IZVORNI ZNANSTVENI RAD

Several pomological and chemical fruit properties of introduced sweet cherry cultivars in agroecological conditions of Eastern Slavonia

Marija Viljevac[1], Krunoslav Dugalić[1], Vlatka Jurković[1], Ines Mihaljević[1], Vesna Tomaš[1], Rezica Sudar[1], Zlatko Čmelik[2], Zorica Jurković[1,3]

[1]*Agricultural Institute Osijek, Južno predgrađe 17, Osijek, Croatia (marija.viljevac@poljinos.hr)*
[2]*Faculty of Agriculture, University of Zagreb, Svetošimunska cesta 25, Zagreb, Croatia*
[3]*Croatian Food Agency, I. Gundulića 36b, Osijek, Croatia*

Abstract
Modern sweet cherry growing requires cultivars with good pomological and chemical characteristics in order to ensure successfull production. Our goal was to assess fruit quality of introduced cultivars grown in agroecological conditions of Eastern Slavonia region. This study was conducted during the 2011 growing season on the seven introduced sweet cherry cultivars grown in orchard Tovljač (Agricultural Institute Osijek). Pomological (fruit weight, stone weight, randman) and chemical (total soluble solids, total titrable acidity, pH value) characteristics were determined. Results showed differences in investigated parameters between the cultivars. Among the evaluated sweet cherry cultivars, Regina is the most promising cultivar because of large fruits and good quality characteristics.

Key words: chemical characteristics, Eastern Slavonia region, introduced cultivars, pomology, sweet cherry

Introduction

Sweet cherry (*Prunus avium* L.) is one of the most appreciated fruit by consumers since it is an early season fruit and has an excellent quality (Martínez-Romero et al., 2006.). Because of rich fiber, vitamins, minerals and antioxidants contents, sweet cherry fruits has a nutritional and dietotherapeutic value so its consumption increasing in the world (Voća et al., 2007.). The main quality indices which determine consumer acceptance are skin color, total soluble solids - total titrable acidity ratio at harvest (Crisosto et al., 2003.) and fruit hardness which is directly related to enhancement of storability potential and induction of greater resistance to decay and mechanical damage (Barret and Gonzalez, 1994.).

A number of new sweet cherry cultivars with tolerance to cold, good fruit quality characteristics, moderate or compact growth habit and early to late ripening period have been bred. Varieties that ripe early achieve higher market price, although the sensitivity to cracking of fruits is larger, fruits are smaller and had lower randman. Varieties that ripe later have better pomological characteristics such as size, color and flavor, and less susceptibility to cracking of fruits (Sansavini and Lugli, 2008.). Flowering time, fruit set and fruit quality of each cultivar in relation to climate conditions of the area are important when choosing the best cultivars for production (Garcia-Montiel et al., 2010.). The replacement of old cherry cultivars with new productive and high quality cultivars has very slow progress as the evaluation of the new cultivars under Eastern Slavonia conditions is limited. The aim of this study was to assess fruit pomological and chemical characteristics quality of introduced cultivars grown in agroecological conditions of Eastern Slavonia region.

Material and methods

This study was conducted during the 2011 growing season (Figure 1) on seven introduced sweet cherry cultivars (Table 1) in the experimental orchard of the Agricultural Institute Osijek, Eastern Slavonia. The soil type is eutric cambisol. The trees were planted in the spring of 2007, in the irrigated orchard on the 1.5 x 4 m planting distance and trained as spindles. Standard agro-technical measures were made. Samples of thirty fruits of each cultivar harvested in full maturity were analyzed. Weather conditions at the test site are presented in Figure 1.

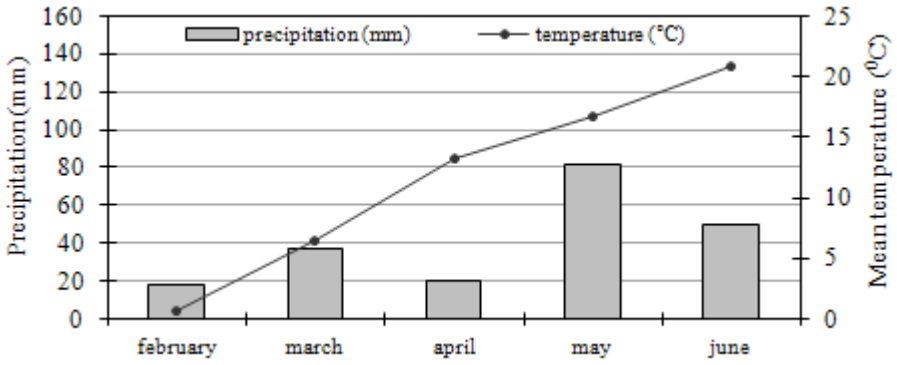

Figure 1. Precipitation (mm) and mean temperature (°C) during 2011 growing season

