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Characteristics of 'Oblacinska' sour cherry (*Prunus Cerasus* L.) clones

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Abstract

This work presents a three-year study of twelve clones of 'Oblacinska' sour cherry. The studies were carried out at production plantings of sour cherry of the social company " Porecje" Vucje at working units Slavujevce and Igriste, and in the laboratories of the Faculty of Technology in Leskovac. Clone 28, which is the most prevalent in productive plantings, was used for comparison. During the performance of experiment, important chemical and technological properties of fruits, the content of dry matter and sugar were monitored. The obtained data were analyzed using statistical methods: analysis of variance and LSD test. According to the research, the following three clones of 'Oblacinska' sour cherry showed the best results: 56/21, 34/10 and 62/22.

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Introduction

The district of Jablanica in Serbia is well known for its cherry production. 'Oblacinska' sour cherry is the most represented autochthonous cultivar. In general, the current 'Oblacinska' sour cherry population was established by vegetative reproduction mainly by shoots. However, the possibility that the generative method of reproduction influenced the spreading of this cultivar should not be excluded (Mišić, 1989). General characteristic of Oblačinska sour cherry is low vigor, small canopy habit, self-fertility and high and regular yields (Milutinović and Nikolić, 1997). Its fruits are used for various types of processing. Juices, jams, marmalades, compotes, preserves, fruit yoghurts, chocolate candies are made from fruits of 'Oblacinska' sour cherry. The fruits can also be used for freezing and drying. Alcoholic drinks, such as liqueurs and cherry brandy, can be prepared from the fruits of 'Oblacinska' sour cherry.

The research of 'Oblacinska' sour cherry clones at different ripening stages, especially early and late clones, and its introduction to the production process, are very important objectives in fruit growing. The largest number of clones cherry ripens in the second and third decade of June. Extension of ripening season is less significant because of longer offer of the fresh fruits on the market, but more significant because of more efficient use of labor and mechanization for carrying out harvesting and processing. The fruits of 'Oblacinska' sour cherry clones should have a good quality flesh and small stone. Good quality of flash is determined by soluble solids content, the appropriate sugar/acid ratio and a high content of anthocyanin. Large expanses in Southern Serbia offer very convenient agro-ecological conditions for successful cultivation of 'Oblacinska' sour cherry, providing fruits of excellent quality and very high technological values (Janda, 1973; Veličković *et al., 2001*; Bugarčić and Janda, 1967). Socio-economic and bio-ecological significance of 'Oblacinska' sour cherry is very important and multifaceted, and therefore more attention should be paid to its cultivation (Niketić, 1966; Pavićević, 1976).

The aim of the research carried out in this study was to determine the proper selection of 'Oblacinska' sour cherry clones on the basis of its pomological and technological properties and its introduction to the further production.

Material and methods

Plant material and experimental design

Researches were carried out at production plantings ''Porecje Vucje'' and in the laboratories of the Faculty of Technology in Leskovac. The experiment was set up at working unit ''Slavujevce-Igriste'' at a height of 350-470m above sea level. The orchard was established in 1998, covering area of 80 ha and planting spacing 4m x 2m. The cultivation form was spindle-shaped shrub. Annually, standard cultural practices were performed.

Different 'Oblacinska' sour cherry clones were used as a starting material for this research. Clones were isolated on the basis of differences in phenophases, habits, leaves, fruits and organoleptic characteristics. Clone 28, which is the most prevalent in productive plantings, was used for comparison. Measurements of all trees' yields were carried out individually within the scope of all clones. In each treatment in random sampling of 50 fruits, fruit weight, stone weight, mesocarp weight and randman were calculated.

Chemical characteristics

Chemical characteristics of fruits were examined in the laboratories of the Faculty of Technology in Leskovac. The percentage of soluble solids content was determined by refractometer. Total acid content was determined by titration with 0.1 sodium hydroxide (N_aOH) and phenolphthalein indicator. They were converted into malic acid using the coefficient of 0.67. The pH value was determined by a pH meter.

Statistical analysis

The obtained data were subjected to an analysis of variance and the LSD test procedure was applied (Hadživuković, 1991).

Results and discussion

When selecting clones, high and regular yielding, fruit properties, resistance to frost and disease-causing agents, prolongation of the ripening stage, moderate vigor, suitability for mechanized harvesting, climate and soil conditions and the use of fruit, should be considered.

Pomological characteristics of Oblacinska sour cherry clones

In all three years of the experiment, the lowest average yield had clone 39/13 (6.60 kg/tree), but the highest clone 56/21(14.40 kg/tree), (Table 1). The results of Fisher's test showed that differences between clones were highly significant in terms of yield. Significant deviations were found in clones 56/21, 62/22, 50/18 and 34/10, in relation to clone 28.

