Effect of pruning timing on yield safety of sweet cherry cultivars

Barbara Vaszily

University of Debrecen, Centre for Agricultural and Applied Economic Sciences, Faculty of Agricultural and Food Sciences and Environmental Management, Institute for Horticulture, 4032 Debrecen, Böszörményi Street 138

*Corresponding author. Email: vaszilyb@agr.unideb.hu

Abstract The fact that the degree of the cherry tree can tolerate cold depends on several factors: features of cultivars, pruning, durability of cold, conditions of the tree, and which dormant stage received the frost damage.

In our country, especially late spring frosts cause varying degrees of damage. However, the effect of changing weather conditions such as fluctuating temperatures in the winter causes the loss of frost resistance of the trees. Thus, larger cooling periods at the end of winter can cause serious damage. This is somewhat affected by the condition of trees, proper nutrition-content as well.

The study was done at University of Debrecen, Farm and Regional Research Institute, Pallag Research Station. Fruit bearing production and frost damage are demonstrated on nine-year-old sweet cherry trees (’Rita’, ’Germersdorfi3’, ’Axel’, ’Anita’, ’Linda’, ’Bigarreau Burlat’) with string and free spindle crown form. Sensitivity of the functional value of fruit set – the generative parts – (pistil and stamen) to frost damage was studied depending on timing of pruning (summer and winter), variability of cultivars and production technology. The productivity of various sweet cherry cultivars was determined by numbers of different fruit bearing parts with different ages.

According to this increasement of intensity through application of novel technological elements (timing, manner and severity of pruning) and selection of the proper cultivar is implement able

Important differences are experienced between sweet cherry cultivars in their growth attributes, light demand and dynamics of fall back in regenerative potencial of different aged wood parts. From this point knowledge of the abow detailed is very important in order to maintain rentability of already established plantations.

Our study showed that special attention has to be paid to determination and combination of timing pruning with taking into consideration the specific fruit bearing properties of cultivars.

Key words

frost damage, sweet cherry cultivars, pruning time, bud cluster

In intensive sweet cherry production, cultivar morphological feature and growth characteristics are based on branching inclination and quantity and quality of fruit bearing. There large differences among growth and fruit bearing characteristics of cultivars which can be a basic knowledge for intensive production (KIRÁLY, 2006). In intensive orchards, the trees are closer to each other (tree density is higher) thus root competition reduces growth. Tree thickening is legitimate in case of narrower tree density which can be compensated with the weakening effect of summer pruning. This can enhance the possibilities of suitable production of fruit bearing part and improve fruit quality. In intensive production, occasionally needed summer pruning can replace winter pruning in many cases.

Comparing winter and summer pruning, summer pruning is more beneficial (ROVERSI et al. 2005). Summer pruning applied in optimal time, degree and methods throughout better light capacity in the canopy can reduce shoot growth which can positively influence the fruit bearing capacity of strong growth orchards (GONDA AND KIRÁLY 2005). Timing and degree of pruning influence the reaction of plant. Strong vegetative characteristics can be delayed by cutting back green shoots, thus more transition bud and fruit bearing bud will be produced on the weakened shoots (KIRÁLY 2005; GONDA et al. 2007). Fruit bud

induction of sweet cherry starts in May but finalisation of flower parts can end from end December to early March depending on the length of cultivar dormant stage and weather conditions (LANG 2005).

Production is affected mainly by frost injury. Selection of excellent production area and role of cultivar and technology is essential on in preventing or reducing frost damage. Sweet cherry can resist -29 ºC, the frost tolerance of cultivars is genetically determined. Frost tolerance of sweet cherry tree is dependent on several factors: cultivar feature, pruning, cold duration, tree conditions, and phenological stage that received the frost effect (WEBSTER AND LOONEY, 1996).

In Hungary, late spring frost causes mainly damage with different degree. However, trees can lost winter resistance partly due to fluctuate temperature in winter. Therefore, more serious cooling can cause serious damage at the end of winter. This somewhat influenced by tree conditions and suitable nutritional status too.

