

CONSUMING QUALITY OF FRUITS OF NEW SWEET CHERRY FORMS SELECTED IN NIKITA BOTANICAL GARDENS

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ABSTRACT

The fruits of sweet cherry are valued for early maturing and high quality of a taste. The sweet cherry likes a warm dry climate. The steppe Crimea (Russia) is a favorable region for cultivation of sweet cherry varieties with high-quality fruits. The aim of research was to evaluate a consuming quality of fruits of new sweet cherry forms selected in Nikita Botanical Gardens. The study included 33 perspective forms and control zoned varieties, growing at the plots without irrigation in Simferopol region of the Republic of Crimea. As the rootstocks of studied forms we used seedlings of *Prunus mahaleb* L. Mill. The study was carried out during 2012-2015. Characteristics such as fruits size, attraction of appearance, density and succulence of a pulp, quality of a taste and fragrance of the fruits were valued. According to the results of evaluation, 12 forms were marked out: 387, 275, 434, 767, 305 and etc. According to the results of evaluation of fruits size, all marked samples were evaluated at 4,7-5,0 points (according to 5 point scale). The fruits weight was ranging from 7.2 to 8.9 g. The evaluation of attraction of appearance of marked samples was ranging from 4.8 to 5.0 points. The evaluation of the quality of taste was 4.8-4.9 points.

Keywords: *fruits, new sweet cherry forms, quality of a taste, appearance, evaluation.*

INTRODUCTION

Ones of the most important indicators of promising cultivars of sweet cherry are high marketable qualities of the fruits. Characteristics, such as attraction of appearance and large size of fruits, play an important role for increase their market value. Consumers are ready to pay a higher price for high-quality fruits (Perez-Sanchez et al., 2010; Prichko et al., 2013). They prefer dense fruit with high quality of taste in their choice (San Martino et al., 2008). Significant works for quality improvement of sweet cherry fruits were carried out in southern regions of Russia, particularly, in North Caucasian Regional Research Institute of Horticulture and Viticulture (NCRRIH&V, Krasnodar) and Nikita Botanical Gardens-National Research Center (NBG, Yalta). In the southern zone of horticulture of Russia, Krasnodar region and Crimea are the most favorable regions for industrial production of sweet cherry fruits with high taste quality. First of all, sweet cherry

fruits are valued for early maturing – she opens the season of consumption of fresh fruits one of the first. Besides, sweet cherry is unpretentious culture. That's why it is possible to cultivate her and to get high-quality production even at minimal pesticide load. It is very important for south of Russia, as the resort area with a great number of health resorts and sanatoriums (Ishina, 2014).

The aim of research was to evaluate a consuming quality of fruits of new sweet cherry forms selected in Nikita Botanical Gardens, such as fruits size, attraction of appearance, density and succulence of a pulp, quality of a taste and fragrance; and to determine influence factors for these characteristics, if it possible.

MATERIALS AND METHODS

The study was carried out during 2012, 2013 and 2015 at the plots in a village Novy Sad in Simferopol region of the Republic of Crimea (Russia). Experimental plots are situated on southern black soil without irrigation. Agrotechnical measures were minimal. The study included 33 perspective forms of sweet cherry selected in Nikita Botanical Gardens. All studied forms were planted according to the scheme of landing 7×6 meters on the seedlings of *Prunus mahaleb* (L.) Mill as a rootstocks. Forms were distributed by three groups according to terms of their ripening. For each group we chose zoned cultivar as a control.

During evaluation we used “Program and methods of cultivars studying of fruit, berry and nuciferous crops” (Sedov et al., 1999). Evaluation included measuring of next fruits parameters: average weight, lengthwise (D_1) and transverse (D_2) diameter and height. Average weight of fruit was determined by weighing of 100 fruit and calculation of average weight of one fruit. Maximal weight implies maximum average weight during the studying period. Sugar-acid ratio was determined by calculation of percentage of sugar and free acid in the fruits (sugar and acid content data were received from biochemical laboratory). Degustation evaluation was carried out by commission according to 5-point scale. Statistical data processing was carried out using Microsoft Office and Statistica 6.0.

