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Summer pruning of sweet cherry trees and an inquiry of winter frost damages

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Summary: One of the most demanded research projects is the intensification of fruit production. The use of dwarfing stocks is a moderate solution as their effect is scarcely satisfactory. Climatic conditions of Hungary are continental in Eastern Europe, where Atlantic and Mediterranean effects are interacting with the continentals in a kind of basin with characters of its own. Capricious meteorological episodes are often disturbing the security of development and fruiting of trees:

- winter frosts are damaging the cambium and fruiting structures of trees
- late spring frosts destroy cambium and flowers
- early autumn frosts hurt the leaves
- excessive precipitation impairs the growing fruits
- drought periods during the summer caused water stress disturbing water husbandry.

Vigorous stocks still prevail in the practice, and they ought to withstand challenges of weather hazards. The strong vigour of plants delays the process of senescence and the tendency of getting bald, and regeneration of plants is a sign of vitality.

In present research, the trees have been trained on vigorous *Prunus mahaleb* stocks. Summer pruning was one of the important tools of intensive growing techniques. They were compared with traditional techniques and with plastic foil protected trees observing the vegetative as well as generative growth of them.

Key words: summer pruning, sweet cherry cultivars, super spindle, frost damage, fruit size

Introduction

The intense growing system means in fruit production higher planting intensity, and small crowns designed to facilitate easier pruning and harvesting procedures. It is possible, moreover, necessary to perform the pruning partly or even entirely during the growing season.

Up to now, cherry cultivation used to be essentially extensive. On large trees, cultivation needed no pruning, which were hardly possible, and after all during the rest period only. The idea of summer pruning was unfamiliar for growers. In intensive plantations, however, the dense plantation threatened the foliage to become too dense, therefore the summer pruning became obligatory.

According to *De Salvador* (1989), the super dense plantations need pruning twice during the summer.

Our studies with summer pruning are concentrated on two phenophases during the growing season. Once before harvest (from the end of May until the second decade of June), pruning is proposed to secure the movement of machines and to avert the danger of shadows by thinning the shoots. It depends highly on the growing vigour of the particular season.

The second pruning needs to be more radical, which means that 1-3 year old woods are involved to be thinned and shortened.

Inventions during the winter are also necessary, of course, for the stimulation of growth, to rejuvenate and regenerate fruiting structures and to optimise the density of the crown. To train for a super spindle, varieties of moderate regeneration potential should be stimulated by that way.

Special aspects of summer pruning

The well illuminated crown is the most essential condition of production (*Jackson,* 1981). The extension of the active photosynthetic area and the utilising sink organs should be brought into balance necessary to obtain fruits of optimal quality (*Whiting,* 2005).

Pruning performed during the dormant period only, may secure light temporarily for a short time for the leaves. Depending on variety, size of the crown and on the strength of pruning, the crown will "close up" sooner or later (*Gonda,* 2006). Beginning with the mid of summer, during about 4 months until the fall of leaves the shadows develop gradually.

Because the better illumination, the upper leaves synthesise more but those in the shadow utilise also the products of the illuminated leaves. The product becomes diluted, the performance diminishes. Therefore, the crowns of traditionally grown, non pruned, large trees are relatively permanently too dense.

In summer pruned cherry trees, the negative effects of winter pruning alone, during dormancy, are eliminated (*Holb,* 2004; *Gonda,* 2006; *Vaszily-Gonda,* 2010). Trees pruned during the summer start in the next year with illumination as after a winter pruning. The peripheral density appears also on those trees, perhaps a little earlier around end of June. The second period considered to be optimal for summer pruning is between mid of July to end of August involves another pruning period from end of May and lasting 2–2,5 months depending on variety. As calculated, the trees pruned in summer receive full illumination for a time at least one and a half months longer than the trees pruned only in the winter.

In summer pruned trees, the time of optimal illumination of all parts of the crown increases substantially, this is realised in their higher productivity. The favourable illumination of the pruned crown secures more photosynthetic activity which compensates for the loss of the pruned leaves.

With summer pruning only those crown parts are eliminated, which do not bear fruit. The vertical shoots, tending or are growing inwards and peripheral shoots without fruits are trimmed or eliminated. All parts of the crown, which do not bear fruits of any age are doomed to be cut.

According to our experiences on the yields per tree, when about 20% of the foliage could be cut off without touching a single fruit, so the illumination could be optimal by summer pruning.

After summer pruning, during the winter, additional survey could be risked to eliminate more older woods, around February –March.