In case of fruit bearing parts, difference among cultivars increases towards older parts (VASZILY 2010). Knowing this feature it can be determined those tree parts that need to be removed during yearly pruning or with partial tree removal in order to ensure the most productive crown parts.

In this study, fruit bearing production and degree of frost injury in 9 year-old garland spindle and free spindle crown sweet cherry orchards will be shown depending on timing of pruning (summer and winter). The effect of cultivar and technology will also be determined.

Material and Methods

The study was carried out in University of Debrecen Farm and Regional Institute, Pallag Horticulture Research Station. The study was performed in 4 m x 1m garland spindle and 5 m x 2 m free spindle crown form. The studies cultivars were 'Rita', 'Germersdorfi3', 'Axel', 'Anita', 'Linda', 'Bigarreau Burlat'. Humus content of soil was low (< 1%), sand soil. Rootstock was *Prunus mahaleb* for all cultivars.

Garland spindle trees were pruned three time annually in summer from 2007 while free spindle trees were pruned only in winter. Date of pruning in 2009 was 13 March for free spindle and 20 May 21 June and 28 July for 2009. In May, pruning was made only on shoots, while in June and July prunings were made on two-year old plant parts.

The aim was to study the effect of pruning timing on production of fruit bearing parts and on frost sensitivity of flower organs. Productivity of various sweet cherry cultivars was determined according to piece, distribution and size of fruit bearing parts in 2009 and 2010. Short fruit bearing shoots were determined according to age and length of crow parts. Size of short fruit bearing part i.e. length (cm), diameter (d) (mm) was determined by veriner caliper (Nib type).

In winter of 2009-2010, the evaluation of frost damage on short fruit bearing parts due to extreme weather factors was done 13 February 2010. Randomly selected 3 tree with 60-60 clustered short fruit bearing parts was evaluated. Longitudinal and cross-section of flower bud collected on different cultivars with similar twig ages form the East part of the tree was examined by microscope. Frost damage of bud basic, pistil, stamen, petal was determined. Effect of pruning (summer and winter) on flower organs (pistil and stamen) was determined depending on differences of cultivars and technology. Temperature data were collected from agrometeorological station of the Research Station.

Results

In 2009, short fruit bearing productivity of sweet cherry cultivars according to pruning timing can be seen in Table 1. On two years old parts, 'Germersdori3' and 'Linda' cultivars produced more short fruit bearing parts due to winter pruning, while for other cultivar this was negligent. On three years old parts, summer pruning was better, except for 'Germersdorfi3', where more short fruit bearing parts were due to winter pruning. On four years old twigs, summer pruning resulted in more short fruit bearing parts in all cultivars and also in 2010. Tendency of 2010 was similar to 2009. On two years old parts, winter pruning was positive only cultivar 'Rita', on three years old parts, cultivar 'Germersdorfi3' produced more fruit bearing parts due to winter pruning as similar to 2009.

It can be stated that production of fruit bearing parts of cultivar 'Germersdorfi3' is more independent from pruning timing than other cultivars. It needs to be noted that cultivar 'Rita' produced no fruit bearing bud on four year old part sin either year independently form pruning timing.

On other cultivars, positive effect of summer pruning on fruit bearing bud parts was determined as with several cutting back more fruit bearing parts are produced (KIRÁLY 2005).

Table 1.

Fruit bearing bud production of sweet cherry cultivars with different twig ages (Debrecen-Pallag 2009-2010)

2009	Age fruit bearing parts					
	2 year		3 year		4 year	
Clustered short fruit bearing parts pc / m	*Summer pruned*	*Winter pruned*	*Summer pruned*	*Winter pruned*	*Summer pruned*	*Winter pruned*
'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	**Age fruit bearing parts**					
	2 year		**2 year**		**2 year**	
Clustered short fruit bearing parts pc / m	*Summer pruned*	*Summer pruned*	*Summer pruned*	*Summer pruned*	*Summer pruned*	*Summer pruned*
'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

Diameter of short fruit bearing parts (Figure 1) was larger on three year old crown parts. Differences among short fruit bearing parts are due to cultivar differences and not production technology. Equality can be seen among cultivars either for age or pruning type.