Several fruit quality characteristics are measured: average fruit weight (g), stone weight (g) and randman (%). Total soluble solid (TSS) was measured by refractometer (PAL-1, Atago, Tokyo Tech) and expressed as degree Brix (°Brix), total titrable acidity (TTA) were determined by titration with 0.1 M NaOH solution and expressed as % citric acid in accordance with AOAC (1995), total soluble solid and total titrable acidity ratio (TSS/TTA) was calculated and pH value was measured from homogenized sample.

Results and discussion

Origin of seven introduced sweet cherry cultivars investigated in this work is in Table 1. Earliest harvest in 2011. had cultivar Burlat (May 30th), and the latest cultivar Hudson (June 30th) (Table 1).

Table 1. Investigated sweet cherry cultivars in the Agricultural Institute Osijek

cultivar	origin	harvest date (2011)
Burlat	France	May 30th
Giorgia	Italy	June 10th
Blaze Star	Italy	June 14th
LaLa Star	Italy	June 24th
Skeena	Canada	June 29th
Regina	Germany	June 29th
Hudson	USA	June 30th

Fruit size and the consequent weight are an important characteristics for consumer choiche of fruits (Kappel et al., 1996). Average fruit weight of investigated sweet cherry cultivars varied from 6.41 g (Blaze Star) to 10.83 g (Regina) (Table 2). „Ideal“ weight of sweet cherry should be about 11 to 12 g in most European countries (Kappel et al., 1996). However, majority of investigated cultivars showed lower fruit weight which is most likely due climatic conditions in Eastern Slavonia during 2011 season (Figure 1). Only cultivar Regina (German cultivars) had almost an „ideal“ fruit weight according to Kapel et al.

(1996). Stone weight (Table 2) ranged from 0.44 g (Blaze Star) to 0.83 g (Skeena). The lowest randman had cultivar Hudson (90.20%), and the biggest randman cultivar Regina (93.29%) (Table 2).

Table 2. Pomological characteristics of sweet cherry cultivars

cultivar	fruit weight (g)	stone weight (g)	randman (%)
Burlat	7.57	0.62	91.76
Giorgia	6.52	0.61	90.59
Blaze Star	6.41	0.44	93.20
LaLa Star	7.03	0.55	92.20
Skeena	8.65	0.83	90.45
Regina	10.83	0.73	93.29
Hudson	8.06	0.79	90.20
Average	7.87	0.65	91.67
Min	6.41	0.44	90.20
Max	10.83	0.83	93.29
C.V.%	19.53	21.20	1.41

General, in sweet cherry fruits total soluble solids ranges between 11 and 25 °Brix depending on cultivar and is mainly due to glucose and fructose contents and less to the presence of sucrose and sorbitol while total titrable acidity depends also on cultivar, with levels of 0.4 - 1.5 % (Bernalte et al., 2003.; Esti et al., 2002.). Over investigated cultivars, an average total soluble solids in fruits varied from 13.8 (Giorgia) to 21.3 °Brix (LaLa Star) (Table 3) while total titrable acidity ranged from 0.41 (Burlat) to 0.71% (LaLa Star). Total soluble solid - total titrable acidity ratio (TSS/TTA) ranged from 22.04 in cultivar Giorgia to 48.83 in cultivar Regina (Table 3) which is in accordance with Garcia-Montiel et al. (2010.) and Vursavuş et al. (2006.).

Table 3. Chemical characteristics of sweet cherry cultivars

cultivar	TSS (°Brix)	TTA (%)	TSS/TTA	pH value
Burlat	15.4	0.41	37.93	3.70
Giorgia	13.8	0.63	22.04	3.68
Blaze Star	14.3	0.51	28.00	3.80
LaLa Star	21.3	0.71	29.90	3.71
Skeena	18.9	0.56	33.65	3.61
Regina	21.2	0.43	48.83	3.78
Hudson	18.9	0.67	28.35	3.60
Average	17.69	0.56	32.67	3.70
Min	13.8	0.41	22.04	3.60
Max	21.3	0.71	48.83	3.80
C.V.%	17.84	20.65	26.54	2.09

Sweet cherry cultivars with high total soluble solids and moderate level of total titrable acids are sweeter taste than those with moderate levels of sugar and low acid concentrations, although the ratio value is similar (Callahan, 2003.). For example, cultivars Blaze Star and Hudson had similar TSS/TTA ratio (28.00 and 28.35, respectively), but they are significantly different according to TSS and TTA content. All investigated cultivars had similar pH value in range from 3.60 to 3.80. Voća et al. (2010.) found pH

values around 3.80 to 3.90 in some introduced sweet cherry cultivars grown in a continental region of Croatia.

