Evaluation of time demands of pruning selected apricot varieties and rootstocks

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Abstract

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The study conducted over the period 2008–2012 demonstrates labour intensity requirements for dormant pruning of selected apricot varieties (Leskora, Betinka, Marlen) on different rootstocks (Julior, M-LE-1, Penta, Tetra, Green Gage, Ishtara and MY-KL-A). The pruning and the assessment of time needed for pruning bearing trees was done in early spring each year during the given period. The results indicate that the labour intensity, i.e. time required to prune the tree depends on variety/rootstock combination. The control variety Marlen on M-LE-1 rootstock required the least amount of time for pruning (138.3 s). Compared to the control, variety Leskora on Penta rootstock was the most time consuming (+125.2 s). With regards to the rootstocks, MY-KL-A (–6.2 s as compared to control) was recommended as the least time-consuming, while rootstock Penta (+41.4 s as compared to control) proved to be the most time-consuming.

Keywords: apricot; winter pruning; labour intensity; variety; rootstock

Bearing apricot trees are considered less labour intensive for pruning. In production orchards, the pruning depends on the intensity of agro-technical measures as well as on the training system. For modified leaders and open centre systems, mechanical uniform contour pruning is frequently applied after harvesting, followed by selective pruning in early spring.

The proper timing of pruning plays a very important role, mainly because of potential infection by wood-decaying fungi. Ingels and Dong (2000) identified a period between mid-February and early March as better timing for pruning stone fruit, than winter season. Wounds pruned during dormant season heal more quickly than those pruned earlier (less rainfall, less harmful organisms).

Summer pruning of non-bearing trees decreases tree size (Gaash 1981). Vachůn (1996) found no significant correlation between the tree growth and pruning intensity.

Summer pruning according to Prof. Sitt's method (Sitt 1952) affects the sprouts development in apricot trees. Milošević et al. (2011) compared three dates of pruning (June 5, July 1, July 15) in three varieties originating in European eco-geographical group and identified that the most positive response occurred to pruning on July 1 (e.g. decrease of growth vigour and positive correlation between generative and vegetative buds).

Relation of the intensity of pruning to apricot rootstocks has been rarely reported. The objective of this study is to assess time demands for apricot

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pruning of bearing trees on seven different rootstocks.

MATERIALS AND METHODS

During the 2008–2012 period, conducted on the premises of Fruit Growing Department, Faculty of Horticulture, Mendel University in Brno, Czech Republic an experiment was conducted to provide information on how different varieties, rootstocks and variety/rootstock combinations influence the labour intensity/time requirements for dormant pruning of apricots. The orchard was established in 2004 and trees were trained to the modified leader training system. The weather is typical for temperate climate zone. The average annual temperature is 9.7°C and annual rainfall averages at 537 mm (long-term average calculated over the period of 1901–2010). In this area the early spring temperatures often fluctuate and are accompanied by spring frosts in the time of bloom and fruit development. Trees were planted with the spacing of 5 × 3 metres. The soil type is classified as loamy sand, alluvial and the soil group being chernozem. Standard fertilization and plant protection treatment was applied in the orchard.

The experiment included the following apricot varieties: Leskora, Betinka, Marlen (clone of variety Hungarian Best) and rootstocks Julior, M-LE-1 (apricot seedling), Penta, Tetra, Green Gage, Ishtara, MY-KL-A (Myrobalan clone). These varieties and rootstocks were used to form the following combinations – Leskora formed 7 combinations, Betinka 5 combinations and Marlen formed 7 combinations. Overall 19 combinations were subject of evaluation. Variety Marlen grafted on rootstock M-LE-1 was chosen as the control combination, the M-LE-1 was set as control rootstock and Marlen was set as the control variety.

Growth characteristics and time requirements for pruning were evaluated on the basis of methodology for apricot varieties and hybrids (Vachůn et al. 1995), and were defined by time required for effective crown pruning (seconds/tree). This indicator for each of the mentioned combinations was evaluated graphically and consequent statistical analysis was performed by the means of Statistica 10 software (StatSoft, Inc., Tulsa, USA), one-way and multi-factor ANOVA analysis. The evaluation was carried out for each variety/rootstock combination, for each rootstock and for each variety, separately. Statistical significance of differences was set between the control combination (Marlen/M-LE-1) and the other combinations, the control variety (Marlen) and the other varieties as well as between the control rootstock (M-LE-1) and the other rootstocks, where (a) stands for insignificant differences, (b) for significant differences, (c) for highly significant differences.

