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THE INFLUENCE OF SPUR THINNING ON YIELD AND FRUIT CHARACTERISTICS OF SWEET CHERRY CV. 'STARKING HARDY GIANT'

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Abstract

This work presents the influence of different intensity of hand spur thinning on yield and fruit characteristics (fruit weight, index of fruit shape, soluble solids, sugars and total acids content) in sweet cherry cv. 'Starking Hardy Giant'. The experiment was carried out in commercial sweet cherry orchard located near Belgrade, during 2010. Planting distance applied was 4,5 x 3,5 m and tree shape was central leader. The obtained results indicate that more intensive spur thinning had a positive influence on increase of fruit weight and earlier ripening, whereas yield was slightly decreased.

Keywords: *Prunus avium*; crop management; fruit quality; yield

Introduction

Sweet cherry is one of the earliest ripening fruit in the season, which is mainly used for fresh consumption (Milatović et al., 2011). Sweet cherry production provides high income based on high price of their fruits in the market.Consequetly, in the last 30 years sweet cherry production was intensified through creating self-fertile cultivars with large and quality fruits and new less vigorous rootstocks, as well as by applying new growing tehnologies. Rootstock and training system affect sweet cherry growth, yield and fruit quality (Whiting et al., 2005).

By increasing sweet cherry production in the world, market demands in terms of fruit quality were also enhanced. Consequently, nowadays small fruit size is one of the limiting factors in marketing cherries (*Prunus avium* L.). In this context, larger fruit are more valuable then smaller fruit. Fruit that are about 26.6 mm (10-row) or larger are considered as premium quality (Whiting et al., 2005) and the target yield for mature (7th year and older) trees is ~16 to 17 mt/ha (Lang et al., 2004).

On highly spurred cultivars, training system and low vigor rootstock may lead to an imbalance between vegetative growth and fruiting, resulting in numerous but small and poorly-colored fruits (Lauri, 2005; Bennewitz et al., 2010). Unlike many other tree fruits, sweet cherry crop loads traditionally have not been thinned (by hand or by chemicals); crop loads are reduced almost by chance during pruning that primarily is done to control tree size (Lang and Ophardt, 2000; Bennewitz et al., 2010). Unfortunately, practical and/or affordable techniques to thin flower buds, or even flowers at bloom, currently do not exist for sweet cherry (Lang et al., 2004). The manual removal of fruiting spurs and chemically thinning blossoms have shown promise as crop loud management tools. (Lonahan et al., 2006)

The cherry rootstocks commonly in use in Serbia are *Prunus avium* L. (mazzard) and *Prunus mahaleb* L. Traditionally, cherry trees were trained as tall (4 to 5 m) trees with average planting distances of 5 to 6 m x 6 m (270 to 330 trees/ha). Recently, in new orchards

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cherry trees are on same rootstocks but planting density is higher (600 to 700 trees/ha) and tree high was being decreased on 3.5-4 m, in accordance with semi-pedestrian design.

The objective of this study was to investigate the influence of different intensity of manual removal of fruiting spurs on yield and fruit characteristics in sweet cherry cv. ‘Starking Hardy Giant’ grafted on *Prunus mahaleb* L.

Material and methods

The experiment was conducted at the commercial sweet cherry orchard that is located near Belgrade, during 2010. At the time of first significant fruiting, five-year-old ‘Starking Hardy Giant’/*Prunus mahaleb* L. sweet cherry trees, trained to central leader architecture, were utilized. The planting distance applied was 4.5 x 3.5 m. Standard pest management and nutrition practices were carried out.

In this study, we compared three different intensities of hand spur thinning. About 2 week before the earliest flowers began to open, fruiting spurs on 2-year and older wood were thinned. Thinning treatments were as followed:

T1) Thinning of every second fruiting spur on each branch (50% of fruiting spurs was thinned).

T2) Thinning of every third fruiting spur on each branch (33% of fruiting spurs was thinned).

T3) Thinning of first three to four fruiting spurs on 2-year-old wood, located below 1-year-old wood.

T4) Control, untreated trees without fruiting spur thinning.

The experiment was organized in a factorial treatment arrangement in a randomized complete block design with 5 blocks. During harvest in Jun, number of fruit was counted for each tree. Yield per tree was calculated as a product of fruit number per tree and average fruit weight. Samples of 50 randomly selected fruit from each replicate were examined for various traits as follows: fruit weight, diameter of fruit, soluble solids content, total and inverted sugars, sucrose content and total acidity. Fruit was graded for size into three groups. Fruit diameter was measured using calipers. Fruit shape index was calculated as a ratio of fruit height and width. Juice obtained from the fruits was used and soluble solids content assessed with an Atago PR-1 digital refractometer. Total sugars were measured according to Luff – Schoorl method (Egan et al., 1981), whereas total acidity was determined by neutralization to pH 7.0 with 0.1 N NaOH and acidity expressed as percent of malic acid equivalent.

A statistical analysis was performed using software Statistica 6.0 for Windows (StatSoft Inc., Tulsa, OK, USA). Data were calculated by ANOVA. Mean separation was done by Duncan’s test at 5% level of significance.

Results and discussion

The influence of fruiting spur thinning intensity on yield characteristics is shown in Table 1. The highest yield per tree, i.e. per hectare was obtained on control trees, whereas the lowest one recorded on trees with the most severe fruit spur thinning. Although yield was greater for 40% on control trees, no significant differences were observed. Fruiting index was also greater in untreated controls compared to all other treatments. Lang et al. (2004) reported that less severe thinning to 2 buds/spur gave enough fruit size with an excellent projected yield than more severe thinning to 1 bud/spur. Lauri (2006) considered that the effects of spur thinning depend on the cultivar. However, there was no clear trend of branch training treatment with regard to crop load or fruit size in cvs. 'Burlat' and 'Sumele', whereas in cv.

