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DUNAVSKI RUBIN –A NEW INDETERMINATE TOMATO CULTIVAR

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Summary: *Dunavski rubin is a medium early indeterminate cultivar with large fruits and average fruit weight of 180 g. It was developed by crossing cultivars Korona and Saint Pierre. Hybrid material was grown by using the pedigree method. Phenotypically uniform line V9 was selected and submitted to the Varietal Release Committee of the Republic of Serbia. Cultivar was released in 2014 by the Decision of Ministry of Agriculture, Forestry and Water Management of the Republic of Serbia under no. 320-04-1871/2/2013-11. Dunavski rubin represents successful combination of genes responsible for high fertility rate and fruit quality. Fruits of Dunavski rubin cultivar have high percentage of dry matter (6.30%), high level of lycopene (106.7 mg/100 g), and excellent total acidity (0.39%). Vitamin C content is 52.7 mg/100 g, while total sugars amount to 5.71%. High K content (1520 mg/kg) and low Na content (79.8 mg/kg) is what distinguishes this cultivar from the others. Comparing with other cultivars trough three year field experiments, it was concluded that Dunavski rubin is a cultivar intended for fresh consumption due to a long fruit-bearing period, but is also an excellent raw material for processing due to its high quality fruit. All of the above mentioned classifies Dunavski rubin as an enhancer in technological processing of tomato.*

Key words: *tomato, fruit quality, fruit yield, seed yield*

INTRODUCTION

Tomato production has significantly increased worldwide. This is confirmed by data showing that tomato was grown on about 2.5 million ha in 1980s, and today it is grown on 4.8 million ha, with an average yield of 35 t/ha (FAO, 2013). The world's largest producers are China, India, USA, Turkey, Egypt, Russia, Italy and Mexico. In European Union, tomato is grown on an area of 249980 ha with an average yield of 61 t/ha (FAO, 2013). In the Republic of Serbia in 2014, the area of 9162 ha was sown under this vegetable species with an average yield of 13.9 t/ha (RZS, 2014). Annually, more than 40 million tons of tomato is processed in the form of ketchup, tomato juice, concentrate, peeled tomato, and many other products all over the world (WPTC, 2015).

Producers use new cultivars and hybrids, as well as the new production technologies in the constant race for achieving as much profit per area unit as possible. In tomato selection during the past decades, increase of yields per hectare and development of cultivars and hybrids that have uniform fruit colour were emphasized. The reason was long storage and transportation periods, but it appeared to be unfavourable for fruit quality. Therefore, customers often submitted complaints. It is frequently heard that there are fewer of the good heirloom tomato cultivars with juicy and sweet fruits. This is confirmed both by producers and experts. Products that draw attention by their looks mostly have a white interior in the middle of the fruit, so as much as a third of the fruit is thrown away. Producers have sacrificed the flavour because of the product that has long storage and transportation period. The flavour, morphological traits and quality of tomato depend on the cultivar. In addition to this claim, there are data from tomato trials of PSS Sombor in 2011 in Sombor, where the percentage of dry matter was 3.1-5.3% in 49 tested tomato genotypes (PSS, 2012). Compared to cultivars Novosadski jabučar, Saint Pierre, and Rutgers, this is extremely low.

Tomato fruits ripen unequally. Ripen fruits are not uniformly red; they can have circles of green and yellow colour. However, about seventy years ago, commercial producers discovered a natural mutation that leads to uniform

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fruit ripening. The mutation appeared to be important for the tomato market, which only in USA accounts to 2 billion dollars per year. Researchers succeeded in identification of the gene responsible for uniform ripening. International group of researchers, led by Powell et al. (2012) from University of California in Davis, discovered that this mutation (uniform ripening and redness) led to decrease in sugar percentage by 20% and decrease of carotenoids by 20-30%. Therefore, beautiful red fruits are usually flavourless.

Institute of Field and Vegetable Crops strived to develop a line with enhanced fruit quality and higher genetic potential for yield through breeding activities. The aim of this study was to present the qualitative traits, agronomic and seed characteristics of the new cultivar Dunavski rubin, which is a genotype with higher potential for more economic and stable tomato production, as well as an excellent raw material in technological processing.