RESULTS AND DISCUSSION

In this experiment, maintenance pruning on the control variety Marlen grafted on rootstock M-LE-1, took 138.3 s/tree on average. With regards to time required for pruning rootstocks, the control rootstock M-LE-1 took 181.3 s/tree on average. As for time demands for pruning the varieties, the selected control variety Marlen required 174.4 s/tree on average. The mentioned assessments were accompanied

Table 1. The average time required for pruning the combinations, varieties and rootstocks for period 2008–2012 compared to the control combination Marlen/M-LE-1, the control rootstock M-LE-1 and the control variety Marlen

Rootstock/Variety	Betinka (s/tree)	Leskora (s/tree)	Marlen (s/tree)	Overall (s/tree)
Julior	50.2 ± 9.9224[a]	67.5 ± 9.7043[a]	22.9 ± 9.7043[a]	3.8 ± 5.4672[a]
M-LE-1	10.8 ± 10.0372[a]	118.2 ± 10.0372[c]	0.0 ± 10.6771[a]	0.0 ± 5.7256[a]
Penta	45.6 ± 10.2791[a]	125.2 ± 9.8116[c]	77.9 ± 10.677[a]	41.4 ± 5.7256[a]
Tetra	31.7 ± 10.0372[a]	112.5 ± 9.9224[c]	16.2 ± 13.4351[a]	17.4 ± 6.0516[a]
Green Gage	37.4 ± 11.1253[a]	47.2 ± 10.6771[a]	38.1 ± 10.5393[a]	−2.0 ± 6.0246[a]
Ishtara	–	83.9 ± 10.1559[b]	68.9 ± 10.6771[a]	33.8 ± 7.1284[b]
MY-KL-A	–	47.6 ± 9.9224[a]	25.4 ± 10.1559[a]	−6.2 ± 6.8752[a]
Overall (s/tree)	−1.1 ± 4.2256[a]	50.6 ± 3.4899[c]	0.0 ± 3.7256[a]	

values are mean ± standard deviation; values followed by the same letter are not significantly different at α = 0.05

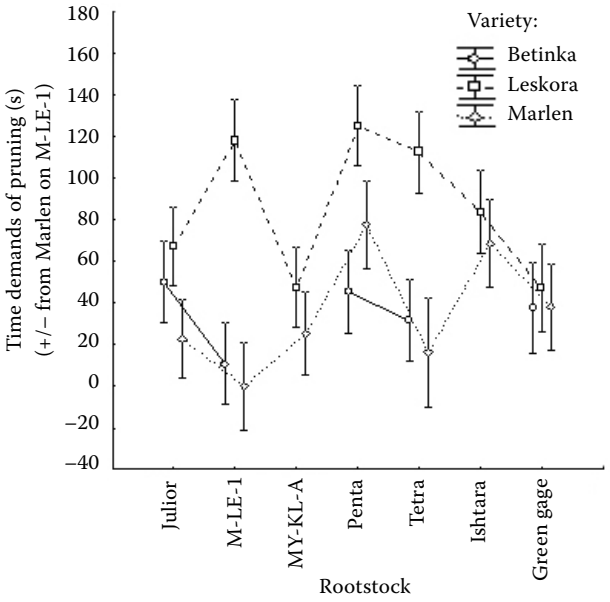

Fig. 1. Statistical description of time demands of pruning the variety/rootstock combinations compared to the control variety Marlen/M-LE-1 for the period 2008–2012

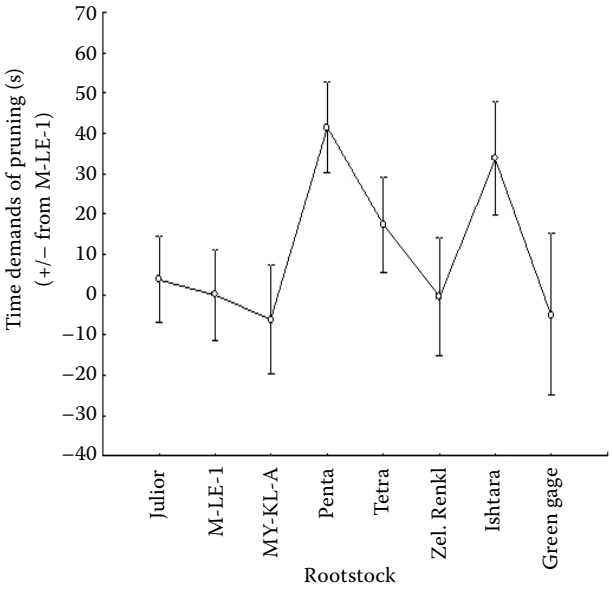

Fig. 2. Statistical description of time demands of pruning the rootstocks as compared to control M-LE-1 between the years 2008–2012

by time frames for pruning the evaluated combinations, varieties as well as rootstocks (Table 1).