Table 1. The mean values of yield and physical characteristics of the fruit of 'Oblacinska' cherry clones.

Clone	*Yield (kg/tree)*	*Fruit weight (g)*	*Stone weight (g)*	*Randman (%)*
56/21	14.40	4.04	0.37	90.08
34/10	12.40	2.74	0.60	78.10
62/22	12.85	4.85	0.44	90.93
50/20	8.55	2.77	0.45	83.75
45/17	12.05	4.48	0.82	81.70
29/8	10.65	3.10	0.51	83.55
39/13	6.60	2.52	0.61	75.79
78/25	8.50	2.34	0.58	75.21
50/18	12.65	4.01	0.55	86.28
18/2	7.55	2.28	0.42	81.58
81/34	9.60	3.43	0.49	85.71
28	9.40	3.39	0.60	82.30
LSD $_{(0.05)}$	1.95	1.16	0.12	-
LSD $_{(0.01)}$	2.66	1.52	0.16	-

Fruit weight presents property that influences yield, economy and profitability of the harvest. Pavićević (1976) cited that fruit weight of 'Oblacinska' sour cherry may vary from 2.8g up to 4g. Milutinović *et al.* (1980) identified varying intervals for fruit weight from 3.12g up to 4.01g in six examined clones of 'Oblacinska' sour cherry during three-year experiment, while Ogašanović *et al.* (1985) cited that in eight selected clones fruit weight varied from 2.8 to 3.1g. Nikolić *et al.* (2011) determined varying fruit weight from 2.97g up to 5.01g in eleven examined clones. The results of our research showed that the lowest fruit weight had clone 18/2, and the highest clone 62/22.

Analysis of variance showed that Fisher's test is very important. In order to determine significant differences between clones, the LSD test was applied. Using this test, significant differences of fruit weight were identified between clone 62/22 in relation to clone 28, and clones 62/22 and 45/17 in relation to clones 56/21 and 50/18. Significant differences of fruit weight were also determined between clones 62/22 and 45/17 in relation to clones 50/20, 34/10, 30/13, 78/25 and 18/2.

The average stone weight in examined clones of 'Oblacinska' sour cherry varied from 0.37g (clone 56/21) up to 0.83g (clone 45/17). Stone weight from 0.199g up to 0.27g was determined in 'Oblacinska' sour cherry clones (Mladenović, 1999), and from

0.27g up to 0.44g (Nikolić *et al.,* 2011). The results of Fisher's test showed significant differences of stone weight in examined clones. Significant deviation was identified in clone 45/17 in relation to clone 28.

Chemical characteristics of Oblacinska sour cherry clones

The percentage of soluble solids content is an important factor that affects the quality of the fruit. Soluble solids content in the fruit varies a lot, depending on weather conditions. In the years of high temperatures and lower precipitation, during ripening period, soluble solids content is higher, and vice versa, in the years of low temperatures and higher precipitation, soluble solids content is lower.

Soluble solids content in 'Oblacinska' sour cherry, in dependence of the year, location and harvest time, varies from 12% up to 17% (Pavićević, 1976). In six examined clones of 'Oblacinska', soluble solids content ranged between 12.81% and 17.90% (Milutinović *et al.,* 1980). On the other hand, Ogašanović *et al.* (1985) cited that in eight examined clones soluble solids content varied from 16.7% to 19.7%, while Nikolić *et al.* (2011) determined variation interval from 15.96% to 19.11% in eleven examined clones. In our three-year research, an average soluble solids content in fruit ranged between 14.63% and 24.70% (Table 2). The highest percentage of soluble solids content had clone 39/13 (24.70%), while the lowest percentage had clone 56/21 (14.63%).

Table 2. The mean values of chemical characteristics of the fruit of selected 'Oblacinska' sour cherry clones.

Clone	*Soluble solids content (%)*	*Total sugar content (%)*	*Invert sugar content (%)*	*Total acid content (%)*
56/21	14.63	10.00	8.86	0.64
34/10	18.87	11.11	9.82	1.07
62/22	23.50	10.78	9.40	1.43
50/20	15.73	8.50	7.54	1.19
45/17	15.80	8.79	7.86	1.37
29/8	16.50	10.13	9.05	1.07
39/13	24.70	10.45	8.57	1.09
78/25	21.17	9.67	8.71	1.06
50/18	19.50	9.33	8.20	0.97
18/2	16.00	11.26	10.40	1.08
81/34	16.50	7.75	7.26	0.72
28	20.33	9.26	8.34	1.20
LSD $_{(0.05)}$	0.73	0.84	0.75	0.13
LSD $_{(0.01)}$	0.96	1.10	0.99	0.18

Analysis of variance determined that the values of Fisher's test of soluble solids content in 'Oblacinska' sour cherry clones are higher than the corresponding table values. The significance of the applied Fisher's test seems to indicate that there are significant differences in soluble solids content in the fruit of examined clones. The LSD test determined significant differences between specific 'Oblacinska' sour cherry clones. The differences in soluble solids content between clones 39/13 and 62/22 in relations to clone 28 were at the level 0.01, whereas differences in clones 78/25 and clone 28 were significant at the level 0.05.