RESULTS AND DISCUSSION

Size of fruits is biological, constant feature, but it can vary in different years. Factors, which influence upon size of fruit, are: peculiarities of cultivars, quantity of precipitation during the formation of the fruits and temperature condition. As example, we can see influence of peculiarities of cultivars on average weight data of forms 828, 275, 343, 434, 453, 593, 975, 297 and 305 (Tabl. 1). During the studying these forms had a minimal variability of fruit weight – variation ratio (measure of sign dispersion) of these forms was no more than 8%. In this instance, particularly valuable are medium ripening forms 275, 453 and 975 – their average weight didn't decrease below 7,4 g during the years of study.

Table 1. Fruit weight and size of new sweet cherry forms selected in Nikita Botanical Gardens

Cultivar	Average weight, g	Max weight, g	Variation ratio, %	Average diameter		Average height, mm
				D ₁ , mm	D ₂ , mm	
Early ripening						
Valeriy Chkalov (control) 21-27 387 758 828 923	6,5 ± 0,4 6,8 ± 0,4 7,6 ± 1,0 7,3 ± 0,5 6,6 ± 0,1 7,2 ± 0,5	7,2 7,5 9,7 8,2 6,9 7,8	10 10 23 11 4 11	24 ± 1,2	19 ± 0,6	20 ± 0,7 22 ± 0,9 21 ± 0,7 21 ± 0,9 20 ± 0,3 20 ± 1,3
				24 ± 1,5	22 ± 1,3	
				23 ± 1,5	20 ± 1,3	
				1,0	0,4	
				24 ± 1,5	21 ± 1,5	
				22 ± 1,5	18 ± 1,5	
				0,7	0,9	
				23 ± 1,9	20 ± 1,2	
				1,9	1,2	
				Medium ripening		
Melitopolskaya Chyornaya (control) 270a 272 275 294 320 343 355 434 453 471 537 593 601 602 607 613 760 762 767 963 964 975	7,2 ± 0,4 7,9 ± 0,6 7,9 ± 1,0 8,9 ± 0,2 7,6 ± 1,4 7,5 ± 0,8 6,4 ± 0,2 7,3 ± 0,7 7,3 ± 0,3 7,7 ± 0,2 8,2 ± 0,7 7,5 ± 0,6 7,3 ± 0,3 9,3 ± 0,9 7,3 ± 0,5 7,2 ± 0,9 6,2 ± 0,3 6,9 ± 0,4 7,2 ± 0,5 7,9 ± 0,7 7,4 ± 0,7 6,4 ± 0,3 8,1 ± 0,3 8,8 ± 1,3 8,3 ± 0,4	7,8 8,8 9,7 9,2 10,4 9,0 6,8 8,5 7,7 8,0 9,2 8,4 7,9 10,9 8,0 8,9 6,8 7,6 7,8 9,2 8,9 7,1 8,5 11,2 8,9	10 14 21 4 32 17 5 16 8 4 14 13 7 16 12 21 9 9 12 15 17 9 7 26 9	25 ± 1,2	21 ± 1,2	22 ± 0,7 23 ± 0,7 21 ± 0,9 23 ± 0,3 22 ± 1,2 22 ± 0,7 20 ± 0,6 21 ± 0,9 22 ± 0,3 20 ± 0,3 21 ± 1,2 20 ± 0,3 21 ± 0,3 23 ± 0,9 21 ± 0,3 21 ± 0,9 20 ± 0,9 20 ± 0,6 22 ± 0,7 21 ± 0,9 22 ± 0,6 23 ± 0,3 22 ± 0,3 24 ± 1,0 23 ± 0,9
				26 ± 0,9	22 ± 0,9	
				25 ± 1,5	22 ± 1,2	
				27 ± 0,9	22 ± 1,0	
				26 ± 1,2	21 ± 0,9	
				24 ± 1,2	20 ± 0,9	
				24 ± 1,2	20 ± 0,3	
				0,0	0,3	
				24 ± 1,5	20 ± 1,2	
				24 ± 1,5	19 ± 0,3	
				26 ± 0,9	20 ± 0,3	
				26 ± 0,3	21 ± 0,3	
				0,3	0,3	
				25 ± 1,2	20 ± 0,7	
				1,2	0,7	
				22 ± 0,9	19 ± 0,7	
				0,9	0,7	
				24 ± 0,9	20 ± 0,7	
				0,9	0,9	
				27 ± 1,2	22 ± 0,9	
				1,2	0,9	