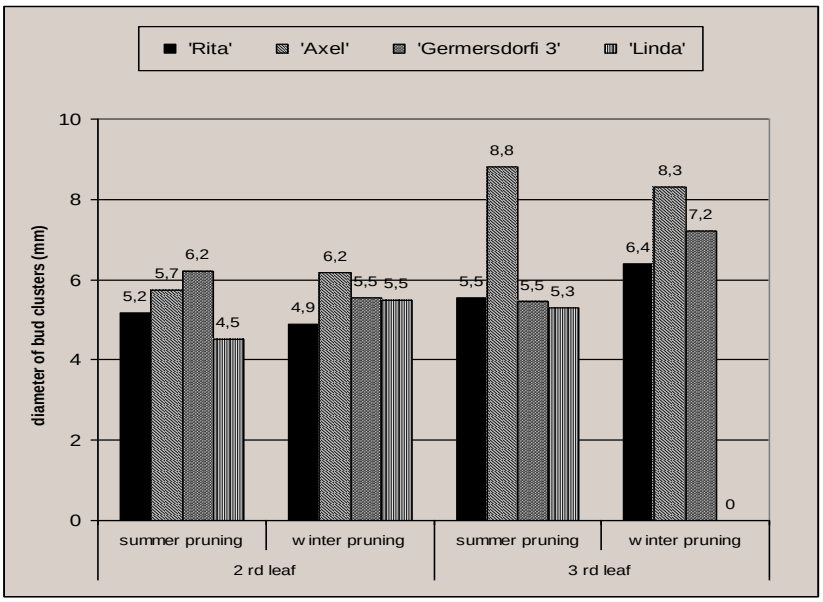

Figure 1. Effect of different pruning type on length of short fruit bearing parts on different aged crown parts (Debrecen-Pallag, 2009)

Longitudinal growth of short fruit bearing parts on different aged plat parts can be seen in Figure 2. The length of short fruit bearing parts are longer on two and on three years old parts pruned in winter. As assimilating area are uninterrupted during the whole season, differentiation of fruit bearing buds are more positive. Longer fruit bearing basics due to their ages can serve for larger fruit bearing safety.

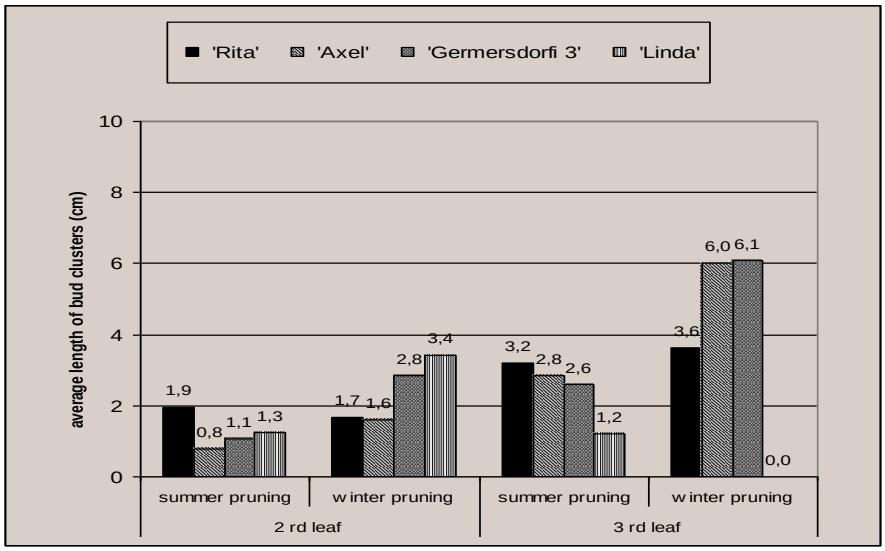

Figure 2. Diameter of short fruit bearing parts on differently aged crown parts due to different pruning type (Debrecen-Pallag, 2009)

