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Detemination of the time of pruning regarding the ability of developing flower buds and their frost tolerance in sweet cherry varieties

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Summary: In sweet cherry growing, intense technology is introduced as the up to date development. Among the elements of the technology are the choice of variety, planting design and pruning are the main elements. The methods, intensity and the timing of pruning are largely dependent from the growing habits of the varieties, the light demand of the parts of different age and their tendency of getting bald on the aging zones. One of the main limiting factors of production, the frost damages are outstanding. In choosing the site of plantation, we must avoid the places, where spring frosts used to occur, the next moment is the role of the variety and the technology applied. In Hungary, the late or spring frosts are considered, however, the winter frosts may also cause heavy losses, which depend also on the health and nutritional condition of the trees when being exposed to temperature minima. Our present study is based on a 9-year-old plantation trained to slender spindle as well as to free spindle crown. We observed the development of fruiting structures and their frost damage also in relation with the timing of the pruning operations during the winter or summer, and compared also the varieties with each other.

Key words: frost damage, sweet cherry varieties, winter pruning, summer pruning, development of fruiting structures

Introduction

In the intensive growing technology, the morphology and growing and branching habits of the cherry varieties are decisive moments, which need adequate modifications of the elements of the technology. The differences between the varieties proved to be conspicuous, and the suitability of varieties could be determined on this basis (*Király,* 2006). In the intensive plantation, the planting density inceases, the concurrence in the root zone is high and weakens the growth; the density of the canopy could be moderated by summer pruning, which stimulates the development of flower buds and improves fruit quality. In intensive plantations, summer pruning is necessary, occasionally instead of winter pruning. Comparing winter and summer pruning, it is obvious that the latter in more advantageous (*Roversi* et al., 2005). Summer pruning performed at the right time reduces the shoot growth and increases yield in vigorous trees (*Gonda & Király,* 2005; *Gonda* et al., 2007). Plants react differently on the time and strength of pruning. A repeated summer pruning is able to prevent vigorous growth, and more flower buds are formed (*Király,* 2005). The induction of flower buds begins in cherry trees in May already, but the development is completed during the rest period, and depends largely on the length of the rest period and weather conditions between the end of December and early March (*Lang,* 2005).

The main limiting factor of yields is the frost in the nature. Frost damages are prevented most successfully by the choice of growing site, the variety and the technology are the next most important decisions. During the deep phase of rest period, the cherry trees may withstand low temperatures as –29 °C but later a couple of conditions are influencing the susceptibility: genetically fixed resistance/susceptibility, pruning, the duration and intensity of cool periods, nutritional conditions of the tree and the phenological phase at the moment of frosts (*Webster & Looney,* 1996).

In Hungary, the late spring frosts are the most dangerous, but the variation of temperature during the winter may weaken the resistance of the tree in spite of being still in dormant stage

Comparing the varieties, we may observe that the differences between varieties are increasing from the young shoots and going backwards in the second and third year old wood. Fruiting structures are differently distributed (*Vaszily,* 2010). If we know the peculiarities of the variety, the decision to maintain or eliminate branches is easier in applying the most advantageous pruning policy.

The present study dealt with a 9-year-old plantation of slender spindle and free spindle trees. The fruiting structures and the frost damages have been registered as results of pruning performed at different times, winter and summer, and by various intensities. Effects of varieties, and growing technologies are also examined.

Materials and Methods

Experiments are located at Debrecen University, Regional Experimental Station Pallag.

The planting design of the orchard was:
- 4 m x 1m, of the slender spindle and
- 5 m x 2 m, of the free spindle block.

The varieties: 'Rita', 'Germersdorfi3', 'Axel', 'Anita', 'Linda', 'Bigarreau Burlat'. The sandy soil contains little humus (< 1%). All varieties are grafted on *Prubus mahaleb* seedling rootstock.

The trees trained to slender spindle crown received each year three times summer pruning since 2007, whereas the free spindle trees were pruned only during the winter.

Dates of pruning during 2009:
- free spindle trees: 2009, March 13.
- Slender spindle trees: 2009, May 20, June 21, July 28.

During the summer, the pruning was concentrated on the shoots in May, in June and July, also two year old wood has been pruned.

Among the purposes of the experiment, the registration of effects of pruning dates on the development of fruiting structures and on the frost susceptibility of flower parts was considered. The productivity of the trees of different varieties is characterised by the number of fruiting structures and their distribution, in 2009 and 2010. The number of spears (bouquets of flower buds) per meter length on the branches of various age are expressed. The measures of the spears, branch length (cm), and the diameter (mm) were made by slide-gauge.