980 H-d 3/127				23 ± 1,8 23 ± 1,7 23 ± 0,3 24 ± 1,2 24 ± 0,7 25 ± 1,2 23 ± 1,0 23 ± 0,3 25 ± 0,6 24 ± 1,2 27 ± 1,5 1,5	20 ± 1,5 19 ± 1,2 19 ± 0,3 20 ± 1,2 21 ± 1,2 22 ± 1,2 21 ± 1,2 19 ± 0,3 21 ± 0,9 21 ± 1,5 22 ± 1,5	
Late ripening						
Karadag (control)	7,8 ± 0,5	8,7	10	26 ± 0,7 25 ± 0,6 25 ± 0,6 24 ± 0,3 26 ± 1,2	21 ± 0,9 21 ± 0,6 22 ± 1,2 21 ± 0,3 20 ± 0,9	23 ± 1,0 22 ± 0,3 22 ± 0,6 20 ± 0,3 22 ± 0,6
297	7,7 ± 0,4	8,2	8	0,6	0,6	22 ± 0,3
300	8,2 ± 0,4	8,8	9	25 ± 0,6	22 ± 1,2	22 ± 0,6
305	7,5 ± 0,3	8,1	8	0,6	1,2	20 ± 0,3
460	7,2 ± 0,6	8,4	15	24 ± 0,3 26 ± 1,2	21 ± 0,3 20 ± 0,9	22 ± 0,6

Meteorological conditions during research period allowed to analyse their influence on quality of fruits. We analyzed temperature indexes and quantity of precipitation during the period of formation of the fruits (period from ending of blossoming till ripening) in each group of ripening (Tabl. 2). In 2012 this period was the hottest (average daily main temperature was 19,1-19,7 °C, average maximum temperature – 26,1-26,7 °C) and rainy (51,6-56,6 mm of precipitation). In 2013 daily temperature fluctuations were more abrupt – nights were colder and day temperature was higher than year before (average maximum temperature was – 26,7-27,0 °C). Nevertheless, average daily main temperature of that period was lower than in 2012 – 18,0-18,6 °C. Medium and late ripening forms got a more quantity of precipitation (45,7-58,1 mm). 2015 was anomalous by quantity of precipitation – 96,6-230 mm of precipitation fell out during the period of fruits formation (when average annual norm of precipitation is 480 mm (Antyufeyev,

2002). In that year average daily main temperature was lower – 15,6-17,3 °C, and average maximum temperature was 22,3-24,2 °C. As a result, in 2015 period of fruits formation was more long (36-53 days), than in 2012-2013 (26-47 and 31-48 days accordingly).

Table 2. Influence of meteorological conditions on fruit weight and sugar-acid ratio of new sweet cherry forms selected in NBG

Year	Average max temp., °C	Average min temp., °C	Average daily main temp., °C	Precipitation, mm	Average fruit weight, g	Average sugar-acid ratio
Early ripening						
2012	26,5	12,8	19,1	51,6	6,7 ±	23,6 ± 1,6
2013	26,7	11,6	18,0	28,1	0,19	22,6 ± 2,0
2015	22,3	10,8	15,6	96,6	6,6 ± 0,22 7,8 ± 0,45	20,2 ± 1,9
Medium ripening						
2012	26,1	13,0	19,1	56,6	7,4 ±	23,4 ± 1,1
2013	26,9	12,2	18,3	45,7	0,20	18,2 ± 0,5
2015	23,7	12,2	16,7	159,5	7,0 ± 0,18 8,4 ± 0,24	18,0 ± 0,7
Late ripening						
2012	26,7	13,5	19,7	56,6	7,6 ±	22,8 ± 1,7
2013	27,0	12,7	18,6	48,1	0,39	19,3 ± 1,5
2015	24,2	13,0	17,3	230,0	7,3 ± 0,26 8,1 ± 0,25	19,8 ± 1,1

Results of research didn't allow to confirm that temperature condition have influence on the fruits size. While a quantity of precipitation has influence on this parameter unconditionally (Fig.1-3). As we can see, temperature curve tends down, while curve of fruits size tends upward by analogy with curve of precipitation quantity.

