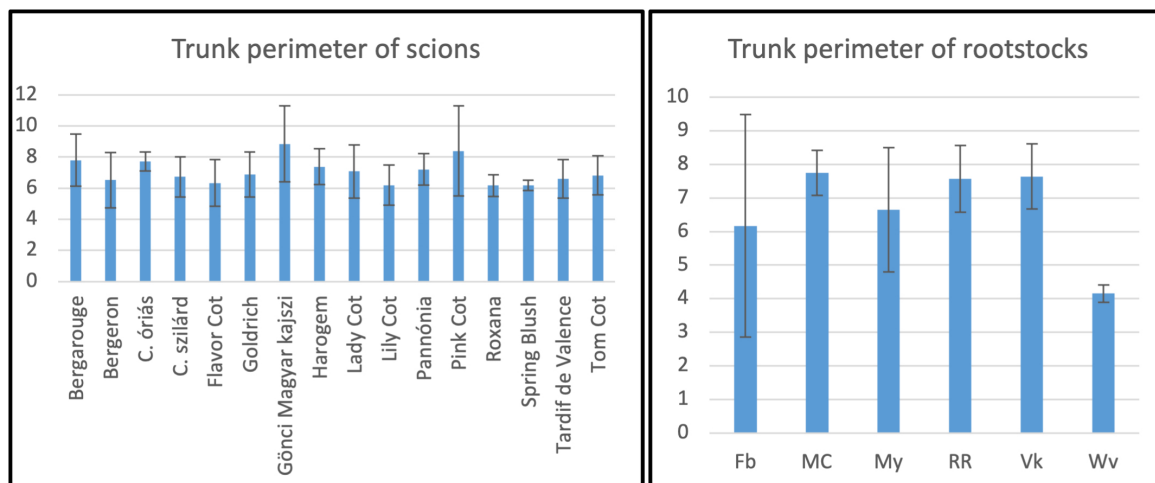


Figure 1. Average trunk perimeter by scion and rootstock cultivars at 35 cm height (cm).

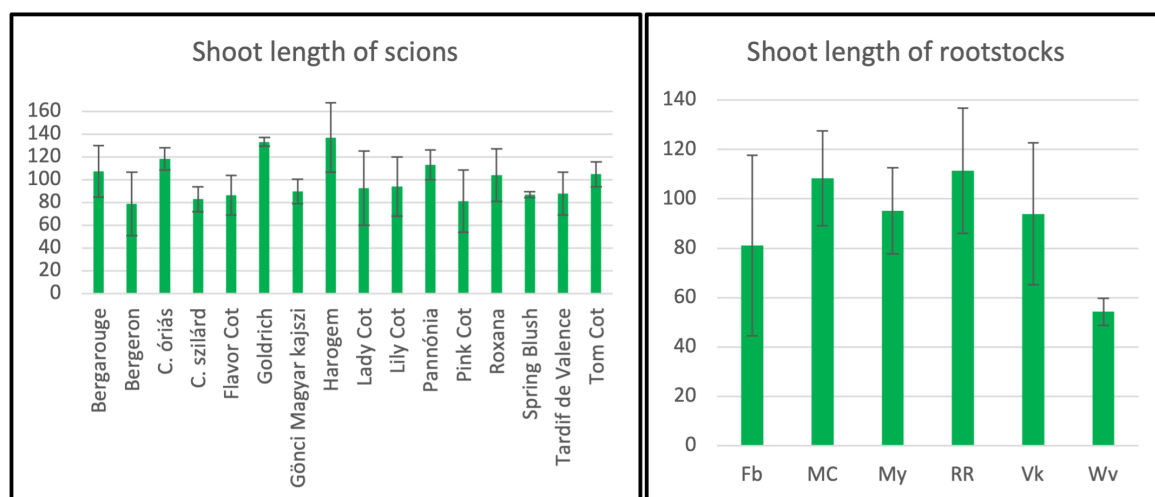


Figure 2. Average shoot lengths by scion and rootstock cultivars (cm).

(92 cm), and Myrobalan 29 C (88 cm). After this Apricot seedling came by 85 cm. Fehér besztercei (57 cm) and Wavit (34 cm) rootstocks had the two smallest crowns. Their average width was 77 cm. Figure 5. shows the total height, including the 80 cm of the trunk too.

