DEVELOPMENT AND MAINTAINENCE OF SUPEINTENSIVE CULTIVATION OF SWEET CHERRY CULTIVARS

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Abstract
In sweet cherry production all over the world including our country, a number of large-scale trial is being conducted for increasing intensity, i. e. development and maintenance of plantations for smaller crown size and higher density per hectare. The subjects with moderate growth and cultivation feature of the application for this fruit species unfortunately very limited. First, rootstocks with the ability for size reduction does not cause appropriate size reduction, as well as those are get old very quickly, buds become dead on the shoot, the fruit size becom smaller and smaller, i.e. they will not serve the requirements of increasing intensity. Adpatation of foreign bred sweet cherry rootstocks in Hungary requires versatile test (Juhász et al., 1996; Hrotkó and Simon 1996; Hrotkó et al., 1999; Bujdosó and Hrotkó, 2003). According to experiences in case of intensive cherry orchards, it can be stated that there is a need for rootstocks with vitality, strong growth, regeneration promoting effect, and dead bud delaying effect. Prunus mahaleb is the subject of intensive plantations, due to ensuring above properties. The increasing intensity, accordingly, the application of advanced technology components and the appropriate choice of cultivar can be provided.

Our work aimed to show the results of yield and fruit quality parameters for specifying the differenes of 6 cultivars in 2009 on a 9-year old plantation with spike spindle crwon form.

Keywords: sweet cherry cultivars, spike spindle crwon form, formation of fruit bearing part, blossom density, fruit quality

INTRODUCTION

The fundamental criterion for the renewal of the Hungarian fruit production is to increase the intensity, i.e. incerase the proportion of fruit bearing crown part (productive area) illuminated by sunlight and the uniform fruit quality in all parts of the tree. The fruit bearing crown surface is located close to the central axis, and also to the xylem and floem, which ensures favorable nutrition, which increases the security of yield production.
Several circumstances make difficult increasing intensity for sour cherry. Int he case of conventional, with the use of strong growth rootstocks, dwarfing effect can be achieved by some phytotechnical operations, (e. g., pruning time, the extent, root pruning, etc.). Based on experience, it can be stated that rootstock with vitality, strong growth, regeneration capacity, repressing of fruit buds dead is needed for intensive sweet cherry orchards. *Prunus mahaleb* is the subject of intensive plantations, it is appropriate to ensure the solution of the above properties. The increase of intensity, accordingly, the application of advanced technology components and the appropriate choice of cultivar can be provided.

The cherry fruit quality, ie marketing size and high value consumer while ensuring the species becomes more and more emphasis on intensive cultivation of the suitability determination. In many countries of the world, dwarfing rootstock are being studied. Extensive studies have been conducted in our country is in relation to the sweet cherry dwarfing (Hrotkó, 2000, 20001). In many cases, the effect of impaired growth in low-growing rootstock, despite the strong pruning, deteriorate the regeneration options, i. e.

renewal of fruit bearing part. Fruit size is also smaller due to reduction in growth and dynamics of fruit buds dead and the tree reach an early aging condition, namely a decrease in general vitality can be observed.

In the intensive plantations, the trees are closer to each other (larger stock density) and it causes: earlier fruit-bearing, the physiologically and economically optimal yield can be achieved a faster and safer, the trees quickly filled the available space. The smaller trees are easier to handle, less mechanical work is needed. Expenditure on other costs are reduced, such as there are no longer need large ladders, material cost of lining materials is less which are needed for covering the plantation of the lining materials (Zahn, 1996).

The spike spindle (super spindle) crwon form of the sweet cherry was introduced by Zahn (Soltesz, 1997).

MATERIALS AND METHODS

Experiment was performed in University of Debrecen, Farm Management and Regional Science Institute, Horticultural Experimental Station, Pallag.

The sweet cherry orchard was planted in 2000 on *Prunus mahaleb* rootstock, with the distance of 4 x 1 m. The used crwon form was spike spindle (supe spindle). The observed cultivars were: 'Linda', 'Axel', 'Stella', 'Germersdorfi 3', 'Sunburst', 'Van'. The orchard soil was sandy soil with lower than 1 % mold. The used rootstock was *Prunus mahaleb* for all cultivars.

