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Training and maintaining spindle crowns in cherry production

Vaszily, B. & Gonda, I.

Institute of Horticultural Science Centre of Agricultural Sciences and Engineering, University of Debrecen, Hungary, H-4032 Debrecen, Böszörményi Street 138. e-mail: vaszilyb@agr.unideb.hu

Summary: In cherry production all over the world, intensification of the technology is the main objective of research. Small crowns and high planting densities are aimed to attain high yields per hectare and easier harvesting. Rootstocks of reduced vigour for cherries are more difficult to find than in other fruit species, and the rejuvenation of fruiting structures by pruning is aggravated by the reduced vigour. Intensity of the technology ought to be achieved by a thoughtful application of the technological elements (timing of pruning by various intensity) moreover, by finding different policies for individual varieties. Sweet cherry varieties dominating the assortment proved to be very variable regarding their growing habits. In our experiment, we dealt with the slender spindle and free spindle forms, and how to train the trees to develop and to maintain the desirable form depending on the respective variety in order to achieve the right load of flower buds and yields repeatedly. In this paper, we examine the most important practical issues with the training and maintaining of the crowns of cherries with circular projection and central axis grafted on Prunus mahaleb rootstocks *(Figure 1).*

Key words: free spindle crown, slender spindle crown, cherry, pruning

Free spindle

This crown form means trees of 3–3.5 m height, 2–2.5 m width, maintaining a dominant central axe with two or three stories of branches, or alternatively, spirally scattered side branches, where the fruiting and sprouting are regulated by turn *(Figure 2)*.

The trunk is 80–90 cm high. Planting design is depending on the fertility of the soil: 5–6 × 2–3 m (1000–670 tree/ha). Tree height is limited to 3–3.5 m. The dominant central axis is an important issue with special emphasis.

After the first pruning for forming the crown, the selection of shoots is regularly actual in June. The main shoot is liberated from its concurrents, below, 3–4 shoots are distributed in all directions as the future main branches and eliminate their concurrents *(Figure 3).*

Next year, towards the end of winter, the side branches will moderately pruned in order to stimulate growth. The main shoot is pruned too if it is less vigorous. The selection of green shoots in June serves for the same purpose, i.e. eliminate the concurrent shoots of the main axis and the primary branches, occasionally break down above 5–10 cm.

After fruiting began, the optimum time of pruning is the time after harvest *(Figure 4).* In that case, pruning should concentrate on young parts, thicker parts of wood will be handled during the winter rest period. Summer pruning is rarely extended to 2–3-year old parts. The occasion is exploited to let the form of the tree approaching the pyramid shape, and cut the dense growth to make them thinner. Pruning should concentrate on vertical or drooping shoots and to secure the penetration of sunlight.

Slender spindle (super-spindle)

The slender or super-spindle is: 2.2–2.5 m high and 1–1.5 m wide crowns with a dominant central axis, randomly or along a spiral, and are less than 4 year old branches rejuvenated and let fruiting in turn.

This is the most intense and most densely planted crown type applied in cherry production. The suggested planting design means (3.5–4.5 × 1–1.5 m) 2900–1500 trees/hectare *(Figure 5).*

The grafts are grown on *Prunus mahaleb* rootstocks and for planting the whips ought to be longer than 2 m. The usual length, 130–150 cm, needs a pruning of the crown to stimulate growth. The trees longer than 2 m do not need pruning at all over the next year. The growth is during the first year very weak, mainly rosettes are formed. We have to concentrate to stimulate growth.

In the second year, a vigorous growth is starting. If everything turns out well, the whole length of the whip or at least on the upper part starts budding. If the shoots attained 40–50 cm, it is worthwhile to halve them depending on the variety, on the whole length or occasionally abandoning them on the lower part only *(Figure 6).* Subsequently, the semi-dormant buds in apical position start thriving, and at favourable conditions, they may grow to a length of 40–50 cm. In this case, we should halve the length as in the former case. The next, third pruning will not be actual in the same year.

In the subsequent year(s) the summer pruning will be performed in the same manner, as before, even three times if necessary.

Beginning with the third year, 3 or 4 vigorous shoots are left without restriction to grow on the upper or middle position, and they will plied to horizontal position. Further on, the restriction of space ought to be necessary. Sometimes, a reduction of shoots to spurs, to branches of two years will needed in order to secure adequate illumination (*Gonda,* 2010).

Figure 1. Foreground: Free spindle tree in a planting to 5×2 m distance. Background: Slender spindle trees in a planting tp 4×1 m

Figure 2. Cherry trees trained to free spindle, planted to 5×2 m design

Figure 3. Young cherry tree before and after summer pruning

Figure 4. Cherry tree before and after postharvest pruning

Figure 5. 5-year-old cherry trees trained to super (slender) spindle crowns

Figure 6. Halving of the shoots stimulates the ramification of the tree

Yielding capacity of the crown types

In *Table 1*, we see that in 2009, all the three varieties produced on slender spindle yielded less, but the yield per hectare was higher except the variety 'Germersdorfi3', which yielded more on the free spindle trees. In fruit size no significant difference was registered.