MATERIAL AND METHOD

Institute of Field and Vegetable Crops, Novi Sad disposes with rich collection of tomato genotypes. The collection includes wild relatives, semi-cultivated forms, populations and heirloom tomato cultivars that are not grown nowadays. Due to their high dry matter content, good quality of fruit and other traits, they are the basis for the breeding activities (Takač et al., 2001).

During the process of selection, the aim was to develop the cultivar that will possess the qualities of Novosadski jabučar cultivar, but also to eliminate cracking of the fruit, presence of the green collar on the fruit, as well as to increase the yields. By crossing cultivars Korona and Saint Pieree, a phenotypically uniform line V9 was selected. Hybrid material was grown by pedigree method. Line V9 was released as the cultivar Dunavski rubin by the Decision of the Ministry of Agriculture, Forestry and Water Management of the Republic of Serbia under no. 320-04-1871/2/2013-11 from November 21, 2014.

All of the important traits of Dunavski rubin were tested in a three-year trial (2010-2012) at the trial fields of the Institute of Field and Vegetable Crops. Dry matter content was measured gravimetrically, sugars according to Luff-Schoorl-u and total acidity by titration method (Sl. SFRJ 29/83). Content of lycopene in lipophilic extracts, Vitamin C in hydrophilic extracts and mineral matters were determined by atomic absorption spectrophotometry (spectrophotometer UV-1800, Shimadzu, Kyoto, Japan). Novosadski jabučar cultivar was taken as the standard cultivar, while the previously released determinate cultivar Alparac was included in the study.

Total yields, and fruit and seed yields by nodes were determined in the field trials of the Vegetable Crops Department at Rimski Šančevi. They were compared to indeterminate cultivars Novosadski jabučar, Pegaz and line V14.

RESULTS

Dunavski rubin is an indeterminate cultivar with growing period of about 127 days. Its fruit has a flat shape. Fruits are round to roundly flattened, red in colour, large in size, and averagely weigh about 180 g. Fruit does not crack and does not have a green collar around the fruit peduncle. It is intended for production with support on one or two stalks.

Chemical composition

Chemical composition of the tomato fruits of Dunavski rubin and two other varieties Novosadski jabučar and Alparac are shown in the Table 1. There are also literature data for all parameters with which obtained results could compare.

The percentage of dry matter in fruits of cultivar Dunavski rubin was 6.3% and 7.63 % in drying oven. Lycopene content in NS genotypes is high; in Dunavski rubin it reached 106.7 mg/100 g and 1694 mg/kg DM.

Dunavski rubin has higher sugar percentage (90.79%) and total acidity (6.32 mg/100 g DM) in the dry matter than two other tested genotypes. Cultivars Dunavski rubin and Novosadski jabučar have total acidity of 0.39%. The sweetness index of Dunavski rubin is lower than sweetness index of Novosadski jabučar, but higher than cultivar Alparac. C vitamin content in Dunavski rubin is also between C vitamin content of these two tested genotypes and it is 52.70 mg/100 g, while in the dry matter Alparac has higer C vitamin content than Dubavski rubin. pH values of all three cultivars are around 4.5, which means that they are suitable for fresh consumption. The content of mineral matters differs depending on the cultivar. Potassium content is dominant in every sample. The highest potassium content was recorded in Dunavski rubin cultivar (1520 mg/kg), while the lowest one in Novosadski jabučar cultivar (767 mg/kg). Cultivar Alparac is distinguished by higher Na, Ca and Mg content. Content of microelements such as Fe, Mn, Zn and Cu has not significant differences in tested genotypes.