Compatibility of *Prunus mahaleb*, CEMA /CT-500/ was good for both sweet and sour cherry cultivars. The horizontal growth is limited mainly due to the root concurrency (Hrotkó, 2003).

The productivity for different sweet cherry cultivars was determened by the number of fruit-bearing parts on different aged palnt The parameters of reproductive characteristics are the next:

- Specific values of the differently aged fruit-bearing parts
- The specific values of blossom density
- The specific values for fruit set
- Number of fruit set from 100 flowers (K%)
- Fruit size (weight, diameter: d1, d2 and height and the length of the stems)
- Total soluble solids content (Brix%)
- Yield productivity

For the age of fruit-bearing, specified for 1 meter, the mean flower numbers from short fruit-bearing shoot was determined and from this the fruit set was calculated.

The size of fruit was determined using digital callipers. Ballance was used to determine the fruit weight. The total soluble solids content was determined by refractometer.

Preparation of spike spindle crwon form

The dominant characteristic of the spike spindle crwon form is the central axis, on which 1-4-year old lateral twigs are located in a spiral form.

In the planting year, in 2000, no pruning was perfomed. Buds of the nearly 2.5 meters trees in height were sprouted on their full lenght or shoot does not formed vital buds on the lower part of tree and they produced rosettes at a rate of 60-80% and produced a small number of short shoot with lesser extent.

A year after plantation (2001), when the longest shoots reached 35-40 cm in length, all shoot was cut on the whole length of the central axis. The growth of cut shoot temporarily stopped, and then terminal buds bursted again and produced 1-3 secondary shoots depending on the cultivar.

Secondary and tertiary branching increased due to the effect of summer pruning, and they gradually filled the space, and developed the trees of spike spindle crwon form with 1 m diameter, and with a 2.5 m in height. The trees in the third year, without exception, reached the 1-meter diameter. This year, apart from shoot pruning, there was a need for shortening the lateral twigs with lower and larger extents during the summer. Summer pruning was performed 2-3 times annully per year and about 10-15% of leaf area was removed depending on the cultivars.

Restrictions of the crown height, i.e. too thick crown parts, was removed in spring before bud swelling by letting grow lateral twigs with a favorable position.

The summer pruning after creating the crown has an important role in the development of the outer peripheral part thinning. The shoots and short fruit-bearing parts with posy developed on the central axis of spike spindle can get appropriate amount of light if they receive 2-3 summer pruning annually (Király, 2006, Gonda et al., 2007).

After 6 years of the plantation, cut-back pruning of shoots was eliminated. The desired illumination was solved with leting grow those lateral shoots that was on lateral part of crown. Thus, the shoots during the growing period can reach full length which was favourable for producing fruit bearing part on older crown parts.

RESULTS

For the short fruit-bearing parts of sweet cherry cultivars with different ages in terms of loading *(Table 1),* the following can be observed. The number of short fruit-bearing part with posy considerable for all cultivars on the two-year old plant parts, which is known to be the most valuable fruit-bearing part. The single bud is considerable for cultivars 'Germersdorfi 3' and 'Stella' which means several growth points. Cultivars 'Linda' and 'Axel', and 'Sunburst' and 'Van' produced the same amount short fruit-bearing part with posy on the two-year old plant parts as the the three-year old plant parts. However, Cultivar 'Germersdorfi 3' produced only half while cultivar ’Stella’ only one-third compared to the two-year old plant parts. In contrast, In contrast, cultivars 'Germersdorfi 3' and 'Axel' was very productive even on the four-year plant parts. Cultivar 'Linda' showed considerable bud dead on the four year old shoots

Table 1

Fruit bearing parts on plant parts of sweet cherry cultivars with various age (Debrecen-Pallag, 2009)

