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The size of the canopy of sour cherry trees depends on the time of pruning

Gonda, I.

University of Debrecen, Centre of Agricultural Sciences, Department of Fruit Production
138 Böszörményi Street, H-4032 Debrecen, Hungary

Summary: The intensive culture of sour cherry is achieved by training of trees to form smaller canopies not by means of dwarfing rootstocks but by growth moderation techniques. The rootstocks traditionally used cause vigorous growth, and it is up to the technology to apply procedures less utilised earlier for that purpose. One of those techniques is the transfer of hibernal pruning to the estival period. The best term of the latter is the period of 1–3 weeks after fruit harvest.
The prolongation of the period of favourable illumination and the reduction of the canopy size facilitate higher densities of planting (number of trees per hectare) and a better exploitation of the crown (specific yield). The regular use of summer pruning resulted also in a better quality of fruit.

Key words: sour cherry, dormant and summer pruning, size of canopy

Introduction

Criteria of quality are increasing in both fresh consumed as well as processed sour cherries. The same is experienced in all stone fruit species, especially in sour cherry being mainly processed. The high quality fraction of the crop could be increased by the intensity of growing technology. That purpose is favoured mainly by the reduction of size and higher density of trees. Both are aiming at the improvement of the cropping surface of the plantation (i.e. the optimal illumination of fruiting structures).

Hungarian sour cherry cultivation developed during the last decennia according to extensive marks, the crop being aimed to be processed. Instead of the large crowns with a central axis and scattered distribution, which did not suit to the mechanical shaking techniques, the vase type crown is favoured. In those arrow-less trees, the illumination is improved, however, the shaded area is still too large. A further diminution of the vase-type crown combined with increasing density (trees per hectare) would not serve the purpose by reducing the applicability of mechanical shakers. The solution of the dilemma would be the introduction of a more frequent and more thoughtful pruning system.

A substantial fraction of Hungarian sour cherry varieties yield an excellent quality for fresh consumption too, which also urges the necessity of a more intense growing practice. The smaller crowns would also facilitate the training and harvesting operation, moreover, the higher fruit quality would benefit both fresh consumption as well as processing of sour cherries.

As a rootstock in Hungary, mainly *Prunus mahaleb* is used, being compatible with almost all sour cherry varieties and supplying the vigour required for regeneration if pruning and phytosanitary conditions are provided (Hrotkó, 2003). For an economical fruit growing, we need vigorous rootstocks, which tend to brake the processes of senescence. Therefore, we claim that the use of "dwarfing" rootstocks will not have any advantage in the future neither. The smaller tree size ought to be achieved by phytotechnical measures, by means of the application of special technological elements, which reduce the size of trees.

Our attempts focused on pruning of different intensity regularly repeated at marked intervals either in summer or in winter, checking its effect on the growth, consequently, on the size of trees. Meanwhile, we checked also the fruit quality on the crop produced on the inner part of the canopies.

Materials and methods

The experimental plantation started in 1995 at Pallag, Farm of the Debrecen University, with the planting of two sour cherry varieties: 'Érdi bőtermő' and 'Újfehértói fürtös'. Grafted on *Prunus mahaleb* and planted to 5 × 3 meter, the half of the plantation was pruned during the rest period only according to the customary maintenance system (being the check of the experiment), whereas the other half of the orchard was pruned every year after harvest, within 3 weeks between July 10 and 30 (which have been called further on as green pruning).

The trees were trained by pruning to form a spindle crown, which proved to be a free spindle in the control

treatment, but a combination of the free spindle and the slender spindle on the trees of green pruning treatment.

The pruning applied

The time of pruning

According to experiences gained during the last ten years, the optimal term of summer pruning used to be the first to third week after fruit harvest. During that period as a reaction to pruning, no vigorous long shoots used to appear (except in especially rainy seasons), which would develop intense shadow within the crown. At the same time, the beneficial effect of summer pruning opens the inner part of the canopy to light, which improves the photosynthesis and stimulates the differentiation of flower buds. The rest of the summer, 3–4 months used to be sufficient to accomplish the initiation of buds. Summer pruning of earlier terms may stimulate shoots, which cause the opposite effect, i.e. increase the density of canopies. A later than optimal pruning, on the other hand, diminishes only the photosynthetic potential of the tree.