In the winter of 2009–2010, frost damages appeared, which are observed in 2010 February 13. The samples are taken from randomly chosen 3 trees per variety, 60 spears (bouquets) per tree. The frost damage was examined on samples taken on the eastern part of the crowns on similar branches and the buds were cut to see the necrotic symptoms at base of the bud, the pistil, the stamina and also the petals under microscope.

The effect of pruning dates (winter or summer pruning) on the frost tolerance of flower parts was also observed, which could be compared between varieties and pruning policies. The temperature was continuously traced by the meteorological facilities of the Experimental Station.

Results

In 2009, the load of fruiting structures on the tree distributed on the branches of different age are shown in *Table 1.* The effect of pruning performed at different dates is clearly evaluated. On the 2-year-old wood, the winter pruning caused higher number of bouquets on spurs in 'Germersdori3' and 'Linda' varieties, which was not significant in the rest of varieties. On the 3-year-old wood, all varieties developed more bouquets as a consequence of summer pruning except 'Germersdorfi3', which developed more spurs after winter pruning. On the 4-year-old wood, there was no exception; all varieties had more bouquets on spurs if pruning was made in summer. The same was true in 2010. On 2-year-old wood, the sole variety, 'Rita', produced more spurs with bouquets after winter pruning, and on 3-year-old wood, 'Germersdorfi3' produced more bouquets after winter pruning like in the former year.

It could be stated that only 'Germersdorfi3' was not bound to the summer pruning as a condition of developing more fruiting structures than by winter pruning.

We call the attention on the variety 'Rita', which did not produce fruiting bouquets at all on 4-year-old wood regardless on the time of pruning.

The superiority of summer pruning over the winter pruning was convincingly proved if the formation of fruiting structures was the target. The appearance of flower buds is

Table 1. Load of flower buds on the woods of different age in sweet cherry varieties (Debrecen-Pallag 2009–2010)

2009 year	**Age of fruiting structures**					
	2-year-old		**3-year-old**		**4-year-old**	
Spurs with bouquets of flower buds per meter	***summer pruning***	***winter pruning***	***summer pruning***	***winter pruning***	***summer pruning***	***winter pruning***
'Germersdorfi3'	18.7	30.7	9.1	16.5	17.8	0
'Linda'	11.8	12.4	11.7	8.7	0	1.3
'Axel'	31.2	26.2	13.2	9.1	9.2	6.9
'Rita'	9.9	n.a.	11.6	n.a.	0	n.a.
'Bigarreau Burlat'	15.1	15.9	15.7	13.0	13.1	4.8
2010 year	**Age of fruiting structures**					
	2-year-old		**3-year-old**		**4-year-old**	
Spurs with bouquets of flower buds per meter	***summer pruning***	***winter pruning***	***summer pruning***	***winter pruning***	***summer pruning***	***winter pruning***
'Rita'	10.9	33.8	7.8	4.8	0	0
'Axel'	21.0	11.5	18.1	3.3	10.5	0
'Germersdorfi 3'	10.5	5.4	2.9	5.5	0	0
'Linda'	10.6	7.4	2.8	0	9.1	0
'Anita'	16.9	16.0	0	1.9	0	1.9
'Bigarreau Burlat'	17.2	16.3	8.2	3.8	17.8	1.9

successfully stimulated by repeated summer pruning (green pruning) (*Király,* 2005).

The diameter of fruiting spurs (*Figure 1*) is somewhat increasing with the age as seen on the 3-year-old wood. The differences A termőnyársak közötti méretbeli különbség a fajták különbözőségére utal, nem a művelésmódra. A fajták között egyenletesség figyelhető meg mind a koronkénti, mind a metszésmódok által befolyásolt méretekben.