The height of Ceglédi óriás exceeded of the scion cultivars with its average 232 cm It was followed by Bergarouge (191 cm), Pannónia (180 cm) and Gönci Magyar kajsz (179 cm). Lowest trees were in average of Roxana (124 cm), PinkCot (131 cm) and Lily-

Cot (143 cm). Average of tree height was 162 cm in total. Amongst the rootstock cultivars Rootpack R was the highest (187 cm), followed by Montclar (186 cm) and Apricot seedling (179 cm). The sequence continued with Myrobalan 29 C (140 cm), Wavit (112 cm) and Fehér besztercei (105 cm). In division of rootstocks, the average of tree heights was 150 cm. Total height of trees is smaller in average than Ognjanov et al. (2018) found in Serbia due to more drained soil conditions.

Table 3. and Figure 6. show the dispersion of the previously described values. Trunk

Table 3. Trunk perimeter, total height, crown diameter, angle of shoots and shoot length of scion cultivars

	Trunk perimeter (cm)	Total height (cm)	Crown diameter (cm)	Angle of shoots(deg.)	Shoot length(cm)
Bergarouge	7.8	191.3	71.4	35.2	107.5
Bergeron	6.5	163.3	63.5	37.2	79.1
Ceglédi óriás	7.7	232.2	89.6	46.1	118.5
Ceglédi szilárd	6.7	143.9	84.2	42.9	83.0
Flavor Cot	6.3	142.1	80.1	42.0	86.6
Goldrich	6.9	158.1	106.8	50.4	133.4
Gönci Magyar kajszi	8.8	179.0	66.4	37.7	89.9
Harogem	7.4	173.3	107.0	48.4	137.3
Lady Cot	7.1	172.1	67.3	36.2	92.6
Lily Cot	6.2	142.6	117.4	49.7	94.2
Pannónia	7.2	179.8	112.3	51.7	113.1
Pink Cot	8.4	131.3	83.3	43.2	81.3
Roxana	6.2	124.1	88.3	45.0	104.2
Spring Blush	6.2	144.6	70.4	37.4	86.9
Tardif de Valence	6.6	162.4	74.7	37.4	87.8
Tom Cot	6.8	149.1	113.3	45.7	104.9
Dispersion	0.8	25.7	18.0	5.4	17.5
Mean \pm SE	7.1 \pm 0.2	161.8 \pm 1.3	87.3 \pm 1.1	42.9 \pm 0.6	100.0 \pm 1.0
SD (5%)	1.0	29.9	19.6	5.8	20.1

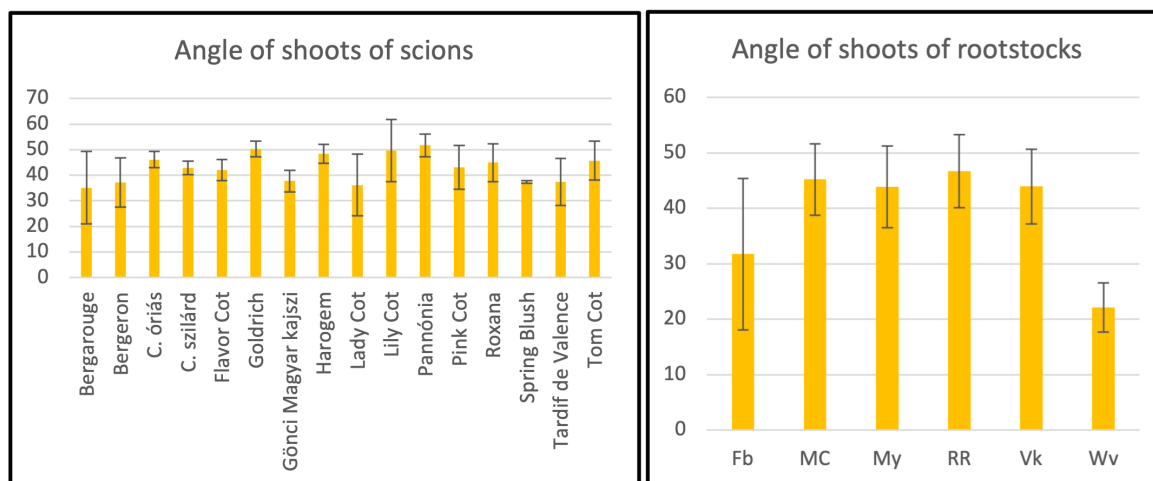


Figure 3. Included angle of shoots to vertical by scion and rootstock cultivars (deg.).

perimeter, total height, crown diameter, angle of shoots and shoot length of scion cultivars, their mean values, the dispersion, the

SE and SD values can be observed there.