Table 1. Chemical composition of tomato fruit

	Dunavski rubin	Novosadski jabučar	Alparac	Literature data
Dry matter (DM) (%)	6.30	6.30	5.04	3.8-6.5 (DePascale et al., 2001)
DM % (drying oven)	7.36	6.91	5.74	4.0-7.0 (Jongen, 2002)
Lycopene (mg/kg in DM)	1694	1187	2180	320-1226 (Garcia and Barrett, 2006)
Lycopene (mg/100 g)	106.7	74.78	109.9	70-106 (Jongen, 2002)
Total sugars (% in DM)	90.79	50.95	60.52	50-60 (Turhan and Seniz, 2009)
Total sugars (%)	5.72	3.12	3.05	2.19-3.55 (Takač and Gvozdenović, 2001)
Total acidity (g/100 g DM)	6.32	5.69	4.56	4.2-6.5 (Takač and Gvozdenović, 2001)
Total acidity (%)	0.39	0.39	0.33	0.22-0.56 (Turhan and Seniz, 2009)
Sweetness index (sugars/acids)	14.67	8.23	18.17	7.1-19.0 (Marko, 1974)
Sucrose (% in DM)	11.75	7.99	1.39	0.37-26.19 (www.fineli.fi)
Vitamin C (mg/100 g in DM)	837	949	854	591-1027 (Yahia et al., 2001)
Vitamin C (mg/100 g)	52.70	59.79	43.01	10-120 (Jongen, 2002)
Natural invert (% in DM)	78.41	62.25	59.13	48.73-70.99 (www.fineli.fi)
Ash (% in DM)	5.74	5.54	4.66	3.2-5.9 (Matotan, 2008)
pH	4.47	4.55	4.58	3.78-5.25 (Giordano et al., 2000)
K (mg/kg)	1520	767	1365	556-1266 (Matotan, 2008)
Na (mg/kg)	79.8	119.0	206.5	39.5-166.0 (Nour at al., 2013)
Ca (mg/kg)	40.6	44.3	87.5	27.3-168.7 (www.fineli.fi)
Mg (mg/kg)	93.3	97.3	141.4	93.0-141.2 (www.fineli.fi)
Fe (mg/kg)	5.0	6.2	5.71	4.4-9.7(www.fineli.fi)
Mn (mg/kg)	0.4	0.53	1.01	0.12-1.46 (Žučenko, 1990)
Zn (mg/kg)	1.7	1.3	1.17	0.27-1.85 (Matotan, 2008)
Cu (mg/kg)	0.6	0.53	0.53	0.35-1.10 (Nour et al., 2013)

Yields of tomato fruit and seed

Besides fruit chemical composition, agronomic traits such as fruit yield and seed yield are also very important. In Table 2, the results of three-year trial with indeterminate cultivars grown on four flower stems are shown. Cultivar Novosadski jabučar was taken as the standard cultivar.

Table 2. Fruit yields and seed yields of the tested tomato genotypes (Popović et al., 2015)

Genotype	Total fruit yield (g/plant)	Share of the first and the second node (%)	Total fruit yield (t/ha)	Absolute seed weight (1000 seeds weight) (g)	Total seed yield (g/plant)	Share of first and second node (%)	Total seed yield (kg/ha)
Dunavski rubin	2248.3	78.0	64.33	2.821	5.256	75	150
V 14	1953.7	71.0	55.87	3.154	5.950	68	168
Novosadski jabučar	1609.4	62.0	46.16	3.273	6.551	60	187
Pegaz	1652.6	76.0	47.66	3.145	5.167	75	147

Tested genotypes differed in total yield of fruit per plant, as well as in fruit yield per nodes. The highest total yield of fruit per plant and fruit yield of first and second nodes were recorded in cultivar Dunavski rubin (Tab. 2). Compared to cultivar Novosadski jabučar, cultivar Dunavski rubin achieved higher yields for 18 t of fruit per hectare.

Dunavski rubin cultivar has lower seed yield than cultivar Novosadski jabučar. The reason is larger and fleshier fruit; 472 kg of fruit is needed for 1 kg of Dunavski rubin seed, while for Novosadski jabučar that amount is 287 kg (Tab. 3). Cultivar Dunavski rubin had the largest average weight of fruit per plant (on the first node) (211.8 g), while all other cultivars have average fruit weight from 104.8 g to 162.8 g.

Table 3. Yields of tested parameters per plant on the first node in different tomato genotypes (Popović et al., 2012)

Genotype	Fruit yield (g)	Fruit weight required for 1 gram of seed (g)	Fruit weight (g)
V14	682.3	377.4	145.3
Pegaz	704.3	334.7	135.5
Dunavski rubin	1057.3	472.0	211.8
Novosadski jabučar	549.1	287.4	119.5
Alparac	650.9	420.6	104.8
Bačka	844.6	552.7	156.4
Knjaz	940.8	439.8	162.8
Average	775.6	412.1	148.0
Min	549.1	287.4	104.8
Max	1057.3	552.7	211.8
CV%	23.1	21.5	23.4
LSD (0.05)	304.8	168.5	57.9
LSD (0.01)	411.1	227.4	78.1

DISCUSSION

Knowing chemical composition of tomato fruit is very important for nutrition, as well as for processing and conservation technologies. Nutritive and dietary values, quality, choice of the technological procedure, yield, and raw material behaviour during processing, conservation and storage, as well as the product quantity, all depend on the chemical composition (Stajčić, 2012). The components contained in tomato form organoleptic, nutritional and biological traits of the product by their quantity and mutual relationship. From the technological aspect, the content of dry matter is very important. Cultivars that are considered high-quality are the ones with higher dry matter content (Takač and Gvozdenović, 2001). The best tomato flavour is characterized by a high content of sugars and relatively high content of acids. High acid content and low sugar content will give a sour tomato, while high sugar content and low acid content will give bland and tasteless tomato (Kader, 1986).