According to temperature data (Figure 3), winter was mild between 22 December 2009 and 3 January 2010 compared to several year average. The daily minimum was clearly above zero °C. After this, cooling was followed for several weeks and then a heeting when the daily minimum was between 3 and 7 °C. From the second half of January, serious cooling started, the daily maximum was under zero °C. Due to several heeting days occasion in winter, trees partially lost their winter resistance thus a later temperature decrease caused evident frost damage. Frost damage was larger on summer pruned trees due to removing larger photo-assimilating area of the tree.

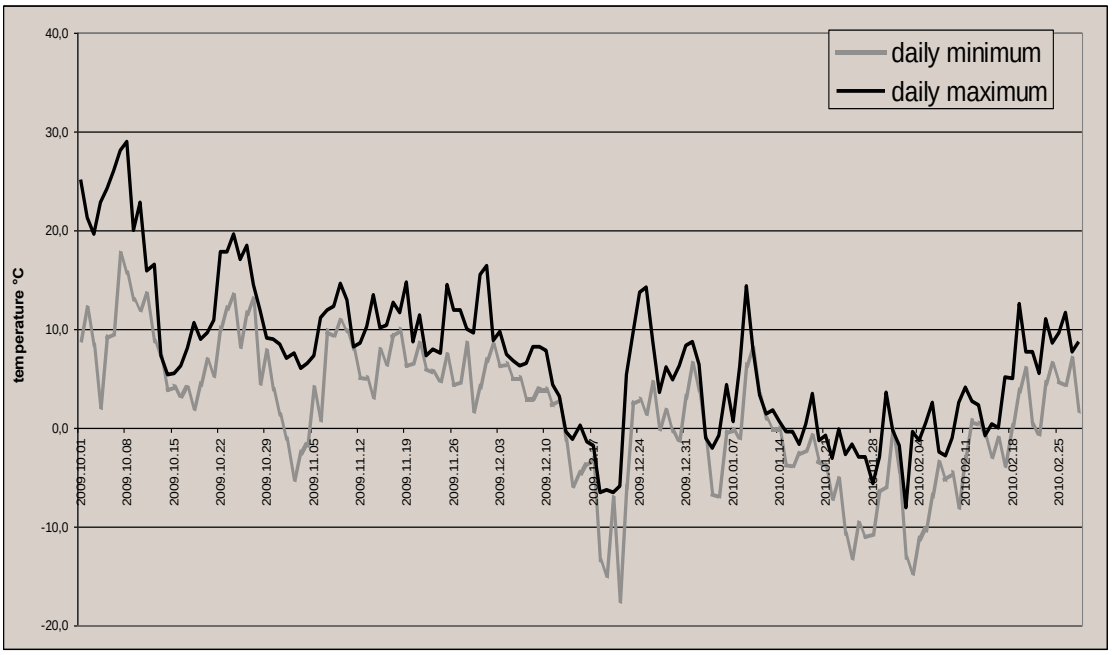

Figure 3. Daily minimum and maximum temperature from 1 October 2009 until 28 February 2010 (Debrecen-Pallag, 2010)

Frost damage of flower parts on studied sweet cherry cultivars are shown in Figure 4. Summer pruning had an evidently influencing effect on frost damage of fruit setting functional parameters (pistils and stamen). Winter frost damage was the largest on cultivar ’Rita’ but frost damage of other cultivars are also not negligible. The summer pruned cultivar ’Germersdori3’ had twice more damage. Largest differences could be seen on cultivars ’Rita’, ’Axel’ and ’Linda’. Pistils of cultivar ’Anita’ was sensitive to frost after winter pruning. In case of petal, winter pruning caused more frost damage. Petal does not influence setting from the production point of view though it is an interesting point in case of pruning timing and damage.