First of all, meteorological conditions have influence on biochemical composition of fruits and, accordingly, on a taste quality. That's why curve of sugar-acid ratio tends down by analogy with temperature curve (Fig.4-6). It confirms that accumulation of sugar in the fruits reduces in rainy cold weather.

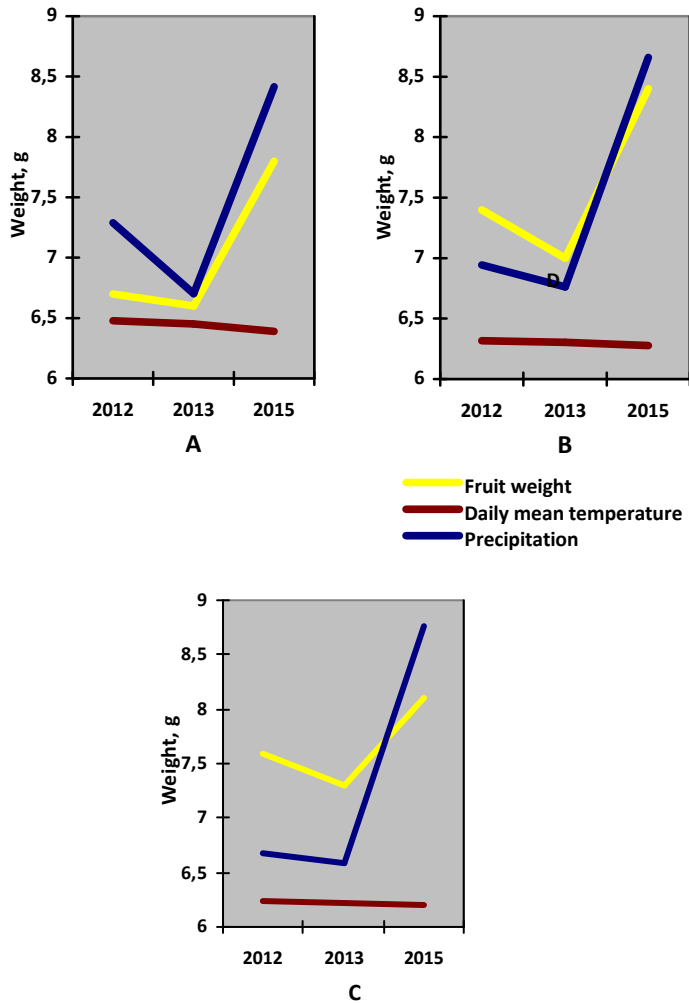


Figure 1-3. Variation of fruits weight with changing of daily main temperature and quantity of precipitation during the formation of the fruits in each group: A – early ripening; B – medium ripening; C – late ripening.