The extent and the method of pruning

Severity of green pruning should be performed according to the practice applied to winter pruning. As a rule, shoots of 1–2 year, or in seasons of vigorously growth, 3 year-old, are cut back with the purpose to clear out the canopy. Particularly, all perpendicularly or nearly so growing shoots of the inner parts were eliminated in order to let sunlight penetrate in this region. Other shoots were not touched, but the perpendicular ones were reduced to stubs of 1–2 cm. The drooping shoots, if getting bare, were eliminated without stubs. Shoots were never trimmed.

During the first 3 years, the concurrent shoots of the main stem and the lateral branches were eliminated in order to stimulate the longitudinal expansion of the crown up to the final size. Lateral branches, especially those, which were under the shadow and tended to get bare were eliminated until the next active shoot.

The severity of pruning achieved a rate of 20–30% compared with the untouched crown and depending on the particular season.

During the 10 years of the experiment, it occurred two times that 3-year-old branches were needed to be sawn and lateral shoots to be shortened in order to secure better illumination and to keep the crown within the right space. Meanwhile, we took into consideration the rules of *Zahn* (1986, 1990) concerning the optimal relations between the cross sections of axis and the lateral branches.

After green pruning, we endeavoured to keep the foliage healthy until the fall time, which needed some spraying 2 or 3 times depending on the season.

For the purpose to check chemical quality of fruit, samples were taken from both treatments considering also the intensity of illumination:

- from the periphery, the most sunlit parts of the crown and
- from the inner, most shadowed part of the crown, where diffuse light was available.

As for the characterisation of tree growth, the following measurements were performed:

- the cross section area of the trunk (cm^2)
- the height of trees (m)
- the lower maximum diameter of crown (m) and
- the calculated crown volume (ground area (m^2) x height of crown (m) = m^3)

Results

The effects of the yearly-performed green pruning moderated significantly the growth of trees compared with the winter-pruned control. The cross section area of the trunks was reduced during the 10-year-long period of treatment of green pruning by 52% in 'Újfehértói' trees, whereas 17% in 'Érdi bőtermő' trees compared with those treated according to the customary winter pruning method (*Figure 1*).

The volume of the crown was also reduced as an effect of green pruning: by 42% in 'Újfehértói fürtös' and 54% in 'Érdi bőtermő'. In the size of trees, the differences were conspicuous as they filled out the space assigned to them, in spite of the regime of pruning, which was restrictive in the winter pruned treatment whereas stimulating in the green pruned treatment.

In 1999 – when the plantation was 5 year old – the difference of crown volume was only 11% in 'Érdi bőtermő' and 21% in 'Újfehértói fürtös'. Further regular green pruning doubled the reducing effect on the crown of 'Újfehértói fürtös', whereas exceeded even this effect in 'Érdi bőtermő'. The green pruned trees still did not fill up the 3 m spacing even after 10 years (*Figure 2*).

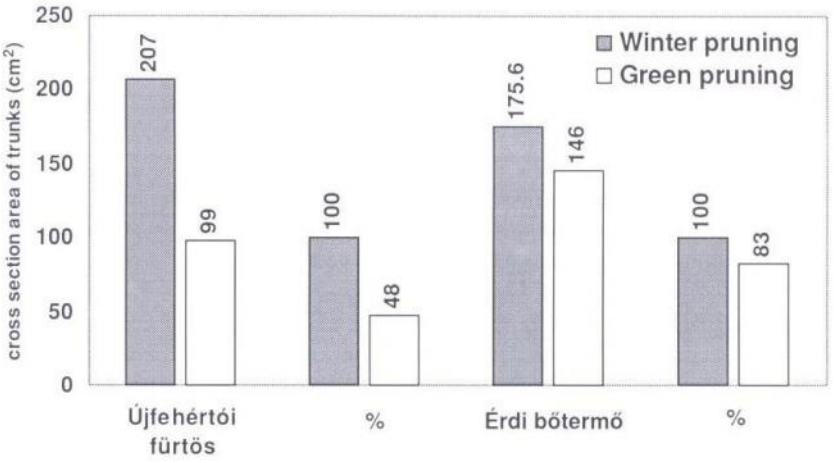

Figure1 Effect of the time of pruning on the cross section area of sour cherry trees (Debrecen-Pallag, 2004)

After the first fruit crop, no substantial difference was observed between the treatments regarding fruit quality in any year. The data of yield obtained in 2004 are suggestive. However, the specific yielding capacity referring to the cross section area of the trunk was improved by green pruning substantially. The smaller crowns were much more exploited with the green pruning techniques (*Figures 4* and *5*).

