EFFECT OF TREE TRAINING SYSTEM ON YIELD AND FRUIT QUALITY OF SWEET CHERRY 'KORDIA'

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A B S T R A C T

The subjects of this study were 8-year-old sweet cherry trees of the cultivar 'Kordia' grafted on the 'Colt' rootstock. The trees had been trained as spindles for four years after planting. In the fifth year, four systems of pruning were introduced: 1) the spindle form – i.e. the pruning system remained unchanged, 2) Zahn's method of pruning, 3) one-year-old shoots were cut back leaving approximately 10 buds, 4) no pruning at all - control trees. An assessment of the effects of these training systems was carried out in the third and fourth year of the study. The best results were obtained with the trees formed in the shape of a spindle and the trees pruned according to Zahn's recommendations. Cutting back long one-year-old shoots caused a significant decrease in the total yield and a small increase in the average fruit weight. The smallest values of canopy volume were obtained in the combination where long shoots had been shortened, while the largest canopies were found in the control combination. Canopy volumes of the trees shaped as spindles and of those pruned using Zahn's method were similar.

Key words: canopy, spindle form, pruning

INTRODUCTION

Sweet cherry trees produce strong-growing shoots and have a tendency towards forming large canopies (Lang et al., 2004). However, in commercial orchards it is preferable to have trees with small dimensions (Rozpara and Grzyb, 2006). Another factor that has an influence on tree size, after the rootstock (Kurlus, 2004; Wociór, 2008; Bielicki and Rozpara, 2010), is the tree training system (Cittadini et al., 2006; Robinson et al., 2006). An appropriate canopy shaping and tree

pruning system allows to obtain high yields of good quality fruit, while making harvesting quick and easy (Hrotkó, 2005).

MATERIAL AND METHODS

The experiment was conducted in 2008-2009 in an experimental orchard near Cracow. The subjects of the study were 8-year-old sweet cherry trees of the cultivar 'Kordia', grafted on the 'Colt' rootstock and spaced at 6 x 4 meters. Up until the year 2004, all the trees were shaped as spindles, which allowed a good yield and fruit quality to be obtained (Facteau et al., 1996). From 2005, the following pruning methods were used: 1) spindle-shaped canopy – i.e. the pruning method remained unchanged; 2) Zahn's method of pruning – branches more than 5 years old and thicker than the radius of the trunk below the crotch (Fig. 1) were cut back, leaving an approximately 25 cm long stub of the old branch; stub pruning is claimed to protect against Pseudomonas cankers by 'distancing' the trunk from infections (Carroll et al., 2010); 3) cutting back one-year-old shoots (all long one-year-old shoots were shortened, leaving approximately 10 buds); 4) no pruning – control trees were not pruned at all. Each combination consisted of 4 replications, with 2 trees per replication. Pruning was carried out in spring, during sunny weather. Fruit weight, pH, soluble solids content and titratable acidity of the juice were determined for 100 randomly selected fruits from each replication. Titratable acidity of the juice was tested using the titration method and the results are given in ml of NaOH. Canopy volume was calculated based on the height and two width measurements of the canopy (along and across the row). Depending on the canopy shape, calculations were performed using the cone or cylinder volume equation.

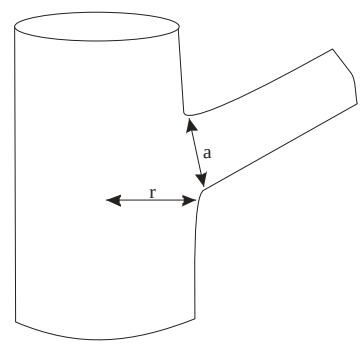

Figure 1. Zahn's method of pruning: a branch (a) that is thicker than the radius of the trunk (r) below the crotch should be cut off, leaving an approximately 25 cm long stub

RESULTS AND DISCUSSION

All three pruning systems and canopy shaping methods caused a reduction in the total yield in comparison with unpruned trees (Tab. 1). The lowest total yield, two times lower than in the control, was obtained from the trees whose long shoots had been pruned back. The total yield from the trees trained as spindles did not significantly differ from that of the trees pruned using Zahn's method. Similar mean fruit weight in 'Kordia' was noted by Wociór (2008). A natural consequence of the reduction in yield should be an improvement in fruit size. Zahn's system of pruning and spindle-shaped canopies contributed to the increase in the average fruit weight (Tab. 1), as observed during both years of the study. Similar positive results of pruning old and thick branches had also been observed in experiments with apple trees (Szewczuk and Gudarowska, 2003). Cutting back one-year-old shoots, in spite of a significant negative influence on the total yield, had a positive influence on the average fruit weight during the first year of the study. During the second year, fruit weight was the same as for the control trees. Both the total yield and average fruit weight obtained during the study were significantly smaller than those reported by Bielicki and Rozpara (2010).