Evaluating the data shows, the higher value of an attribute, the higher is the disperse

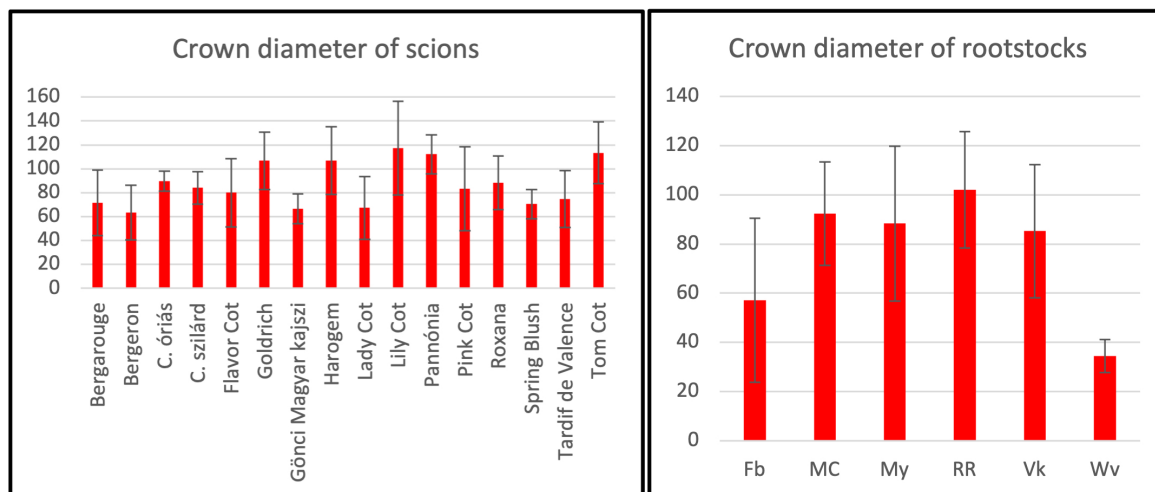


Figure 4. Average crown diameters by scion and rootstock cultivars (cm).

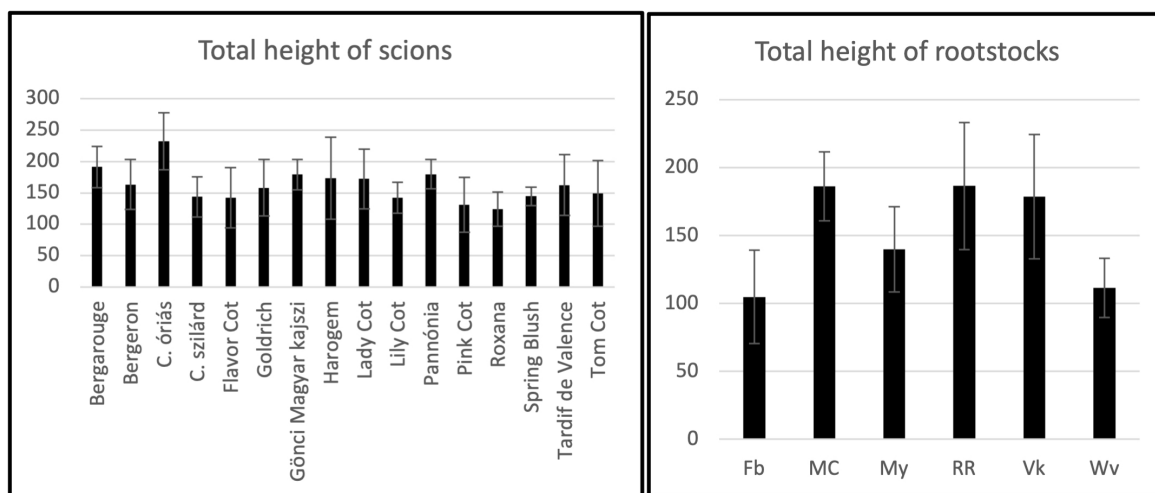


Figure 5. Average total height by scion and rootstock cultivars (cm).

