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POMOLOGICAL PROPERTIES OF SWEET CHERRY CULTIVARS ON GISELA 5 ROOTSTOCK IN THE REGION OF SARAJEVO

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Abstract

Pomological properties of five sweet cherry cultivars, grafted on Gisela 5 rootstock, were studied in the region of Sarajevo, during a two – year period (2010 – 2011). Studies have included time of flowering and maturing, and the most important physical and chemical properties of fruits. Cultivar 'Karina' had the greatest abundance of flowering, and, at the same time, the lowest weight of fruit. The highest weight of fruit was found in cultivar 'Schneider's Spate Knorpelkirsche', which also had the lowest abundance of flowering. In general, among the studied cultivars, 'Kordia' and 'Regina' were shown the best properties, and they can be recommended for commercial production in the region of Sarajevo.

Keywords: *sweetcherry, cultivar, flowering, maturing, fruit quality*.

Introduction

Sweet cherries are grown worldwide, on all continents, in all parts of temperate climate. They are very interesting for consumers and has always been described as ''respected'' fruits of high quality. Fruits of sweet cherry are refreshing, diuretic, energetic, anti–infective and it has the laxative and detoxifying effect. That is the reason why the greatest part of harvest (around 85%) is used fresh for consumption, although it is also used for various kind of processing (compote, jam, candied fruit, juice, brandy, etc.). Concerning the fact that the demand for sweet cherry fruits increases from year to year, in perspective, there are real conditions to expand the production, and at the same time to enlarge its economic significance. An increase in production of sweet cherries, as well as profitability of its growing, depends on biological and economic properties of the cultivar and the rootstock.

Bosnia and Herzegovina has a long tradition of fruit production, as well as all conditions for the development of fruit production. According to the data of Federal Bureau of Statistics, there has been an increase in the number of planted and productive trees recently, affecting an enlargement of production. In the region of Bosnia and Herzegovina, sweet cherry is mostly grown on the location of Mostar and in the valley of the Neretva River, in the first place due to favorable agro-ecological conditions. The mostly grown are early – season cultivars, that ripen at the beginning of May. They are, mostly, autochthonous cultivars such as: Mostarska, Arslama, Bosanlija, Hrust, Bjelica. Unavailability of sweet cherry on the market is permanent, and the export of fruits is almost negligible. According to the data of Agency for Statistics of Bosnia and Herzegovina during 2007 and 2008, there was no export of sweet cherries and the whole production was put on the domestic market. Apart from that, a certain amount of fruits was also imported during this period.

The aim of this work was the study of pomological properties of sweet cherry cultivars, with different time of ripening. According to this results, recommendation of the best cultivars for commercial growing in the conditions of Sarajevo could be made.

Materials and methods

The research was carried out during 2010 and 2011, on the location of Sarajevo, in the cherry orchard for cultivar testing of Federal Bureau of Agriculture of Bosnia and Herzegovina located in Butmir – Ilidza. Test plantation was bulit in the spring of 2007, at the altitude of 600 meters above sea level. Five cultivars of sweet cherries were studied: 'Burlat', 'Kordia', 'Schneider's Spate Knorpelkirsche', 'Karina', 'Regina'. Rootstock for all varieties was 'Gisela 5'. Training system is modified slender spindle with spacing of planting 4×2 m (1250 trees/ha).

Flowering was followed by recommendations of the International working group for pollination (*Wertheim*, 1996). The date of beginning of flowering was taken when 10% of flowers were open, full – when 80% of flowers were open, end – when 90% of petals were fallen. Duration of flowering was determined by the number of days from the beginning to the end of flowering. Abundance was assessed according to a scale from 1 (no flowers) to 9 (abundant bloom). The date of harvest is taken as the time of maturing. Characteristics of fruit are determined on a sample of 30 fruits for each cultivar. Standard morphometric methods were used to determine the weight of fruit, dimensions of the fruit, the length of the stalk and the weight of the stone. Index of the fruit shape is calculated by formula: length of the fruit^2/width of the fruit × thickness of the fruit. Proportion of the stone is calculated by formula: the weight of the stone × 100 / total weight of the fruit. Soluble solids are determined by refractometer, total acidity is determined by titration with 0,1N NaOH, and sugars by method of Luff-Schoorl.

The results are processed by the statistical method of the analyses of variance for two factorial experiment. The significance of differences between mean values is determined by Duncan's multiple range test at P=0,05.