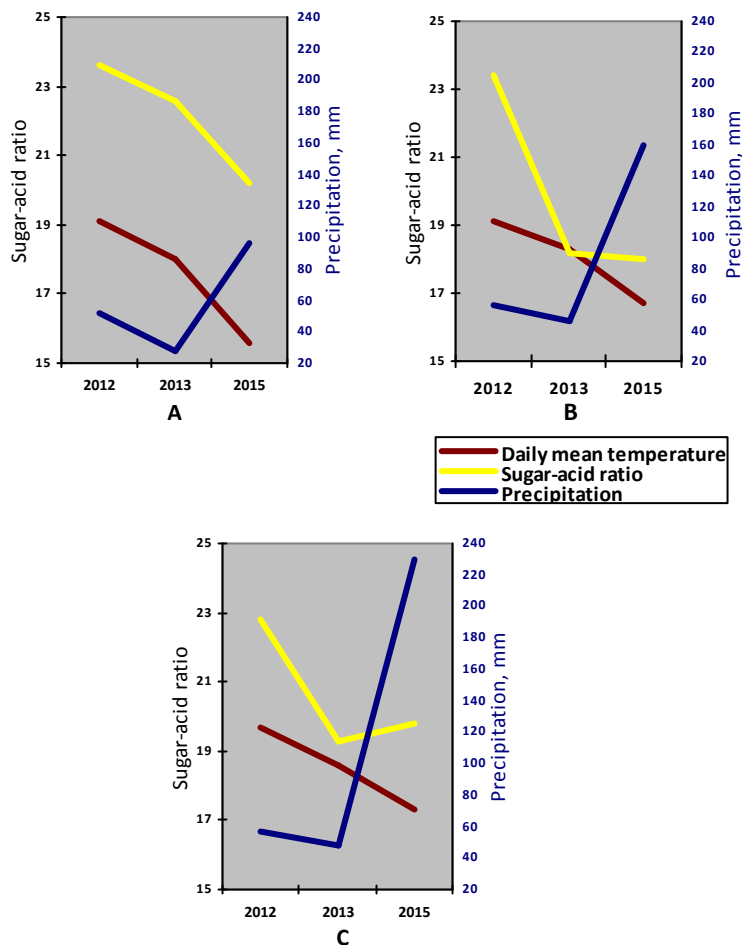


Figure 4-6. Variation of sugar-acid ratio with changing of daily main temperature and quantity of precipitation during the formation of the fruits in each group: A – early ripening; B – medium ripening; C – late ripening.

In our region the mean destination of sweet cherry is for fresh consumption. That's why degustation evaluation has a great importance. We carried out evaluation of fruits size, attraction of appearance, quality of taste and gave general assessment of the fruits (Tabl. 3). All studied forms were valued on 4-5 points as the fruits from medium till large sizes; from attractive till very beautiful form and coloring; from good till excellent taste.

According to the results of evaluation, 12 forms were marked out, which exceeded control zoned varieties. These are forms of early ripening – 387, 758; medium ripening – 275, 434, 593, 762, 767, 975, H-d 3/127; late ripening

– 297, 300, 305. The evaluation of quality of a taste of these forms was 4,82-4,92 points, and average assessment of the fruits was 4,82-4,96.

Table 3. Degustation evaluation of new sweet cherry forms selected in NBG (in points, according to 5-point scale).

Cultivar	Fruit size	Attraction of appearance	Quality of taste	Average fruit assessment
Early ripening				
Valeriy Chkalov (control)	4,60±0,21	4,74±0,14	4,81±0,07	4,72±0,12
21-27	4,83±0,06	4,86±0,02	4,76±0,01	4,81±0,02
387	4,92±0,02	4,95±0,02	4,86±0,04	4,90±0,04
758	4,81±0,08	4,81±0,08	4,83±0,07	4,82±0,08
828	4,16±0,34	4,38±0,38	4,42±0,36	4,31±0,36
923	4,30±0,37	4,37±0,21	4,43±0,29	4,37±0,29
Medium ripening				
Melitopolskaya Chyornaya (control)	4,39±0,21	4,65±0,14	4,48±0,14	4,50±0,16
270	4,67±0,13	4,79±0,11	4,77±0,18	4,76±0,14
272	4,82±0,15	4,76±0,11	4,69±0,11	4,75±0,12
275	4,97±0,01	4,97±0,02	4,88±0,04	4,94±0,02
294	4,76±0,14	4,66±0,08	4,61±0,10	4,69±0,10
320	4,57±0,40	4,63±0,34	4,70±0,25	4,63±0,33
343	4,48±0,41	4,53±0,30	4,55±0,33	4,52±0,28
355	4,74±0,04	4,77±0,01	4,78±0,0003	4,76±0,01
434	4,99±0,001	4,95±0,03	4,92±0,05	4,96±0,03
453	4,80±0,09	4,83±0,09	4,79±0,09	4,81±0,09
471	4,85±0,04	4,86±0,03	4,78±0,02	4,83±0,03
537	4,42±0,34	4,55±0,38	4,45±0,36	4,47±0,36
593	4,85±0,05	4,85±0,05	4,82±0,02	4,84±0,03