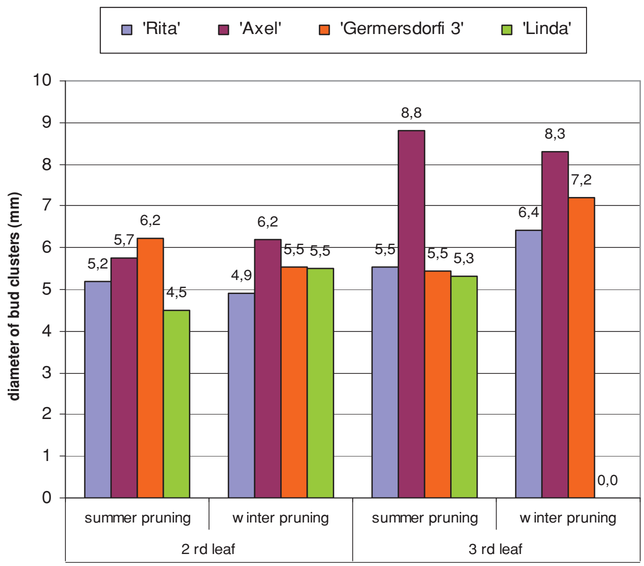

Figure 1. The effect of pruning policies on the diameter of spurs developed on different ages of wood (2- and 3-year-old wood) (Debrecen–Pallag, 2009)

In *Figure 2*, the length of the spurs are compared. It is evident that the spurs are longer after winter pruning on both, the 2 as well as on the 3-year-old wood. The long spurs are obviously advantageous for developing flower buds as having more light and space during the growing season. The older parts improve the yield security of the trees.

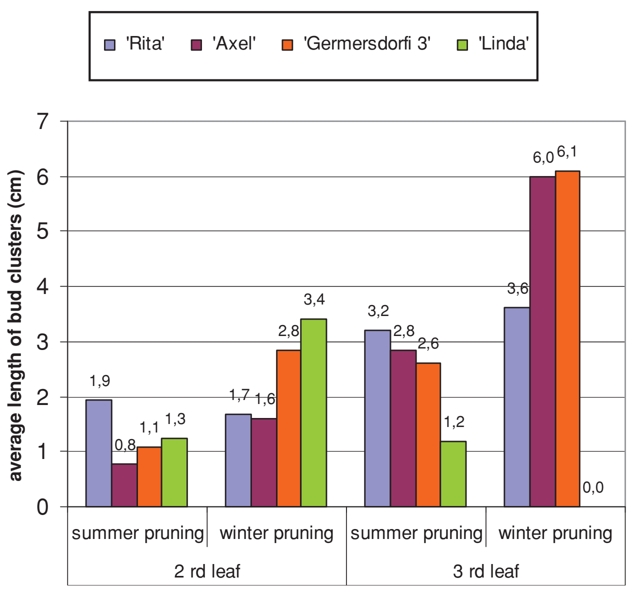

Figure 2. The effect of pruning policies on the length of spurs developed on different ages of wood (Debrecen–Pallag, 2009)

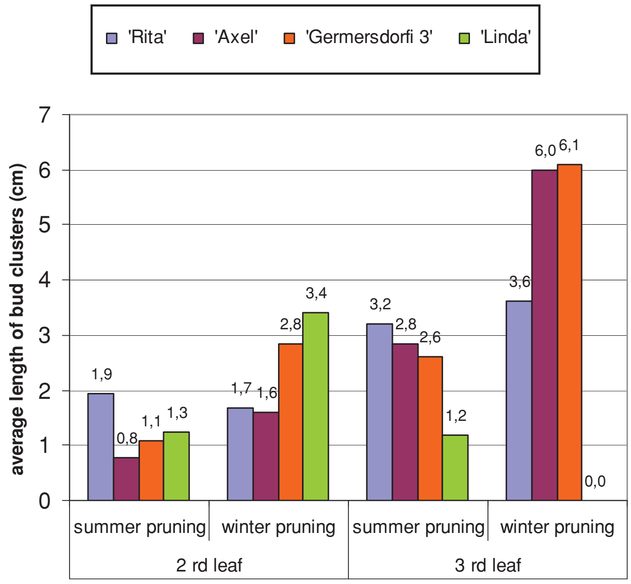

Figure 3. Daily minimum and maximum temperatures at Pallag between 2009, October 1 and 2010, February 28 (Debrecen–Pallag, 2010)

Regarding the data of temperatures (*Figure 3*), between 2009 December 22 and 2010 January 3 the weather was very mild compared with the mean of many years. After a moderately cooler period, the second decade of January was again mild with daily minima of 3-7°C. The second half of January was really cold, when the daily maxima remained largely below 0°C. The mild periods weakened the winter hardiness of the trees, and the subsequent cold spells caused significant frost damages. The frost damages were heavier in the summer pruned trees, allegedly because of the repeatedly reduced photosynthetic potential during the summer.