Sweet cherry cultivar	single bud piece/m	short fruit-bearing part with posy piece/m	single bud piece/m	short fruit-bearing part with posy piece/m	single bud piece/m	short fruit-bearing part with posy piece/m
Age of fruit-bearing part (year)						
	year 2		year 3		year 4	
'Germersdorfi3'	3.8	18.7	2.2	9.1	1.4	17.8
'Linda'	0.4	11.8	0.0	11.7	0.0	0.0
'Axel'	0.0	31.2	4.2	13.2	1.7	9.2
'Van'	1.5	12.6	0.3	13.1	2.2	1.1
'Sunburst'	2.6	12.4	0.0	11.6	0.0	2.3
'Stella'	3.8	23.4	3.9	8.5	0.0	2.4

The actual flower quantity per 1 meter is in *Figure 1*. In this case, the differences between cultivars and age are substantial. Cultivar 'Linda' showed outstanding flower numbers on one-year twigs and with aging this was the only cultivars which ahowed increasing flower number. However, still not forget that 4-year old twigs are already considered critical for fruit-bearing, i.e. they are not producing living buds. In case of

cultivar 'Axel' and 'Stella', the degradation is spectacular towards the older parts. On the 4 year parts, flower number is the lowest in almost all cultivars. Cultivar 'Van' and 'Germersdorfi 3' showed the most differences. The average number of flowers was considerable on the 2-3 year old parts for the former cultivar, while on 2 year old parts and on the 4 year old parts for the latter cultivar.

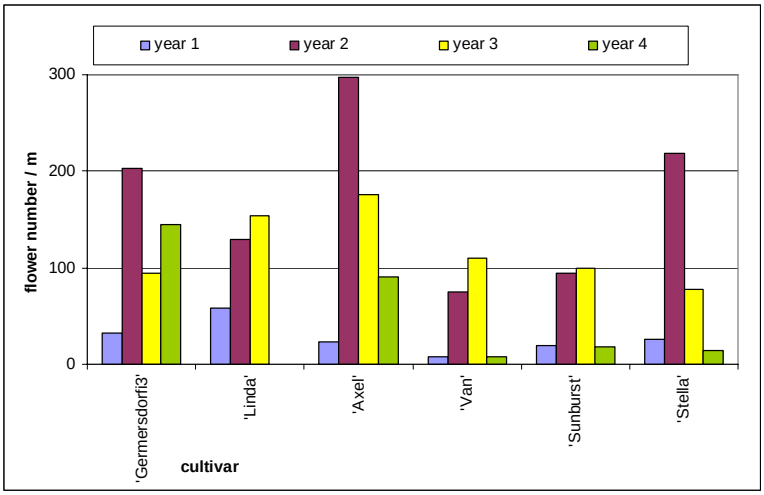

Fig. 1: Specific value of flower number on plant parts of sweet cherry cultivars with various age (Debrecen-Pallag, 2009)

Specific value of permanently setted fruit (K%) is shown in *Figure 2*, while the setting potential is shown in *Figure 3*.

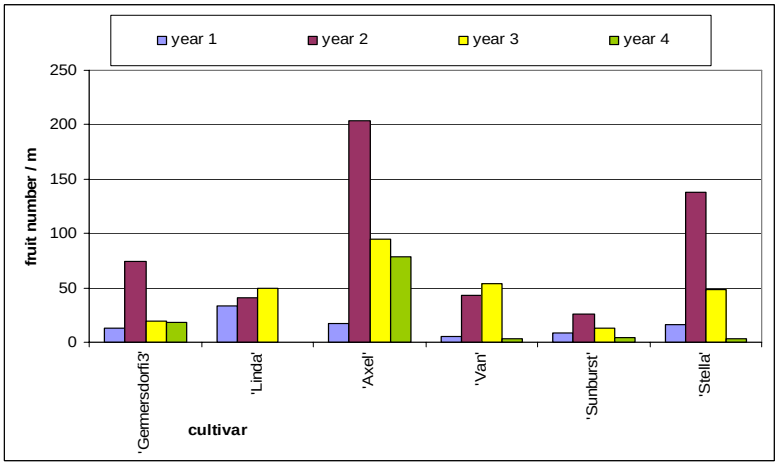

Fig. 2: Specific value of fruit production on sweet cherry cultivars (Debrecen-Pallag, 2009)