'Duroni 3' a negative impact on these properties was observed only in the first year. Lang and Ophardt (2000) found that the thinning of floral clusters to 3 buds/node resulted in yields similar to the untreated controls, thinning floral bud number to 2 buds/node reduced total yield by 17% and at 1 bud/node the total yield was reduced by 25%.

In the present study, the highest intensity of thinning with removing of 50% fruiting spurs showed significant influence on fruit weight increase (Table 2). The obtained fruits in this treatment were 11% larger than those obtained on the control trees. Our results are in agreement with Reginato et al. (2008) who confirmed that spur thinning generally improves fruit size. Lang and Ophardt (2000) determined that thinning floral buds to two/node increased fruit weight by 30% and treatment with one floral bud/node increased fruit weight by 43%. In both cases, the relative increase in fruit size was greater than the relative decrease in total yield, which was also confirmed by results obtained in our study. By examining the proportions of the total yield that fall into various fruit size classes, the highest number of fruit had diameter ranged from 22 to 26 mm (Fig. 1). Smaller fruits with diameter below 22 mm were recorded in control treatment, whereas the largest fruits with diameter above 26 mm were obtained on the most severe thinned trees. Considerable share of fruits in class of 22-26 mm observed in control treatment can be explained with first significant yield of examined trees. It can notice that fruits with longer stem were harvested on the most severe thinned trees in comparison to control trees and trees with 33% fruiting spurs thinned. Chemical fruit composition was improved significantly as yields were reduced through fruiting spur thinning (Table 3). The highest soluble solids content was found in fruits obtained on the most severe thinned trees and it was 2.2% higher than in fruits obtained in control treatment. Also, Lang and Ophardt (2000) determined that severe thinning floral buds increased soluble solids content. The same trend can be observed with regard to total and inverted sugars content, as well as total acidity. As noted before (Lauri, 2006), fruiting spur thinning can advance ripening date by an average of 2 to 4 days.

Conclusion

Results obtained in this study confirm that hand fruiting spur thinning decreased yield per tree and hectare. The most severe spur thinning significantly increased fruit size, so the largest fruits with diameter above 26 mm were obtained on the trees with 50% fruiting spurs removed. Smaller fruits with diameter below 22 mm were mainly recorded in control treatment. In general, soluble solids content and levels of total and inverted sugars were higher in fruits harvested on the trees with fruiting spur thinning in comparison to control treatment.

Acknowledgement

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Tables

Table 1. Yield characteristics affected by hand spur thinning intensity

Treatments	Yield (kg tree^{-1})	Yield (t hectare^{-1})	Fruiting index (kg cm^{-2} TCA)
T1	10.9	8.9	0.12
T2	12.7	8.1	0.11
T3	11.8	7.5	0.12
T4	15.4	9.8	0.15
	ns	ns	ns

* = *P* < 0.05 according to Duncan's test.

Table 2. Physical fruit characteristics affected by hand spur thinning intensity

Treatments	Fruit weight (g)	Fruit shape Index	Length of fruit stem (cm)
T1	8.3a	0.85	4.8a
T2	8.1ab	0.83	4.3b
T3	8.0	0.88	4.6
T4	7.5	0.84	4.2
	*	**ns**	*

* = *P* < 0.05 according to Duncan's test.

Table 3. Chemical characteristics affected by hand spur thinning intensity

Treatments	Soluble solids (Brix°)	Total sugars (%)	Inverted sugars (%)	Sucrose (%)	Total acidity (%)
T1	21.30a	17.66	16.26	1.32	0.79
T2	19.47ab	16.06	14.67	1.32	0.72
T3	19.59ab	15.96	14.57	1.32	0.73
T4	19.08	15.78	14.40	1.31	0.68
	*	ns	ns	ns	ns

* = *P* < 0.05 according to Duncan's test.

Figures

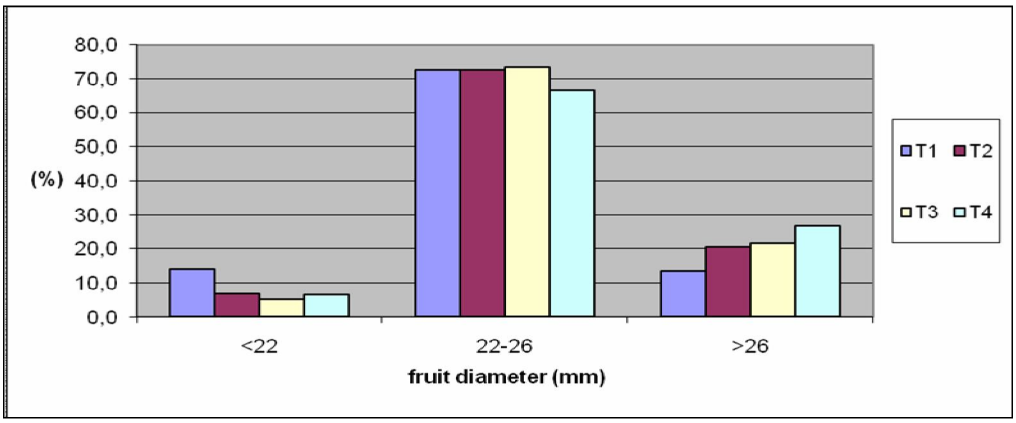

Figure 1. Fruit size distribution of sweet cherry cv. 'Starking Hardy Giant'