All the pruning systems caused a reduction in canopy volume (Tab. 1). The trees whose long shoots had been pruned back had the smallest canopies. There were no differences observed in the size of the canopies trained as spindles and those pruned using Zahn's method.

The results for pH, soluble solids content and titratable acidity of the fruit juice did not show any significant influence of the pruning system and canopy shaping method on the tested parameters (Tab. 2). The results suggest that the spindle shape is a universal form of the canopy, suitable not only for apple (Buler and Mika, 2004), pear (Sosna and Czaplicka, 2008) or plum trees (Buler et al., 2006), but also for sweet cherry trees.

Table 1. Yield, fruit weight and canopy volume depending on tree training system

Combination	Yield [kg per tree]		Fruit weight [g]		Canopy volume [m^3]	
Training system	2008	2009	2008	2009	2008	2009
Control	20.0 a*	25.7 a	6.8 b	8.0 b	30.4 a	36.3 a
Spindle tree	12.9 b	16.2 b	7.5 a	8.6 a	20.6 bc	23.2 bc
Zahn's pruning	12.8 b	17.5 b	7.7 a	8.3 a	23.7 b	27.8 b
Long shoots pruning	7.8 c	11.5 c	7.8 a	8.0 b	18.8 c	20.5 c

*Values marked with the same letter do not differ at p = 0.05

Table 2. Extract, pH and acidity of fruit juice depending on tree training system

Combination	Extract [Brix °]		pH		Acidity of juice [ml NaOH]	
Training system	2008	2009	2008	2009	2008	2009
Control	16.3 a*	15.2 a	3.9 a	3.8 a	4.3 a	4.8 a
Spindle tree	15.6 a	14.9 a	3.9 a	3.8 a	4.5 a	4.3 a
Zahn's pruning	16.8 a	14.9 a	3.9 a	3.8 a	4.5 a	4.3 a
Long shoots pruning	16.0 a	14.8 a	3.9 a	3.8 a	4.4 a	4.8 a

*Explanation, see Table 1

CONCLUSIONS

1. The most favourable canopy form for 'Kordia' sweet cherry trees proved to be the spindle shape and the form produced by Zahn's pruning method.

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WPŁYW SYSTEMU CIĘCIA DRZEW NA PLON I JAKOŚĆ OWOCÓW CZEREŚNI ‘KORDIA’

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S T R E S Z C Z E N I E

Badano ośmioletnie drzewa czereśni odmiany ‘Kordia’ na podkładce ‘Colt’. Drzewa przez cztery lata po posadzeniu prowadzone były w formie korony wrzecionowej. W piątym roku po posadzeniu wprowadzono cztery systemy cięcia i prowadzenia drzew: 1) kontynuowano formę wrzecionową, 2) zastosowano metodę cięcia według Zahna, 3) skrócono długie pędy jednoroczne do około 10 pąków, 4) pozostawiono drzewa bez cięcia, co stanowiło kontrolę. Ocenę wpływu systemów cięcia i prowadzenia drzew przeprowadzono w trzecim i czwartym roku badań. Najlepsze rezultaty zanotowano na drzewach prowadzonych w formie korony wrzecionowej oraz ciętych według systemu Zahna. Skracanie długich pędów jednorocznych na 10 pąków spowodowało wyraźne obniżenie plonu ogólnego i niewielki wzrost średniej masy owoców. Najmniejszą objętość korony drzew zaobserwowano przy skracaniu długich pędów, natomiast największą na drzewach kontrolnych. Drzewa prowadzone w formie korony wrzecionowej oraz cięte według systemu Zahna miały podobną objętość korony.

Słowa kluczowe: korona, forma wrzecionowa, cięcie