Table 1. Fruit yield of trees trained to different crown types and planting designs (Debrecen-Pallag, 2009)

Design	4 × 1 m (slender spindle)		5 × 2 m (free spindle)	
Cherry varieties	**kg/tree**	**t/ha**	**kg/tree**	**t/ha**
'Linda'	*10.9*	*27.3*	*17.1*	*17.1*
'Germersdorfi 3'	*3.9*	*9.8*	*14.3*	*14.3*
'Valerij Cskalov'	*10.5*	*26.2*	*21.7*	*21.6*

The relations between growing as well as fruiting and pruning policy

In every year, continuously, during the winter, early spring as well as in summer or after harvest any pruning intervention ought to be adapted to the specific development of the fruiting bodies, which may differ conspicuously depending on the varieties.

In spite of the vigorous growth inducing Prunus mahaleb rootstock, the regeneration may display significant differences in developing fruiting structures, which is open to be modified by the pruning policy for the sake of the grower *(Table 2).*

In *Table 2,* we find data collected over two years. Generally, the slender spindle trees – which received the summer pruning – developed more fruiting structures on woods of different age than the free spindle trees, which have been pruned in winter. As an exception, the free spindle trees of 'Germersdorfi3' proved to be more productive than the slender spindles. The load of fruiting structures on the slender spindle trees excelled most in the varieties' Axel' and 'Linda'. 'Bigarreau Burlat' variety was neutral when compared the fertility between the two crown types.

The differences among the varieties are well expressed on *Figure 7,* where the means number of bouquets of flower buds are compared as a function of the age of woods.

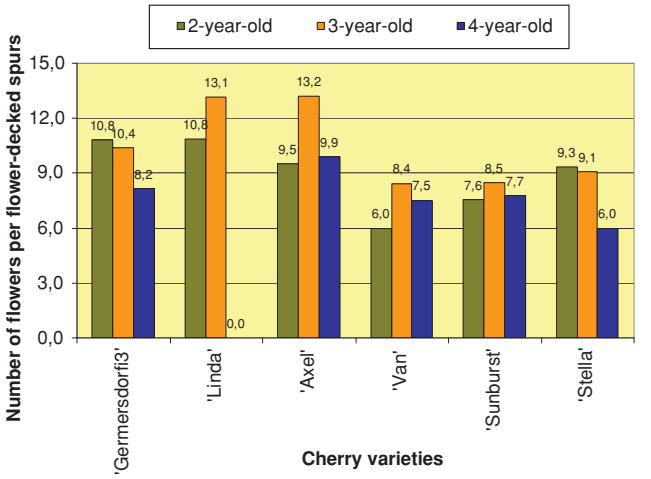

Figure 7. Number of flower buds on spurs of different age of wood in different cherry varieties (Debrecen-Pallag, 2009)

It is interesting that with the exception of 'Germersdorfi 3' and 'Stella' varieties, most flowers were developed on three-year-old spurs. The two varieties mentioned ('Germersdorfi 3' and 'Stella') produced more flowers on two-year-old spurs. The decline of the number of flower buds ensued clearly with further age of the wood. From this point of view, an extreme case is the variety 'Linda', which shows on *Table 1* the complete sterility on 4-year-old wood.

It is clear, that the rejuvenation of the fruiting structures on both crown types is continuously necessary after the 3 to 5 year old woods. One exception is the variety 'Isabella', which needs rejuvenation on the 4-6-year-old parts. In variety 'Linda', all structures more than 4-year-old ought to be pruned as worthless.

On the older parts of the tree, the differences between the varieties tend to be more conspicuous regarding the fruiting structures as well as their ability to regenerate. If we know those characters, we will be able to decide upon the pruning policy to be applied.

It is stated that for each variety a special pruning policy recommended in order to produce optimal yields and quality continuously for a longer period with an intensive growing technology. After a critical age, which is specific for each variety, the rejuvenation of the fruiting structures is necessary, when the yielding capacity of the old woods declined, and the regeneration of the shoots is still vigorous. Those properties of the varieties ought to be studied as a new aspect of their utilisation in intensive technologies.

Table 2. Load of fruiting structures on wood of different age in cherry varieties (Debrecen-Pallag, 2009–2010)

2009 year	**age of fruiting structures**					
	2 years		**3 years**		**4 years**	
bouquet of spurs per meter	***slender spindly***	***free spindle***	***slender spindly***	***free spindle***	***slender spindly***	***free spindle***
'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 years		**3 years**		**4 years**	
bouquet of spurs per meter	***slender spindly***	***free spindle***	***slender spindly***	***free spindle***	***slender spindly***	***free spindle***
'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
'Bigarreau Burlat'	17.2	16.3	8.2	3.8	17.8	1.9

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