Conclusion

Pomological and chemical characteristics of fruits are under strong influence of genotype, but environmental and agroecological conditions of production have significant effect on this traits. According to all results, tested cultivars are well suited to agroecological conditions of Eastern Slavonia but we need to continue investigation through more seasons. Among the evaluated sweet cherry cultivars, Regina is the most promising cultivar because of large fruits and good quality characteristics.

Acknowledgement

The work presented in this paper is part of project „073-1781844-1930“ which is supported by MZOŠ RH.

References

AOAC (1995.). Official methods of analysis (16th ed.). Washington, DC: Association of Official Analytical Chemists.

Barret D.M., Gonzalez C. (1994). Activity of softening enzymes during cherry maturation. Journal of Food Science. 59: 574–577.

Bernalte M.J., Sabio E., Hernández M.T., Gervasini C. (2003). Influence of storage delay on quality of „Van“ sweet cherry. Postharvest Biology and Technology. 28: 303–312.

Callahan A. (2003). Breeding for fruit quality. Acta Horticulturae. 622: 295-302.

Crisosto C.H., Crisosto G.M., Matheney P. (2003). Consumer acceptance of „Brooks“ and „Bing“ cherries is mainly dependent on fruit SSC and visual skin color. Postharvest Biology and Technology. 28: 159-167.

Esti M., Cinquante L., Sinesio F., Moneta E., Di Matteo M. (2002). Physicochemical and sensory fruit characteristic of two sweet cherry cultivars after cool storage. Food Chemistry. 76: 399–405.

Garcia-Montiel F., Serrano M., Martinez-Romero D., Alburquerque N. (2010). Factors influencing fruit set and quality in different sweet cherry cultivars. Spanish Journal of Agricultural Research. 8(4): 1118-1128.

Kappel F., Fisher-Fleming B., Hoghe E. (1996). Fruit characteristics and sensory attributes of an ideal sweet cherry. HortScience. 31(3): 443–446.

Martínez-Romero D,. Alburquerque N., Valverde J.M., Guillén F., Castillo S., Valero D., Serrano M. (2006) Postharvest sweet cherry quality and safety maintenance by *Aloe vera* treatment: A new edible coating. Postharvest Biology and Technology. 39: 93-100.

Sansavini S., Lugli S. (2008). Sweet Cherry Breeding Programs in Europe and Asia. Acta Horticulturae. 795: 41-58.

Voća S., Dobričević N., Družić J., Čmelik Z., Knežević A., Vokurka A., Pliestić S. (2007). Kemijske karakteristike sorata trešnje s otoka Cresa. Pomologia Croatica. 13: 173-180.

Voća S., Šindrak Z., Dobričević N., Družić J., Pliestić S., Galić A., Skenderović Babojelić M., Kovač A. (2010). Kemijski sastav plodova nekih sorata trešanja sa Zagrebačkog područja. Proceedings of 45th Croatian and 5th International Symposium on Agriculture. 1143-1147.

Vursavuş K., Kelebek H., Selli S. (2006) A study of some chemical and physico-mechanic properties of three sweet cherry varieties (*Prunus avium* L.) in Turkey. Journal of Food Engineering. 74: 568-575.

Neke pomološke i kemijske karakteristike plodova introduciranih sorata trešanja u agroekološkim uvjetima Istočne Slavonije

Sažetak
Moderan uzgoj trešanja zahtijeva sorte s dobrim pomološkim i kemijskim karakteristikama kako bi se osigurala uspješnija proizvodnja. Naš je cilj bio procijeniti kvalitetu plodova introduciranih sorata uzgojenih u agroekološkim uvjetima Istočne Slavonije. Ovo istraživanje je provedeno tijekom 2011. godine na introduciranim sortama uzgojenim u voćnjaku Tovljač (Poljoprivredni institut Osijek). Utvrđene su pomološke (masa ploda, masa koštice, randman) i kemijske (topljiva suha tvar, ukupna kiselost, pH vrijednost) karakteristike plodova. Rezultati su pokazali razlike u istraživanim parametrima između ispitivanih sorata među kojima se sorta Regina ističe veličinom i kvalitetom plodova.

Ključne riječi: introducirane sorte, Istočna Slavonija, kemijske karakteristike, pomologija, trešnja