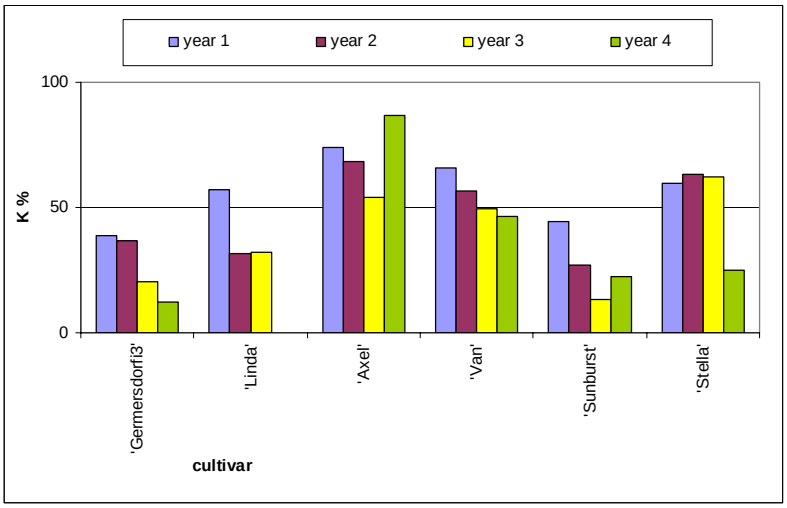

Fig. 3: Number of fruit set from 100 flowers (K%) on sweet cherry cultivars (Debrecen-Pallag, 2009)

According to *Figure 2* it can be stated that the really valuable part of productivity is the 1-2 years old plant parts in case of cultivar 'Germersdorfi 3'. Despite this potential, this cultivar can be characterized low setting potential *(Figure 3).* The setting potential decreases with age for cultivar 'Linda', despite the fact that number of flowers was contrary. The setting potential was moderate for cultivar 'Van' and it was more or less the same on variously aged plant parts, while cultivar 'Sunburst' is characterized by low fruit setting values.

Excellent, i.e. high fruit setting values was observed *(Figure 3)* for cultivars 'Axel' and 'Stella', even the 4-year-old part was very productive.

Table 2

Typical size of fruits of sweet cherry cultivars (Debrecen-Pallag, 2009)

Cultivar	d1 (mm)	d2 (mm)	M (mm)	Lenght of stem (mm)	Weight (g)
'Germersdorfi3'	27.7	23.6	24.5	48.7	9.5
'Linda'	27.1	22.1	24.0	48.8	8.4
'Axel'	22.5	18.9	21.6	33.6	5.9
'Van'	24.4	20.2	21.1	28.3	6.3
'Sunburst'	24.5	20.7	22.7	38.2	6.1
'Stella'	23.1	20.2	23.9	42.1	6.2

The mean wieght of fruit of sweet cherry cultivars *(Table 2)* is due to load. We know that cultivars 'Linda' and 'Germersdorfi 3' has great fruit size, but in this case it can be stated that a large fruit size of cultivar Germersdorfi 3 ' is due to small load. While the oversetting of cultivar 'Axel' resulted only in a mean fruit size of 6 grams.

Analyzing further fruit parameters, it can be seen that again cultivars 'Germersdorfi 3' and 'Linda' produced fruit diameter over 27 mm in diameter (in the context of wieght). Clearly fruit diameter of cultivar 'Axel' was the least because of the excessive fruit setting. In general, the 24 mm fruit diameter could be seen this year.

Table 3 summarizes yields obtained on spike spindle crown from in 2009. The following yields are available for the yield per tree per hectare, i.e. 2500 tree per hectare.

The 'Axel' as an oversetting cultivar with widely dispersed fruits, produced very high yield this year. In qualitative terms, its small fruit was expressly disadvantageous. All cultivars

reached the excess of 10 tonnes of yield with exception of cultivars 'Germersdori 3' and 'Sunburst'. In particular, cultivar 'Linda' is remarkable as this cultivars produced almost 30 t / ha, which was coupled with is very good fruit size and weight.