Materials and methods

Experiments have been performed in the Experimental farm of the Debrecen University and Regional Experimental Station for Horticulture, Pallag. The trees were spaced to 4 x 1 m distance in the autumn of 2000. The apple varieties examined were: ’Rita’, ’Germersdorfi3’, ’Axel’, ’Linda’, which are represented in commercial plantations of the country. The soil was sandy wit low humus content (< 1%). Grafts were made on seedlings of *Prunus mahaleb*.

Crowns are trained according to the slender spindle system since 2007, and summer pruning has been made in 2009 three times May 20, June 21 and July 28..

Interventions have been concentrated in May to thinning of shoots, in June and July also two year old woods are pruned. In 2010, one part of the slender spindle trees have been left without pruning, whereas other trees received summer pruning once on July 25.

The construction of rain protecting foil system was installed in 2005 on one quarter of the plantation. Observation of the effects of rain-averting foil on yield and quality of fruit was also an objective of the experiment. Parameters of the construction:

Width: 8 m

Length: 20 m

Height: 4.5 m.

The date of mounting the foil was in 2010 the mid of May and dismounted at end of July. The 60 of each foil covered the trees to avert rain, the sides are left open. Uncovered trees served as check.

The immediate aim was to explore the effects of pruning dates on shoot growth of different cherry varieties regarding fruit quality and subsequently frost susceptibility of flower organs.

Frost damages on fruiting darts with flower bouquets have been explored at 2011. February 21. Samples were taken from 3 trees per variety, 60 darts each, from the eastern part of the crowns. Longitudinal and cross sections of flower buds were studied by microscope. Damages were noted on the basis of buds, carpels, anthers and petals.

The correlations were calculated between pruning dates and fruit set, susceptibility of frost damages on flower parts as well as relations of varieties and technological variants.

Measures on fruits as diameter (x), height (z) and width (y) are made with a sliding gauge (Kinex, Atest, Czechia). Meteorological data were furnished by the weather station *(Figure 1–2).*

Temperature of 2010–2011 was registered in Figure 1, where the winter proved to be rather severe and variable. Changes ensued by weekly intervals between + 10°C and -5 and -15 as daily maxima and minima.

As observed, warming up of the weather diminished the cold tolerance of trees, which caused the frost damage during the following cold periods.

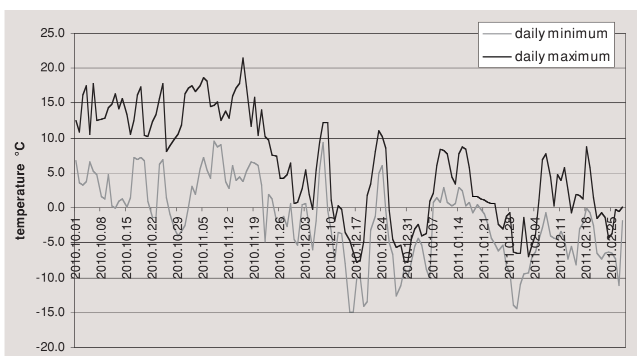


Figure 1. Daily minimum and maximum temperatures at Pallag between 2010 October 1 and 2011 February 28 (*Debrecen–Pallag,* 2010)

In 2010, precipitation was much more abundant during the growing season than in earlier years (Figurer 2), which influenced largely the quality of fruits by causing cracking and infection of Monilinia fruit rot.

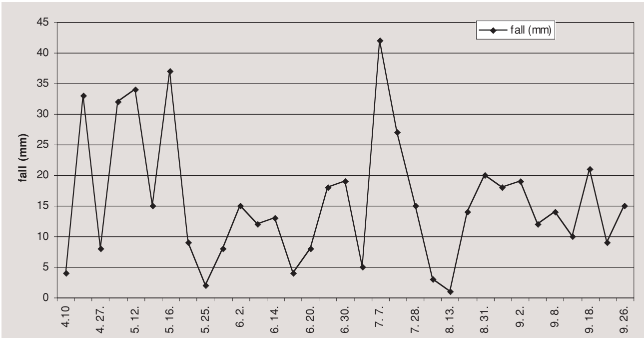
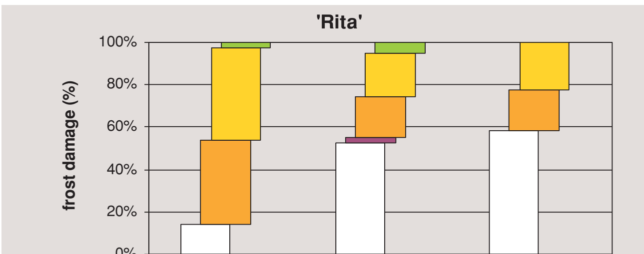