of it. This property of the analysis comes from the recording of data, and is not considered as a scientific achievement in this experiment. However, it can be seen that in every measured attribute the dispersion between rootstock cultivars were higher than between scions. Percental fraction of distributional values of the rootstocks were established from these data. 63.2% of trunk perimeter, 58.6% of total height, 57.9% of crown diameter, 64% of angle of shoots, 53.7% of shoot length depends on the cultivar of rootstock.

Conclusions

1000 apricot trees were planted from 96 combination of 6 rootstock and 16 scion cultivars. Data were collected from 5 properties which describe well the vegetative growth of an graftment. Scion cultivars represents the cultivar preferences in Hungary, while there are less used rootstock cultivars (Rootpack R, Montclar) in this trial too.

Highly vigorous rootstocks are Montclar and Rootpack R, these cultivars had the highest values in all cases. Apricot seedling and My-

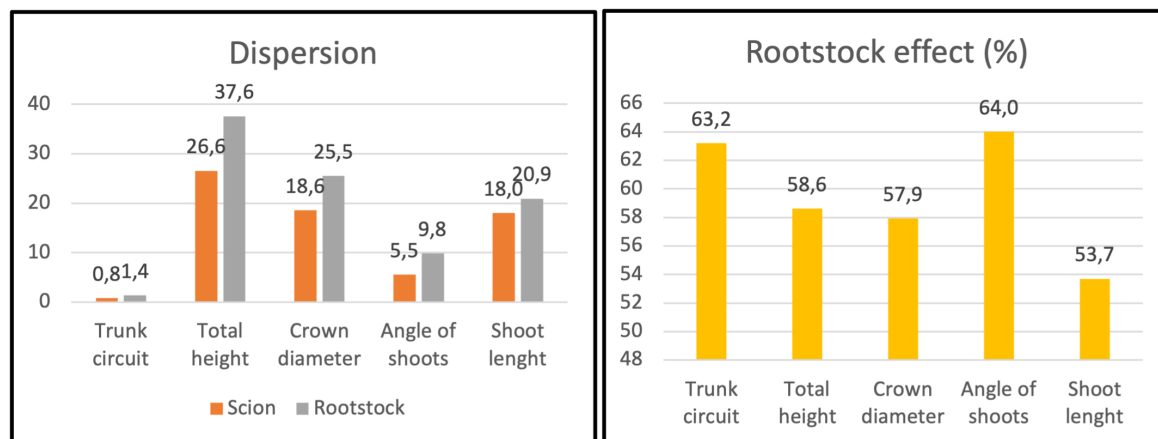


Figure 6. Dispersion of data divided by scion and rootstock cultivars, and fraction of rootstocks of dispersion (%).

robalan 29 C can be typified with moderate growth habit with very similar characteristics. Weak growth was observed at Fehérbesztercei and Wavit rootstocks. Wavit rootstock cultivar had the lowest parameters in every case. Here, it had to be declared, that our non-irrigated circumstances are not ideal for this last two rootstocks (for they plum origin).

In case of scion cultivar, it is harder to make up discrete categories like previously. Some parameters are not in strong correlation with others, but differences can be observed here too. As a general principle vigorous growth typifies the Ceglédi óriás, Pannónia, Goldrich, Harogem, TomCot and Bergarouge cultivars. Roxana, PinkCot, Ceglédi szilárd and Spring Blush

cultivars appeared with expressly weak growth. The other cultivars positioned between this two separate groups.

It appears unequivocally, that the rootstock cultivars give the bigger portion of the differences of growth habit in this experiment, therefore it has to be a very important element of the planning of a growing system. Vigorously growing rootstocks are suitable for replanting or refilling apricot trees, while weak rootstocks are only acceptable with proper irrigation and fertilization for ensuring the lower spacing in the orchard. Besides this, scion cultivars responsible for important differences (36-46%). Accordingly, if other factors permit, the vegetative growth could also be an aspect of choosing a cultivar.

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