Dry matter is the content of all components in the tested sample without water. It consists of solubles (sugars, acids and other soluble matters) and insolubles (starch, cellulose, hemicellulose, protopectin, etc.). Dry matter content gives clear and specific instructions for directing technological process and provides significant data on raw materials utilization. Dry matter percentage depends on the cultivar, characteristics of the soil where it is grown, and especially on weather conditions – more sunny periods result in higher dry matter (Jongen, 2002). High dry matter percentage and high percentage of soluble solid substance are desirable characteristics in processing industry because they enhance the quality of the processed product (DePascale et al., 2001). Dry matter content usually varies in the range 4.0-7.0% (Matotan, 2008). Similar results were also published by Turhan & Seniz (2009), who determined dry matter percentage from 3.83 to 7.00 in studies of 33 tomato genotypes in Turkey. According to the abovementioned data from the literature, cultivar Dunavski rubin with dry matter percentage of 6.3% can be classified as an enhancer in tomato technological processing.

Tomato fruit contains sugars; glucose and fructose are the most important of the monosaccharides. They are the carriers of flavour and they make 50-60% of dry matter, which is 2.19-3.55% of total tomato weight (Jongen, 2002). Sugar percentage in tomato fruit is primarily a cultivar trait and it ranges from 1.67 to 3.73% (Turhan and Seniz, 2009). Sugar content in total tomato dry matter should not be below 48% (sweetness coefficient) (Marko, 1974). Considering the data, cultivar Dunavski rubin has high sugar percentage in the dry matter (90.79%), which is significantly higher than standard cultivar Novosadski jabučar. Compared to literature data, cultivar Dunavski rubin has about 65% higher sugar content in the fruit, which is an excellent basis for all types of processing and fresh fruit consumption.

According to literature data, the acid content in fresh tomato is 0.4% (www.fineli.fi). According to Takač and Gvozdenović (2001), the content of total acids in tomato fruit ranged from 0.354 to 0.563%, and according to Turhan and Seniz (2009) it ranged from 0.22 to 0.40%. Cultivars Dunavski rubin and Novosadski jabučar have total acidity of 0.39%, which complies to literature data, i.e. fruits of cultivar Dunavski rubin have higher content of total acids than cultivar Alparac.

Vitamin C (L-ascorbic acid) is one of the most important vitamins. It belongs to the antioxidant group and neutralizes free radicals that occur every day in the organism as a consequence of stress, ultra violet radiation, smoking and improper nutrition. Free radicals are one of the potential causes of malignant diseases. Due to its antioxidant characteristics, vitamin C is used to increase organism resistance toward infections. Vitamin C is necessary for the formation of collagen, protein that is involved in formation of skin, cartilage, tendons, ligaments, blood vessels. It increases absorption of iron, so it is used in therapies for anaemia and regulation of vitamin E in the organism. Increased intake of vitamin C is recommended for treating inflammation and bleeding gums, fever, infection, pneumonia, burns, poor wound healing, etc.

Tomato is a rich source of vitamin C. Quantity of vitamin C in ripen tomato fruit varies depending on the ripening stage, time of harvest, type of harvest and storage conditions. Soil type where tomato was grown also affects vitamin C content. Soil rich in boron and zinc will increase vitamin C content. Average concentration is about 25 mg/100 g, which makes circa 40% of the average daily intake for an adult and 60% of the recommended daily intake for children (Jongen, 2002). According to Yahia et al. (2001), minimum value of ascorbic acid (12.8 mg/100 g) was determined 18 days after the fruit formation. It increases with ripening, so 74 days after the fruit formation its value reached 94.9 mg/100 g. The content of vitamin C in presented cultivars ranged from 43.01 (cultivar Alparac) to 59.79 mg/100 g (cultivar Novosadski jabučar). Dunavski rubin has 52.70 mg/100 g of vitamin C.