Figure 2. Rainfall amount in 2010 (*Debrecen–Pallag,* 2010)

Results

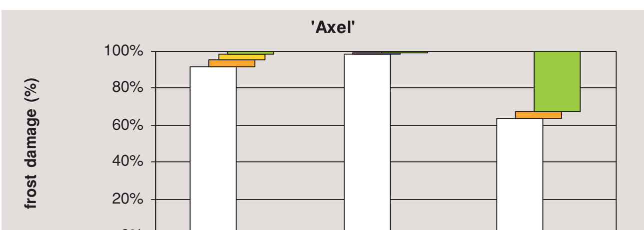
In 2011, frost damage was registered in the variety ’Rita’ as presented in *Figure 3.*



	unpruned	summer pruned	under rain cover
petal	2.57	4.93	0.24
stamen	43.30	20.53	22.30
carpel	40.00	19.10	19.42
bud basic	0.00	2.87	0.00
undamaged	14.13	52.57	58.03

Figure 3. Frost damage in buds of the variety ’Rita’ observed on trees in 2011 as an effect of different pruning methods performed during 2010 (*Debrecen–Pallag,* 2011)

Highest damage was clearly observed in the unpruned treatment. Carpels and stamina froze at a rate of 40%, only 14% of buds were unimpaired, whereas summer pruning and rain cover allowed 19–22% damage of buds. Damages of bud base and petals were practically negligible.



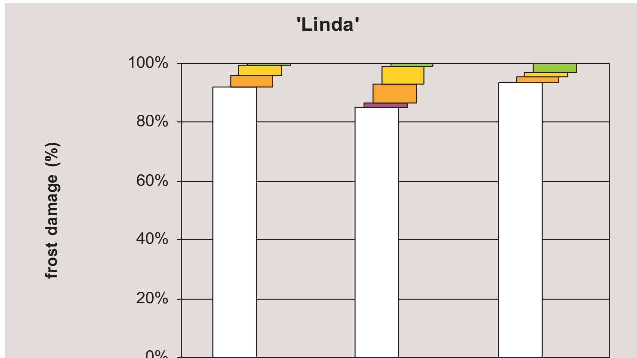
	unpruned	summer pruned	under rain cover
petal	1.79	0.58	32.90
stamen	2.87	0.00	0.00
carpel	3.58	0.00	3.23
bud basic	0.00	0.58	0.00
undamaged	91.76	98.83	63.87

Figure 4. Frost damage in buds of the variety ’Axel’ observed on trees in 2011 as an effect of different pruning and treatments performed during 2010 (*Debrecen–Pallag,* 2011)

In 2011, frost damage was registered in the variety ‘Axel’ as presented in *Figure 3.*

It is observed that a temporary covering of the trees under the plastic foil caused a higher rate of frost damage than in the uncovered treatments. Almost 33% of damage in petals suffered. Most resistant were the buds of the summer pruned trees, 99% of them undamaged.

In 2011, frost damage was registered in the variety ‘Linda’ as presented in *Figure 5.*



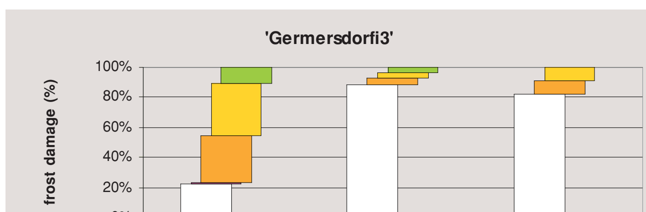
	unpruned	summer pruned	under rain cover
petal	0.60	1.16	2.81
stamen	3.57	5.78	1.75
carpel	3.57	6.36	1.75
bud basic	0.00	1.73	0.00
undamaged	92.26	84.97	93.68

Figure 5. Frost damage in buds of the variety ’Linda’ observed on trees in 2011 as an effect of different pruning methods performed during 2010 (*Debrecen–Pallag,* 2011)

The variety ’Linda’ (which is one of the most frost resistant one) displayed the less frost damage. The effect of a temporary foil cover caused some damage in petals like in ‘Rita’, whereas the carpels and stamina died at a rate of around 5–6% in the summer pruned treatment.