The frost damage of flower parts in the sweet cherry varieties is presented in *Figure 4.* The damage on the flower buds, and especially on the functionally decisive pistils and stamina was evidently heavier in the summer pruned trees. From this point of view, the variety ’Rita’ was most affected, but other varieties suffered also substantially. In

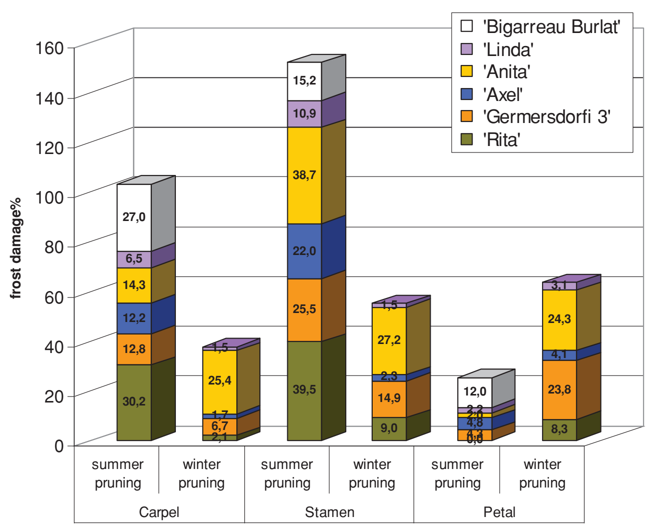

Figure 4. Frost damage of the organs within the flower buds and its distribution depending on pruning policies (Debrecen–Pallag 2010)

'Germersdori3' the damage of pistils was almost twofold in summer pruned trees. The most differences in damage produced the varieties 'Rita', 'Axel' and 'Linda'. However, in 'Anita' the winter pruned trees were more affected regarding the pistils of the flowers.

The petals, on the other hand, seemed to be more affected on the winter pruned trees. As the health of petals does not decide the fruit set, this relation may regarded as a problematic consequence of winter pruning.

Conclusions

Our experiments prove that summer pruning recommended increased the development of spurs with bouquets of flower buds on the wood of different age compared with the winter-pruned trees. However, the summer pruning increased the susceptibility to winter frost damage, but the frost tolerance was lowered. Summer pruning was performed three times each year, which induced vigorous shoot growth and inhibited the development of fruiting structures as well as diminished their size. However, the training to intensive crown forms requires the green pruning. This calls our attention to restrict the pruning to the thinning of the number of shoots.

As the time of summer pruning is coincident with the initiation of flower buds, the timing of the operation is very important. The preparation for the winter requires large and healthy photosynthetic capacity. In our case, the summer pruning three times to secure a maximum illumination of the potential fruiting structures seems to be exaggerated. The variable weather during the winter should be counteracted with a more favourable nutritional condition, preventing the frost damages.

The peculiarities in developing fruiting structures are variable depending on the varieties. Consequently, each variety should require its own pruning policy to achieve the optimum yielding potential. The variety 'Rita' for instance is unable to bear fruit on 4-year-old wood, which means that the partial rejuvenation ought to be started on the 3-year-old branches.

As a matter of fact, further experiments have to be planned to clear questions of the right intensity and timing of summer pruning for each potentially important sweet cherry variety regarding its peculiar fruiting capacities.

References

Gonda, I. & Király, K. (2005): A nyári metszés hatása a meggyfajták növekedésére és gyümölcsminőségére. Kertgazdaság, 37 (1): 45–52.

Gonda, I., Király, K. & Holb, I.J. (2007): Examination of growth of cherry cultivars adapted to intensive production. Acta Hort., 732: 429–434.

Király, K. (2005): Improvement of cherry production using phytotechnical methods. 5th International Cherry Symposium, Bursa-Turkey, Abstracts, 143. p.

Király, K. (2006): Cseresznyefajták intenzív termesztésre való alkalmasságának összehasonlító vizsgálata. Doktori értekezés, Debrecen

Lang, G. A. (2005): Underlying principles of high density sweet cherry production. Acta Hort. 667: 325–335.

Roversi, A., Ughini, V. & Monteforte, A. (2005): Productivity of 4 sweet cherry varieties as influenced by summer and winter pruning. 5th International Cherry Symposium, Bursa-Turkey, Abstracts, 168. p.

Vaszily, B. (2010): A study of processes active in regeneration of different sweet cherry varieties. International Journal Of Horticultural Science. 16 (1): 55–57.

Webster, A. D. & Looney, N. E. (1996): World distribution of sweet and sour cherry production: national statistics. (In: Webster, A. D. and Looney, N. E. (eds): Cherries, crop physiology, production and uses.) CABI. Cambridge. 25–69. p.