601	4,86±0,03	4,84±0,02	4,67±0,03	4,79±0,01
602	4,55±0,33	4,48±0,41	4,56±0,18	4,53±0,30
607	4,12±0,23	4,24±0,21	4,38±0,18	4,25±0,20
613	4,57±0,08	4,73±0,10	4,63±0,09	4,64±0,03
760	4,76±0,15	4,78±0,13	4,74±0,02	4,77±0,08
762	4,87±0,05	4,89±0,03	4,90±0,02	4,88±0,03
767	4,94±0,06	4,95±0,04	4,85±0,05	4,91±0,05
963	4,76±0,14	4,82±0,11	4,69±0,08	4,76±0,11
964	4,56±0,24	4,40±0,02	4,49±0,20	4,48±0,15
975	4,92±0,06	4,88±0,07	4,82±0,10	4,88±0,08
980	4,61±0,17	4,58±0,13	4,62±0,11	4,60±0,13
H-d 3/127	4,86±0,10	4,85±0,08	4,82±0,10	4,84±0,09
Late ripening				
Karadag (control)	4,85±0,09	4,86±0,09	4,78±0,07	4,83±0,08
297	4,80±0,11	4,78±0,10	4,80±0,09	4,80±0,10
300	4,98±0,02	4,97±0,01	4,88±0,02	4,94±0,02
305	4,94±0,03	4,87±0,07	4,85±0,04	4,89±0,04
460	4,70±0,15	4,80±0,14	4,79±0,10	4,76±0,13

Besides these features, during degustation we evaluated density and succulence of a pulp, fragrance, character of taste and coloring of the fruit. Character of taste, mainly, depends on combination of sugar and acid, and determined by the following terms: *sweet* (acid is not felt), *acidulous-sweet* (sweetness dominates, there is a slight acidity), *sour-sweet* (acidity and sweetness are felt good, sweetness dominates), *sweetly-sour* (acidity and sweetness are felt good, acidity dominates), *sweetish-sour* (acidity dominates, there is a slight sweetness), *sour* (sweetness is not felt). According to the results of evaluation, all studied forms were distributed on groups by each characteristic (Fig. 7). The samples with maroon coloring of fruits, with dense or very dense, succulent sour-sweet pulp and weak or medium intensity of fragrance constitute the main group among studied forms.

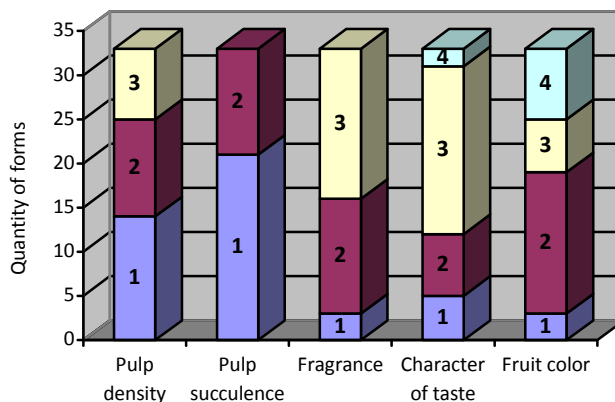


Figure 7. Distribution of studied forms by characteristics according to results of degustation evaluation. *Pulp density*: 1 – very dense, 2 – dense, 3 – medium density. *Pulp succulence and fragrance*: 1 – intense, 2 – medium, 3 – weak. *Character of taste*: 1 – sweet, 2 – acidulous-sweet, 3 – sour-sweet, 4 – sweetly-sour. *Fruit color*: 1 – blackish, 2 – maroon, 3 – from red to dark-red, 4 – yellow with reddish blush.

CONCLUSION

According to the results of research 6 forms, which have stable high quality of fruits, were marked out: 275, 434, 593, 975 (of medium ripening), 297 and 305 (of late ripening). These forms are recommended for use in the breeding and for transmission to the state tests of cultivars.

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