Conclusions and suggestions

In sweet and sour cherry as well as in early ripening plum, green pruning exerts a beneficial effect on the fruit quality but according to different mechanisms compared with apple (pomaceous fruits) and peach varieties. The latter fruits should be given more sunlight during the growing season in order to improve the development of cover colour and chemical composition of the growing fruits.

In our experiments, the post harvest pruning of trees was aimed at an intensified illumination of the vegetative organs of the trees during the second half of summer and the next spring.

Customary winter pruning improves the light conditions of the tree during the next spring only. Depending on variety and intensity of pruning, the crown got "closed" from the end of May until the mid of June, when the dense canopy together with the neighbouring trees create a massive shadow on the inner part of the crown. Afterwards, this region of the crown grows under a dense shadow over 4–4.5 months until the fall of leaves.

The products of the intense photosynthesis on the outer parts of the crown are partially consumed by the poorly supplied organs of the inner parts, thus diluted, and that impairs the quality of the whole crop.

Winter pruning does not change much in relation to the trees, which were not pruned at all because the dense growth starts just at springtime and continues all over the summer.

Green pruning eliminates almost all weak consequences of the winter pruning. The next spring finds the green (in July) pruned trees as which were winter pruned, i.e. the crown is sufficiently cleared. Some dense growth may occur though less intense around the end of June on the periphery.

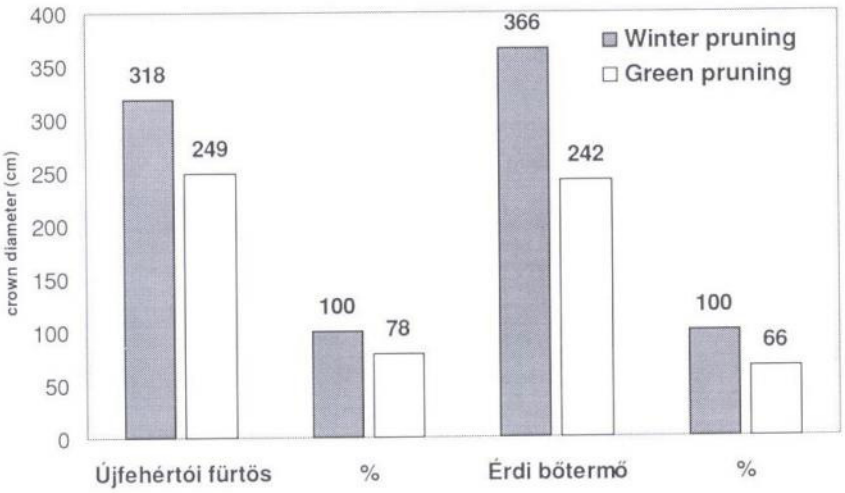

Figure 2 Effect of the time of pruning on the crown diameter of sour cherry trees (Debrecen-Pallag, 2004)

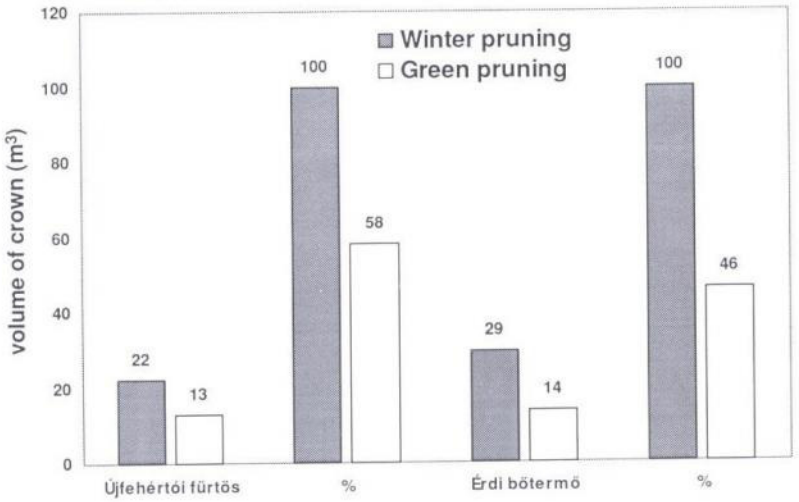

Figure 3 Effect of the time of pruning on the volume of crown of sour cherry trees (Debrecen-Pallag, 2004)