Results and discussion

Flowering is one of the most important sweet cherry phenophases, because yield depends on the start, duration and abundance of flowering. The flowering time is greatly influenced by weather, particularly by temperature and relative humidity before the beginning of flowering and during flowering. Considering that many high – quality cultivars of sweet cherries are self – incompatible, knowing the flowering phenophase is very important for choice of cultivars before orchard planting. For a successful pollination it is necessary to combine those varieties that belong to the same group by the time of flowering.

Table 1. Phenological properties of sweet cherry cultivars in conditions of Sarajevo (average, 2010-2011)

Cultivar	Flowering					Time of maturation
	Beginning	Full	End	Duration /days	Abundance (1-9 Scale)	
Burlat	13.04.	17.04.	25.04.	12	2,3	03.06.
Kordia	17.04.	20.04.	30.04.	13	4,1	21.06.
Schneider's	18.04.	24.04.	02.05.	14	2,0	22.06.
Karina	17.04.	22.04.	01.05.	14	7,1	27.06.
Regina	19.04.	23.04.	04.05.	15	6,2	29.06.

The differences in flowering between the years of studies were noticed. Namely, in 2011, an earlier flowering period was noticed, 2 – 8 days in comparison with 2010. The average duration of flowering was 13.6 days (with variation of 12 – 15 days). The abundance of flowering has large influence on fruit set and yield. The largest flowering intensity was found in cultivar 'Karina' (grade 7.1), while the smallest intensity was found in cultivar 'Schneider's Spate Knorpelkirsche' (grade 2.0). In 2010, there was a smaller abundance of flowering because the studied cultivars were in the first year of production. The time of maturation of the studied cultivars was from 03. 06. ('Burlat') to 29.06. ('Regina'). Comparing the years of studies, it can be concluded that the differences in the time of maturation for the same cultivar were not big (4 – 6 days).

The weight of fruit is one of the most important pomological characteristics because the fruits are mainly used for fresh consumption. *Kappel et al.* (1996), giving the model of 'ideal' of sweet cherry cultivar, state that it should have the weight of fruit 11 – 12 g. *Crisosto et al.* (2003) state that the size of the fruit determines the crop, quality and acceptance of the cultivar by the consumers.

In our study, the weight of fruit ranged from 6.20 g in cultivar 'Karina' to 8.03 g in cultivar 'Schneider's Spate Knorpelkirsche'. 'Karina' and 'Regina' had statistically significant lower fruit weight than other cultivars . According to the obtained coefficients of variation, it can be concluded that the most uniform fruits were in cultivar 'Kordia' (5.76%) while the greatest variation was in cultivar 'Burlat' (11.41%).

Table 2. Fruitproperties of sweet cherry cultivars in conditions of Sarajevo (average, 2010-2011)

Cultivar	Fruit weight		Fruit dimensions (mm)			Shape factor	Stalk lenght (cm)	Stone properties	
	g	CV (%)	Lenght	Width	Thickness			Weight (g)	Share (%)
Burlat	7,94 ab	11,41	23,1	25,2	20,3	1,04	3,2	0,44	5,5
Kordia	7,81 b	5,76	23,0	24,7	20,6	1,03	4,9	0,42	5,3
Schneider's	8,03 a	6,27	23,3	25,3	21,1	1,01	5,0	0,48	5,9
Karina	6,20 d	7,71	20,9	22,7	20,0	0,96	4,4	0,45	7,2
Regina	7,50 c	6,92	22,5	23,8	21,0	1,01	5,1	0,57	7,6

Means followed by the same letter do not differ significantly according to Duncan's multiple range test at P=0,05

Average values of fruit dimensions were in correlation with the weight of fruit. In all studied cultivars, the larger width than length was found. On the basis of fruit dimensions, fruit shape factor was calculated. That value was lowest in cultivar 'Karina' (0.96), and highest in cultivar 'Burlat' (1.04). The length of stalk is an important parameter in cultivar determination. Longer stalk is better than shorter one because of easier picking and lesser tendency to decay and cracking of the fruit. According to *Schick* and *Toivonen* (2000) short and green stalk reminds buyers on freshness and juiciness of the fruit. Average weight of the stone in studied cultivars ranged from 0.42 g in cultivar 'Kordia' to 0.57 g in cultivar 'Regina'. The lowest share of the stone in total weight of the fruit was in cultivar 'Kordia' (5.3), and highest in cultivar 'Regina' (7.6). Sweet cherries with lower weight of the stone have better value, as well as those having lower share of the stone in total weight of the fruit.