As for time demands for pruning each combination, variety Leskora grafted on rootstock Penta (+125.2 s from the control variety) was identified as the most time-consuming. On the other hand, the control combination Marlen grafted on M-LE-1 (138.3 s) took the least time to prune. Comparing all the combinations, statistically significant differences were found between the control variety and the variety Leskora grafted on Ishtara (P = 0.02). Highly significant differences in time required for pruning were identified between the control combination and variety Leskora grafted on Penta (P = 0.00), Tetra (P = 0.00) and Green Gage (P = 0.00). It is evident that pruning the combinations of Leskora variety required roughly tens of seconds more in comparison with the other combinations of Betinka or Marlen varieties (Fig. 1).

As for rootstocks (Fig. 2), Penta was identified as the most time-consuming when compared to the control rootstock M-LE-1; it required 41.4 s more for thinning. The least time-consuming was MY-KL-A requiring 6.2 s less than control. Significant and highly significant statistical differences were found between control rootstock M-LE-1 and rootstocks Ishtara (P = 0.04), and Penta (P = 0.00).

However Missere et al. (2010) describes different results. Rootstocks Penta and Tetra proved to be of intermediate vigour, with values close to Myrabolan 29C, and apricot seedlings were the most vigorous in all combinations. The particular soil and climate conditions and combination with variety may significantly influence this behaviour.

According to Monney et al. (2010), growers could be interested in low-vigour rootstocks for better vigour control and fruit quality. The modified apricot spindle is the main training shape in modern apricot plantings and selection of suitable rootstock is one of most important factors from the tree vigour and pruning demands point of view.

As for varieties, Leskora was the most time-consuming variety, requiring 50.6 s more for pruning as compared to the control variety Marlen. On the other hand, Betinka required 1.1 s less than the control variety and thus was classified as the least time-consuming variety for pruning in the evaluated collection. Highly significant differences in time demands were found between the control variety Marlen and Leskora (P = 0.00).

According to Neri et al. (2010), apricot varieties show different architecture in their tree growth habit and fruiting branches. The most common groups are: (A) with a very vigorous and spreading growth habit, and tendency to bear fruit on spurs, brindles and sylleptic shoots; (B) with a generally less vigorous and semi-spreading growth habit, and with capacity to produce fruit on spurs and more vigorous shoots; and (C) with a very vigorous, mixed spreading growth habit, and ability to produce fruit on all kinds of shoots.

Another difference was confirmed with regards to time demands for pruning the apricots from a wide genetic base. Leskora is the fourth generation of breeding in prof. Hough programme (Rutgers University, New Brunswick, USA). On the other hand, bearing apricot trees with upright growth habit required the least amount of time for pruning. M-LE-1 apricot seedling as well as some rootstocks from other Prunus species such as MY-KL-A and Green Gage showed no statistical differences in time requirements for pruning.

The least time-consuming combination proved to be the variety Marlen on rootstock M-LE-1 (138.3 s/tree). Among the rootstocks, MY-KL-A (175.1 s/tree) was identified as the least time-consuming. Betinka (173.3 s/tree) was evaluated as the least time consuming compared to the other two varieties in this study. Based on the obtained data, Marlen/M-LE-1 combination (control) can be recommended as the least time-consuming in performing maintenance pruning. Rootstocks MY-KL-A, Julior, M-LE-1, Green Gage can be considered as less time-consuming. As for the apricot varieties, Betinka and Marlen varieties required the least time for pruning. In addition, the origin of apricot varieties influenced the pruning time requirements. Different pruning time demands were also observed evaluating the collection of rootstocks.

CONCLUSION

In the experiment on apricot rootstock, the evaluation of labour intensity of pruning the selected combinations variety/rootstock with different time demands was conducted. The least time-consuming combination proved to be the variety Marlen on rootstock M-LE-1 (138.3 s/tree). As for rootstocks, MY-KL-A (175.1 s/tree) was identified as the least time-consuming and from the collection of three varieties, Betinka (173.3 s/tree) was evaluated as the least time consuming.

On the basis of the obtained data, combination variety/rootstock Marlen/M-LE-1 (control) can be recommended as the least time-consuming with regards to time demands for maintenance pruning. Rootstocks MY-KL-A, Julior, M-LE-1, Green Gage can be considered as less time-consuming. As for the apricot varieties, Betinka and Marlen varieties required the least time for pruning. In addition, different time demands of varieties were confirmed with regards to their origin. Different time demands were also observed in evaluation of the collection of rootstocks.

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