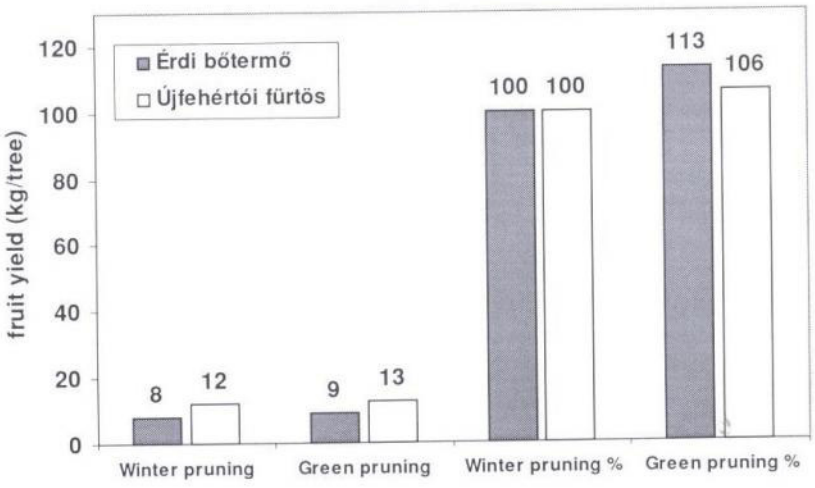

Figure 4 Effect of the time of pruning on fruit yield of sour cherry trees (Debrecen-Pallag, 2004)

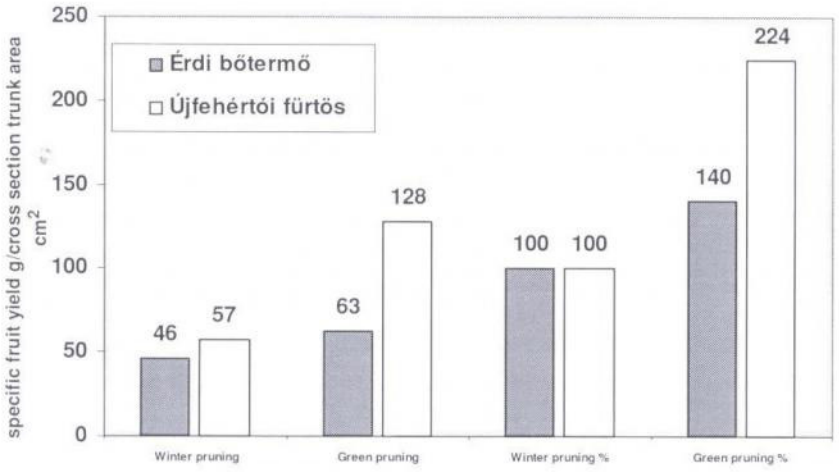

Figure 5 Effect of the time of pruning on the specific fruit yield of sour cherry trees (Debrecen-Pallag, 2004)

With further development of our sour cherry cultivation, it is highly probable that the spindle forms will gain more space in the future.

In spite of the invariable dominance of the processing industry, the smaller trees facilitating hand picking of fruit favour the training to spindle crown forms. Not only the crop for fresh consumption will gain quality but also the processed one due to the green pruning technique.

The occasional application of green pruning may become also beneficial on the sour cherry trees trained to traditional, "extensive" crown forms, by resulting in higher productivity and better quality of the fruit because of the improved illumination of the inner parts of the crown.

However, until the optimum time of green pruning, a relatively short time will suffer from some shadow due to spring growth depending on the variety for 1 to 1.5 months. Green pruning practised regularly, instead of winter pruning, secures a better illumination of the whole volume of the crown, and increases the yielding potential and longevity of the trees.

The main benefit of the technique is a well cleared crown with high specific productivity because the differentiation of flower buds is stimulated and the fruit quality is secured. Smaller trees are more productive and easier to harvest compared with the winter pruned ones.

The green pruned trees – as demonstrated for both varieties – did not exhaust the space of 3 meters. In our experiments, sour cherry trees grafted on *Prunus mahaleb* rootstock will do well when planted at a distance of 5 m × 2–2.5 m (800–1000 trees/hectare), on the long run.

Acknowledgements

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