Table 3

Yield productivity of sweet cherry cultivars (Debrecen-Pallag, 2009)

Cultivar	kg/tree	t/ha
'Germersdorfi3'	3.9	9.8
'Sunburst'	4.7	11.7
'Van'	7.6	19.1
'Stella'	10.7	26.8
'Linda'	10.9	27.3
'Axel'	11.3	28.4

According to *Table 4*, it can be said that cultivar 'Sunburst' is the most prominent among the cultivars (16.4% Brix), while the lowest of total soluble soluble solid was reach by cultivar 'Axel'. The low value is probably the result of overloading for this latter cultivar, while the high Brix % is the result of low loads for cultivar 'Sunburst'.

Table 4

Total soluble solids content of fruits of sweet cherry cultivars (Brix%) (Debrecen-Pallag, 2009)

Cultivars	Brix %
'Axel'	10.6
'Stella'	11.0
'Linda'	12.0
'Van'	14.0
'Germersdorfi3'	14.6
'Sunburst'	16.4

CONCLUSIONS, SUGGESTIONS

Our studies confirmed that there are significant differences between the cultivars on properties of setting and fruit bearing parts and yield production. Tested sweet cherry cultivars was good on spike spindle crwon form, with the exception of cultivar 'Germersdorfi 3', which produced only 4 kg fruit per tree due to underloading. Note that 6-9 kg fruits per tree can be harvested on those years when the tree was not threatened by frost.

In case of yield, it can be stated that, very significant yield can be achieved on spike spindle trees planted in distances of 4 x 1 m. To ensure this, it is essential to know the different ages and the number of fertility of fruit bearing parts of crown parts. The characteristics the production of fruit bearing parts - which vary by cultivars - raise awareness of the development and maintenance of best cultivar specific production surface. With the so-called "rotation" pruning, i.e. renewal pruning of parts of different ages at different times, the aging process can be avoided or delayed.

As we could seen for cultivar 'Linda', this cultivar can not produce buds on the four year twigs, therefore, partial renewal of the crown need to be started on the 3 years old trees. In contrast, cultivars 'Axel' and 'Van' is very fertile on the 4-year parts.

Further studies on these cultivars will specify the fruit size and inner content features on tree parts with different ages.

The intensity and quality oriented production and the excellent quality in long-term can be implemented with cultivar specific pruning.

REFERENCES

1. Bujdosó G.- Hrotkó K. (2003): A cseresznye és a meggy növekedése és termőre fordulása növekedést mérséklő alanyokon. Kertgazdaság, 35 (3): 3-10.
2. Hrotkó K. (2000): A cseresznye, meggy és szilva intenzív művelési rendszerei. Gyakorlati Agrofórum, 11 (13): 10-14.
3. Hrotkó K. (2001): A cseresznye és meggy intenzív művelése: Módosított Brunner-orsó és karcsúorsó. Botanika Kft, Budapest.
4. Hrotkó K. (2003): A cseresznye és a meggy alanyai. In: Hrotkó K. (szerk): Cseresznye és meggy. Mezőgazda kiadó, Budapest, 119-145.
5. Hrotkó K.- Simon G. (1996): Effect of rootstock on the growth and productivity of cherry trees. Acta Hort. 410: 519-525.
6. Hrotkó K.- Magyar L.- Simon G. (1999): Growth and yield of sweet cherry trees on different rootstocks. International Journal of Horticultural Science 5 (3-4): 98-101.
7. Juhász L.- Páldi E.- Brunner T. (1996): The relationships among fruiting, vegetative growth and rootstock in sweet cherry trees. Acta Hort. 410: 291-294.
8. Király K. (2006) : Cseresznyefajták intenzív termesztésre való alkalmasságának összehasonlító vizsgálata. Doktori értekezés.
9. Gonda I, Király K, Holb IJ (2007) Examination of growth of cherry cultivars adapted to intensive production. Acta Hort. 732: 429-434 (2007)
10. Soltész M. (1997): Cseresznye. In: Soltész M. (szerk): Integrált gyümölcstermesztés. Mezőgazda kiadó, budapest.653.
11. Zahn F. G. (1996): Close planting in relation to low orchard height. Horticultural Science 28 (1-2) : 58-66.