Fruit quality of sweet cherry cultivars was defined on the basis of chemical properties of the fruit, and the results are presented in Table 3.

Table 3. Chemical composition of sweet cherry cultivars in conditions of Sarajevo (average, 2010-2011)

Cultivar	Soluble solids	Total sugars	Inverted sugars	Total acids
Burlat	13,40	8,28	7,25	0,44
Kordia	16,50	10,48	9,10	0,49
Schneider's	15,00	7,35	6,38	0,46
Karina	16,10	9,53	8,33	0,62
Regina	14,50	7,38	6,08	0,52

Main factor of fruit quality, is the content of soluble solids (*Crisosto et al*., 2003). It depends on many factors, and mostly on the cultivar (*Goncalves et al*., 2006), rootstock (*Usenik et al., 2010*) and stages of fruit ripeness (*Drake and Elfving*, 2002). The content of soluble solids in studied cultivars was 15.10% on average. The lowest content was found in cultivar 'Burlat' (13.20%), and the highest in cultivar 'Kordia' (16.50%). Lower content of soluble solids in cultivars 'Regina' and 'Kordia' was found in our study in comparison to the results of *Milatovic et al.* (2011). Comparing our results to the results of *Voća et al*. (2010) we can see that content of soluble solids in cultivar 'Karina' is slightly higher, while it is lower in cultivar 'Regina'. Content of total sugars ranged from 7.35-10.48%. The highest sugar content level was found in cultivar 'Kordia', while the lowest content of sugar was found in cultivar 'Schneider's Spate Knorpelkirsche'. Lower content of sugar in studied cultivars in comparison to the results of *Milatović et al*. (2011) is the result of earlier picking in relation to optimal fruit ripeness. Analysing the content of sugar types in the fruit, we made a conclusion that inverted sugars are dominant, and sucrose is present in smaller amounts, which is in accordance with the results of other authors (*Girrard and Kopp*, 1998; *Voca et al*., 2008). The content of acids ranged from 0.44% ('Burlat') to 0.62% ('Karina'). *Vangdal* (1985) states that the acid content does not significantly determine the quality of sweet cherry, considering that most of sweet cherries cultivars have almost the same low level of acids. According to *Kappel et al*. (1996) the 'ideal' of sweet cherry cultivars would be the one having the content of soluble solids between 17% and 19%. The differences between our results and results of other authors can be explained by the influence of different rootstock, soil and climate conditions, cultural practeces, and stage of maturity (*Drake and Elfving*, 2002; *Crisosto et al.*, 2003).

Conclusion

On the basis of two-year investigations of important pomological properties of sweet cherry cultivars, grafted on Gisela 5 rootstock in the region of Sarajevo, we have made the following conclusions:

Flowering of studied cultivars started in the second half of April, and it lasted 12 – 15 days (13.6 days on average). The earliest flowering was in cultivar 'Burlat', and the latest in cultivar 'Regina'.

Average time of maturation was from 3rd June ('Burlat') to 29th June ('Regina').

The weight of fruit ranged from 6.20 g ('Karina') to 8.03 g ('Schneider's Späte Knorpelkirsche'). 'Karina' and 'Regina' had statistically significant lower fruit weight than other cultivars. The most uniform fruits were in cultivar 'Kordia' while the greatest variation was in cultivar 'Burlat'.

Fruit shape factor ranged from 0.96 ('Karina') to 1.04 ('Burlat').

The length of stalk varied from 3.2 cm ('Burlat') to 5.1 cm ('Regina'). The studied cultivars can be divided into cultivars with short stalk ('Burlat'), cultivars with medium length of stalk

(‘Karina’) and cultivars with long stalk (‘Schneider’s Späte Knorpelkirsche’, ‘Regina’, and ‘Kordia’).

The lowest weight of stone was in cultivar ‘Kordia’ (0.42 g), and the highest was in cultivar ‘Regina’ (0.57 g). The lowest share of stone in the weight of fruit was in cultivar ‘Kordia’ (5.3%), and the highest was in cultivar ‘Regina’ (7.6%).

The content of soluble solids ranged from 13.40% (‘Burlat’) to 16.50% (‘Kordia’). The content of total sugars was 7.35 - 10.48%, and of inverted sugars 6.38 - 9.10%. Total acidity of studied cultivars ranged from 0.44 - 0.62%.

Taking all into account, the best features among studied cultivars were found in cultivars ‘Regina’ and ‘Kordia’. However, in order to make a final conclusion about these cultivars, the study has to be continued.

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