In 2011, frost damage was registered in the variety ‘Germersdorfi3’ as presented in *Figure 3.*

As shown on the figure, unpruned trees suffered most from the winter frost, only 22.35% was undamaged. Summer pruning and the foil cover protected the effectively the trees, so 82 and 88% of buds were undamaged.



	unpruned	summer pruned	under rain cover
petal	10.89	3.73	0.00
stamen	34.64	3.73	8.73
carpel	31.56	3.73	8.73
bud basic	0.56	0.00	0.00
undamaged	22.35	88.80	82.55

Figure 6. Frost damage in buds of the variety ’Germersdorfi3’ observed on trees in 2011 as an effect of different pruning methods performed during 2010 (*Debrecen–Pallag,* 2011)

In *table 1,* the effects of plastic foil cover on the size and mass of fruit s in three varieties are shown for comparison with the uncovered trees in 2010.

Largest fruits were found on the variety 'Germersdorfi3'. The next largest was 'Linda' with larger than 27 mm diameter of fruits. Smallest fruit occurred in the variety 'Axel'. The temporary foil cover increased the fruits of 'Germersdorfi3' and 'Axel'. The former produced 29.5 mm large fruits with 11.55 g weight under the foil cover. In 'Axel', the increment was 1.3 mm in size under the cover. In 'Linda' however, the effect of cover proved to be negative, i.e. the smaller fruits, the ripening process was prolonged. At harvest, half of the fruits was still semi-mature.

Table 1. Size measures and mass of cherry fruits of three varieties grown without and under the plastic foil cover (*Debrecen–Pallag,* 2010)

Cherry varieties	Large diameter (mm)	Diameter at the suture (mm)	Height (mm)	Fruit mass (g)
Without cover				
'Germersdorfi3'	28.20	23.01	25.3	7.61
'Linda'	27.30	22.05	25.15	8.47
'Axel'	24.30	19.08	22.24	6.75
Under the plastic foil cover				
'Germersdorfi3'	29.50	24.08	25.96	11.55
'Linda'	25.50	23.11	25.59	6.88
'Axel'	25.67	20.83	24.65	8.27

Conclusions

The intensive technology of sour cherry growing is aiming to develop the suitable capacity of fruiting structures and the adequate photosynthetic area by utilising the notable vigour of the plants without the risk of develop too high density of leaves, which cause useless shadowing. The vigour, ramification, development fruiting structures vary conspicuously according to the varieties (*Király-Gonda,* 2004).

Our observations proved that the technology of summer pruning stimulated the formation of fruiting structures (darts with flower buds). The frost susceptibility of those buds was variable depending from the varieties. Our technology of specific summer pruning adapted to varieties was suitable to produce regular, high yields with excellent quality.

For that purpose, growing habits of the respective varieties ought to be known as an important condition of success.

In sweet cherry growing technologies, the summer pruning is an obligatory element. In the modern dense plantations, the crowns trained to slender spindle need to be pruned during the summer period. The intensity of pruning must be adapted to the respective variety.

Sweet cherry fruit representing high quality needs to be protected against weather hazards as an important moment of the commercial growing technology. Precipitation during the maturity of cherry fruits means the highest risk of production (cracking of fruits, fruit rot and pests). The most effective technique to prevent damages, plastic foil covering seems to be indispensable also in Hungary. According to our experiences, the temporary cover exerts a positive effect on fruit quality of cherry fruits in addition the frost damages of buds could be diminished in some varieties (*Vaszily,* 2010).

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References

De Salvador, F. R. (1989): Observations on sweet cherry bed system. Acta Hort. 243: 319–326.

Gonda, I. (2006): A szilvafák metszése és a termőegyensúly fenntartása, pp. 212–224. (In: SURÁNYI, D. Szilva.) Mezőgazda Kiadó, Budapest.

Holb, I.J. (2004): The brown rot fungi of fruit crops (*Monilinia* spp.): II. Important features of their epidemiology. INT J HORT SCI. 10 (1): 17–33.

Jackson, J. E. (1981): Theory of light interception by orchard and a modelling approach to optimizing orchard design. -Acta Hort. 114: 69–79.

Király, K. & Gonda, I. (2004): A fajta szerepe és jelentősége a cseresznye intenzív termesztéstechnológiájában. Acta Agraria Debreceniensis, 2004:13.

Vaszily, B. (2010): Determination of the time of pruning regarding the ability of developing flower buds and their frost tolerance in sweet cherry varieties. International. Journal of Hort. Sci. 16 (4): 45–48.

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

Vaszily, B. & Gonda, I. (2010): Training and maintaining spindle crowns in cherry production. International Journal of Horticultural Science. 16 (3):51–53.

Whiting, M. D. (2005): The physiology of high density orchard systems: sources, sinks and solutions. 5th International Cherry Symposium, Bursa-Turkey, Abstracts, 4. p.