Our research results are different than those obtained by the authors above. Soluble solids content in the

fruit of 'Oblacinska' sour cherry clones is higher in comparison with the above authors' researches. The reasons for these higher values in soluble solids content could be due to low precipitation and high temperatures in Southern Serbia.

Fruit flavor is determined by the sugar/acid ratio. In cherry cultivars, it mostly amounts to 3-8 (Niketić-Aleksić, 1988), whereas in some Hungarian cherry cultivars it was above 10 (Mratinić *et al.,* 2009).

Total acid content in 'Oblacinska' sour cherry, in dependence of the year, location and harvest time, varies from 1.4% to 2% (Pavićević, 1976). Milutinović *et al.* (1980) determined that in six examined clones of 'Oblacinska', total acid content ranged between 1.45% and 1.95%. Slightly lower total acid content, ranging from 1.12% to 1.54%, was determined by Nikolić *et al.* (2011) in eleven examined 'Oblacinska' sour cherry clones. According to Ogašanović *et al.* (1985), total acid content in eight clones of 'Oblacinska' varied from 3.17% to 3.30%. In our three-year research, total acid content ranged between 0.64% (clone 56/21) and 24.70% (clone 62/22).

The LSD test determined significant differences of total acid content in clones 62/22, 50/20, 39/13, 34/10, 78/25, 50/18 and 18/2 in comparison to clones 56/21 and 81/34. The differences in clones 62/22 and 45/17 in relation to clones 50/20, 50/18, 39/13, 18/2, 29/8, 34/10 and 78/25 were at the level 0.01. The differences in clones 28 and 50/20 in relation to clone 78/25 and clone 28 in relation to clones 78/25, 34/10, 29/8 and 18/2 were at the level 0.05.

Total sugar and invert sugar contents vary in different clones. Then lowest average total sugar content had clone 81/34 (7.75%), while the highest total sugar content had clone 18/2 (11.26%). In some Hungarian cherry cultivars, total sugar content of the fruits ranged from 13.7-17% (Fotirić, 2009). Nikolić *et al.* (2011) reported that total sugar content in eleven examined 'Oblacinska' sour cherry clones varied from 9.36% to 11.82%.

Analysis of variance and the results of Fisher's test showed significant differences in total sugar content of the examined fruits. The LSD test determined significant differences of total sugar content in clones 18/2, 34/10, 62/22 and 39/13 in comparison to clone 28 at the level 0.01, and differences between clone 29/8 and clone 28 at the level 0.05.

Invert sugar content is lower than total sugar content in the examined fruits. The average invert sugar content in eleven 'Oblacinska' sour cherry clones ranged from 6.63% to 9.54% (Nikolić *et al.,* 2011). Our range values showed that the lowest invert sugar content had clone 81/34 (7.26%), while the highest invert sugar content had clone 18/2 (10.40%). Analysis of variance, applied for this characteristic, showed statistical significance. The LSD test determined significant differences of invert sugar content in clones 18/2 and 34/10 in comparisons to clones 78/25, 39/13, 45/17 and 81/34. Significant differences were determined in clone 28 in relation to clone 50/20, in clone 78/25 in relation to clone 45/17, in clone 34/10 in relation to clones 56/21 and 29/8. The difference in clone 18/2 in relation to clone 29/8 is at the level 0.01.

According to the obtained results of all examined characteristics, the following clones can be identified as the most perspective: 56/21, 34/10 and 62/22.

Conclusion

The results from conducted research reported that: examined clones showed statistically significant mutual differences under the investigated agro-ecological conditions that existed from 2008-2011; the highest average yield per tree was reached in clone 56/21 and the lowest in clone 39/13; the lowest fruit weight had clone 18/2, while the highest value had clone 62/22; the lowest stone weight had clone 56/21, while the highest value had clone 45/17; the lowest mesocarp weight had clone 78/25, whereas the highest value had clone 62/22; the lowest fruit

randman was reached in clone 39/13 and the highest in clone 62/22; the highest soluble solids content of the fruit had clone 39/13 and the lowest value had clone 56/21; the lowest total sugar content was reached in clone 81/34 and the highest in clone 18/2; the lowest invert sugar content was reached in clone 81/34 and the highest in clone 18/2.

Considering the obtained results, related to pomological, biological and technological characteristics of the examined 'Oblacinska' sour cherry clones, the expansion of the following clones can be recommended: 56/21, 34/10 and 62/22. In order to improve yield, fruit size and fruit quality, clone selection should be further pursued.

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