Lycopene is a natural pigment synthetized by plants and microorganisms, but not animals. It is one of the strongest antioxidants from the group of carotenoids. It has two times higher antioxidant activity than ß-carotene and ten times higher than α-tocopherol (Matotan, 2008). It protects lipids, proteins and DNA from oxidation in a human organism.

As it ripens, tomato changes colour from green through orange to red. Green colour of unripen fruit comes from chlorophyll. Chloroplast in ripen fruit transforms to chromoplast that contains lycopene in crystal links to the membrane. When full ripening is reached, lycopene quantity can reach 88-106 mg/kg (Garcia and Barrett, 2006). According to Jongen (2002), lycopene content in ripen tomato fruits can reach 80-100 mg/kg, which is up to 85% of total carotenoids. Lycopene content is affected by water, fertilization, temperature and light, ripening level of the fruit, time of harvest (Dumas et al., 2003; Adeniyi and Ademoyegun, 2012; Ćota et al., 2013), fruit size, and storage conditions after the harvest. Lycopene level also varies depending on how the tomato was grown (open fields or greenhouses) (Jarquin-Enriqez et al., 2013; Ehret et al., 2013).

The factor that initially determines quantity of coloured matters in the fruit is cultivar, or genotype. According to Baranska et al. (2006), lycopene content in tomato ranges from 2.62 to 60.40 mg/100 g, and in tomato products from 18.8 to 629 mg/100 g. Lycopene content in showed genotypes is high; in Dunavski rubin it reached 106.7 mg/100 g, which is in accordance with study of Jongen (2002), but is higher than in study of Baranska et al. (2006).

Mineral matters are necessary for appropriate nutrition. Their intake can be regulated by diverse nutrition. Mineral matters in an organism are important ingredient of cells and body fluids. Those that are part of fruit and vegetables are mostly metals K, Ca, Na, Fe, Mg, Al, and in smaller amounts Cu, Zn, Mo, Co and some other oligo elements, as well as non-metals S, P, Si, Cl, B, F.

Out of mineral matters, potassium is mostly widespread in tomato, while phosphorus, magnesium, calcium, sodium and iron are significantly present in tomato. Tomato is richer in iron than fish and chicken meat (Matotan, 2008). The presence of trace elements in tomato is important for growth and development of tomato, especially trace elements like boron, manganese, zinc and copper. Boron increases fruit number, weight and vitamin C content. Copper increases yields, accelerates ripening and enhances fruit quality.

The content of mineral matters differs depending on the cultivar. Potassium content is dominant in every sample. Compared to previous studies (Nour et al., 2013) where potassium content was 2139-3056 mg/kg, cultivars of Institute of Field and Vegetable Crops have significantly lower quantity of this element.

Besides potassium, Na, Ca and Mg were present in somewhat higher quantities in the tested samples, compared to other minerals. According to data www.fineli.fi, Na content ranged from 25 mg/kg up to 39.5-166.1 mg/kg. Na values for cultivar Alparac deviate from literature data. This genotype has circa 20% higher Na content compared to maximum obtained value in literature. Cultivar Alparac is distinguished by its high Ca content (87.5 mg/kg). Mg content in showed genotypes was 93-141 mg/kg, which complies with literature data of 110 mg/kg (www.fineli.fi). Content of the microelements (Fe, Mn, Zn and Cu) is in the accordance with literature data (www.fineli.fi; Žučenko, 1990; Matotan, 2008; Nour et al., 2013).

pH values are essential for processing; values higher than 4.4 can lead to sensitivity of pulp toward thermophilic pathogenic agents. Tomato with lower pH values should be used for processing industry (while it does not negatively affect the flavour) (Georgelis, 2002). In the study of Turhan and Seniz (2009), pH of fruit that ranged from 3.78 to 5.25 (Giordano et al., 2000) showed that pH below 4.5 is a favourable trait in processing. According to Compos et al. (2006), pH value of tomato fruit necessary for processing industry should range from 4.3 to 4.4. Cultivar Dunavski rubin has pH value of 4.47, which defines it for fresh consumption, as well as for preparation of quality products in processing.