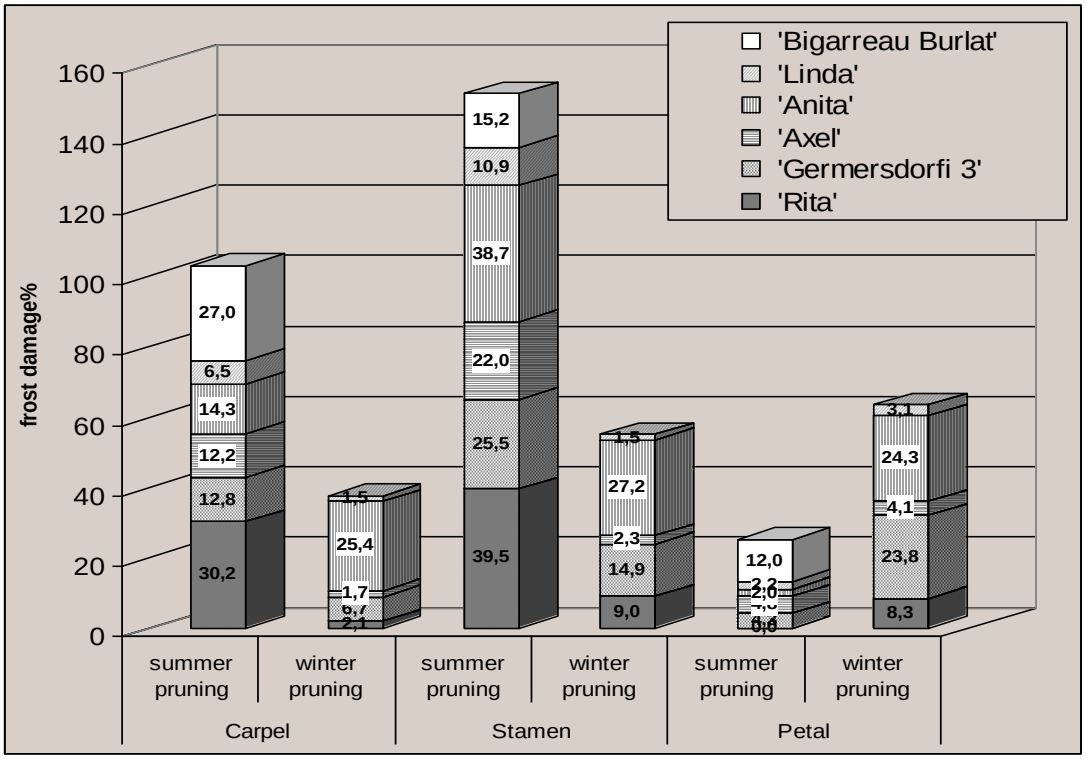

Figure 4. Frost damage of flower organs of fruit bearing buds depending on pruning timing (Debrecen-Pallag 2010)

Conclusions

According to our study it can be stated that more clustered short fruit bearing parts were produced after summer pruning compared to trees pruned in winter, however, frost damage was larger and condition was moved in a negative direction. Three green prunings in a year cause such shoot growth which inhibit production of fruit bearing parts and negatively influence their sizes too. On the other hand, fitotechnical operations are essential for keeping the intensive crown from. This draw attention that moderate pruning has to be done with interspacing shoots.

As summer pruning was done at the starting phase of differentiation of flower bud, determination of its optimal timing is essential. We have to ensure suitable conditions (optimal amount of healthy assimilating area) for preparing for winter. Three summer pruning due to keeping trees in space and three lightening was excessive. Optimal conditions of tree is an essential factor for surviving fluctuating winter weather and reducing sensitivity of frost damage is essential for

Features of fruit bearing parts production, which are various for cultivars, draw attention to optimal and cultivar specific creation and maintainence of fruit bearing area. In case of cultivar ’Rita’, we need to know that four year old parts are in-productive thus for this cultivar renewal cutting has to be started on three year old parts.

Of course further studies are needed for different intensity and timing of pruning combination as well as cultivar features.

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