Averagely, in all genotypes, the highest yield was recorded on the first node. Fruit yield from first nodes is very important in production, because it affects higher prices of tomato on market, and consequently higher income per hectare. Dunavski rubin has the best ratio of the first and the second node in the total fruit yield per hectar , and also this cultivar has the best yield compared to the other tested cultivars.

Tomato fruit is a juicy berry that consists of chambers, partition walls, placenta, and seed, with seed content from 0.25 to 0.35% of fruit weight. Tomato is a part of plant group with high coefficient of multiplication. There can be up to 228 seed embryos in only one flower (Žučenko, 1990). Republic of Serbia is an important tomato seed producer, both for domestic and export market. Therefore, from seed production point of view, seed yield per hectare is also very important.

Heirloom cultivars and populations have soft fruit, so smaller quantity of fruit is needed for 1 kg of seed, while newly selected determinate cultivars have sturdy fruit and much more unfavourable ratio of fruit quantity and seed quantity. The example is cultivar Bačka; 522 kg of fruit is needed for 1 kg of seed. Cultivar Dunavski rubin also has lower seed yield than cultivar Novosadski jabučar. Ratio of fruit quantity needed for 1 kg of seed is a very significant piece of information in seed production, because producers need to be payed to for adequate seed price. As follows, cultivars where smaller amount of fruit is needed for a kg of seed should be differentiated by price from those where larger amount of fruit is needed for a kg of seed.

Fruit weight is a cultivar trait and represents one of the factors that determine cultivar purpose. Cultivars with large fruit weight 120-250 g, medium 80-120 g and small 60-80 g. Lately, cocktail type cultivars are also grown and its fruits weigh 30-50 g, as well as cherry tomato of 10-30 g weight (Đurovka et al., 2006). Cultivar Dunavski rubin with average fruit weight 211.8 g depends in the group of large tomato fruit cultivars.

CONCLUSION

With release of Dunavski rubin cultivar, tomato assortment was enriched with one quality cultivar with medium early ripening. Extraordinary quality of fruit with high content of dry matter, lycopene, C vitamin, and organic acids makes this cultivar an enhancer in technological processing. The cultivar is intended for fresh consumption due to longer fruit-bearing period, as well as for processing. Dunavski rubin cultivar achieved significantly higher yield than standard cultivar (Novosadski jabučar) with higher share of fruits on the first and second nodes in total yields. Besides high yield, Dunavski rubin cultivar has larger fruits that are not prone to cracking. The value of this cultivar is increased by the fact that besides potassium content in the fruit, it has about 1.5 times lower Na content, which is extremely important in nutrition. Seed yield is rather high (plant grown on four flower stems), so all of these define Dunavski rubin as a cultivar in a group of perspective cultivars that should be sown in both gardens and open-fields.

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DUNAVSKI RUBIN – NOVA INDETERMINANTNA SORTA PARADAJZA

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Izvod: Sorta Dunavski rubin je srednje rana indeterminantna sorta, krupnih plodova, prosečne mase 180 g. Nastala je ukrštanjem sorti Korona i Saint Pierre. Hibridni materijal je uzgajan po pedigre metodi. Fenotipski ujednačena linija V9 je odabrana i prijavljena Komisiji za priznavanje sorti. Sorta je registrovana 2014. godine rešenjem Ministarstva poljoprivrede, šumarstva i vodoprivrede Republike Srbije pod brojem 320-04-1871/2/2013-11. Dunavski rubin predstavlja uspešnu kombinaciju gena odgovornih za visok potencijal rodnosti i visok kvalitet ploda. Plodovi Dunavskog rubina imaju visok procenat suve materije od 6.30, visok nivo likopena od 106.7 mg/100 g i odličnu ukupnu kiselost od 0.39%. Sadržaj vitamina C iznosi 52.70 mg/100 g , dok ukupni šećeri čine 5.71%. Visok sadržaj K od 1520 mg/kg i nizak sadržaj Na od 79.8 mg/kg je ono što ovu sortu izdvaja od drugih. Na osnovu trogodišnjih poljskih ogleda i poređenja sa drugim sortama utvrđeno je da je Dunavski rubin pogodan za svežu potrošnju zbog dugog perioda plodonošenja ali je i odlična sirovina za preradu zbog visokog kvaliteta ploda koji je svrstavaju u red poboljšivača u tehnološkom procesu prerade paradajza.

Ključne reči*: paradajz, kvalitet ploda, prinos ploda i semena*

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