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THE PERFORMANCE OF THE PERSIMMON GROWN IN THE SOUTHERN OF ROMANIA

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Abstract

In Romania until now, are no commercial persimmon (Diospyros kaki Thunb.) orchards. But, the interest for the fruits of this species is increse. Solitary trees of Diospyros virginiana being found in parks and private gardens it have fruits are very astringent, without interest for consuummers, but they offer a very atractive wiew in lands to the starting of the winter season. In the South of Romania, during the winter, are occasional registered temperatures of -20-25°C which cane affects the varieties from Diospyros kaki. For this reason, in 2019 year, we established an experimental plot with two cultivars Rosseyanka and Jiro, to study the persimmon culture suitability in Romania. The study carried out so far, shows that the Rosseyanka cultivar, reached a high fruits yield of 11 kg/tree, in the fourth year after planting. From the point of view of fruit quality, the Jiro variety recorded a value of fruit weight of 162.2g/fruit and 85.36 mg% vitamin C fruits contents.

Key words*: yield, fruit quality, biometrics indices.*

INTRODUCTION

Currently in the world there is a tendency to change eating habits. On the one hand, the emphasis is on maintaining and providing traditional, local foods, on the other hand, new resources are being sought to change eating habits. In this context, the consumption of the fresh and processed fruits is also included. Generaly, in the fresh fruit market, in search of an elixir for health, the consumers are looking for fruits whose species are less cultivated, but are traditionally consumed species in Asian countries, countries considered to have the population with the longest and healty live. Thus, the fruits of the *Diospyros kaki* Thumb species entered the market, numerous studies show that fresh kaki fruits have antitumor effects, prevent dyslipidemia, have anti-hyper-cholesterolemic effects, have antioxidant and antidiabetic properties. The antioxidant effects are due to the wealth of vitamins, phenolic compounds and carotenoids (Direito et al., 2021)
Diospyros kaki Thunb., is a species native to China. It has been cultivated here for over 2000 years, over extensive areas from altitudes of 20 m to altitudes of 600-800 m (George et al., 1990). In Europe this species has been known during the age of Plinio, Roman works show that some persimmon trees were cultivated in Rome since then. Spaniards during the Colony carried out a quite important introduction of plants from Far Eastern countries (Belini and Giordani, 2003).
Today, kaki has grown in popularity outside of its traditional production region, becoming a thriving crop in Brazil and some Mediterranean countries such as Italy Spain and Grace (Guan et al., 2020).
Currently, the largest collection of Diospyros species genotypes is in Italy (125 genotypes) (Lim et al., 2012). The germplasm collections from the larges producing countries as well as the local biotypes are a support source for the genetic diversity, to the breeding activity in order to create genotypes with increased adaptability to the increasingly evident conditions of climate change (Samarina et al., 2021).
In Europe the cultivation of persimmon is limited to the proximity to the Mediterranean Sea (Direito et al., 2021). In France, the first persimmon plantations were established in 1970, In Portugal in the Algarve region, is a area

with orchards dedicated to persimmon, altought the persimon trees are scattered throughout the central and northern regions of the country. In the countries on the Mediterranean coast as Italy, Spain, Greece, Turkey the persimons orchards are in extension, also (Yesiloglu et al., 2022). Now, the world production of persimmon is around five million tons (Direito et al., 2021). In Romania, due to its temperature requirements (at -18°C the anual shoots are affected in winter), this species *Diospyros kaki* has not been yet cultivated in commercially orchards, although genotypes from *Diospyros virginiana* L. give beautify the parks in our country. The genotypes from *Diospyros virginiana* L., beiing from North America, their fruits have a attractive wiev, like the Chrismas ornaments in the winter, but do not lose their astringency at full maturity, which makes them unattractive for fresh consumption. But this species is an important genetic resource, usually used in crosses with *D. kaki* in breeding programs for frost resistance and as rootstock also in propagation activity.

In our country, in Romania, studies on the behavior of 16 biotypes of *Diospyros virginiana* and *Diospyros lotus* were initiated by Dr. Mladin Gheorghe, at the Research Institute for Fruit Growing Pitesti-Mărăcineni, but they were not extended into orchards.

Thus, currently there are no commercial persimmon plantations in the country, but this fruit is sold by the piece in large stores.

The purpose of this paper is to highlight the growth and fruiting performance of 2 genotypes: Rosseyanka, an interspecific hybrid *Diospyros virginiana* x *kaki*, and the genotype Jiro from the species *Dyospiros kaki*, in the pedoclimatic conditions of southwest Romania with a view to expanding into commercial crops.

MATERIALS AND METHODS

In the period 2019-2022, within the Research and Development Station for Plant Culture on Sandy Soil Dăbuleni, Romania, two genotypes *Rosseyanka* (Photo 1) and *Jiro* (Photo 2) were studied, planted at a distance of 5 x 5 m, on raised beds, mulched with agrotextile and irrigated with a drip irrigation system under mulches.The location of the experimental plot was 43 80 63 N and 24 95 96 East on a sandy soil poorly in nitrogen (0.02%), phosphorus (25 ppm), and potassium (36 ppm) with very low organic carbon content (0.07%) all those are characteristic of sandy soils, and the soil reaction was neutral (pH 6.36).

For evaluate the growth capacity, the following determinations were made: the diameter of the trunk (cm) was measured at the beginning of the vegetation period 10 cm from the grafting point, marking the reading point with paint; the dynamics of shoot growth (cm) was recorded by monthly measurement of annual shoots; the surface of the tree trunk cross sectional (TCSA) was calculated according to the formula: $\pi r2$ considering the circular trunk (Toplu C. et al., 2009) and the canopy volume (CV) was measured before pruning, calculated according to the formula $CV= 4/3\pi ab2$, where a is the axis length/2, and b is the minor axis length/2 (Toplu C. et al., 2009).

To evaluate the fruits quality, samples of 30 fruits was evaluated annually in three repetitions for determining the average weight of the fruits (g); as well the fruits diameter (mm); the fruits height (mm) by measuring every fruits with a digital caliper; the fruits color indices were measured using the Hunter system, where L*(brightness); a*(redness +, greenness -); b*(yellowness + or blueness-) with the PCE-XXM20 colorimeter. For L*a*b* values hue angle was calculated as $h^0 = \tan^{-}(b^*/a^*)$ (Abbott, 1999) and Chroma index as $C = (a^{*2}+b^{*2})^{1/2}$ (Lopez & Gomez, 2004). The color values and firmness for each fruit were computed as means of two measurements taken from both sides at the ecuatorial region of the fruit. The fruits colour and the firmness were measured both at the time of harvest and 28 days after harvest when the fruits became soft good for consumption, the firmness of the fruits were determined with the PCE-FM 200N penetrometer. The yield (Y) per hectare (ha) was estimated by calculating as Y = average yield per tree x no. trees/ha (400 trees/ha). The biochemistry of the fruit at harvest maturity were made as follows: soluble dry matter (% Brix) was made with the Atago apparatus; the vitamin C content (mg%) was determined by the iodometric method (Croitoru 2021); the glucides content (%) was made by the Fehling Soxhlet method, and titratable acidity (%) was determined by the titrimetric method.

Photo 1. The *Rosseyanka* cultivar

Photo 2. The *Jiro* cultivar

The obtained results are presented in tables and figures, and the bars in each column of the figures represent the standard deviation.

RESULTS AND DISCUSSIONS

The illustration of the trees trunk diameter evolution in table 1, shows that the Jiro cultivar on the study period had registered the highest values versus the *Rosseyanka* cultivar. So, since the first year (2020) to the planting, has recorded an increase of 12.3 cm, and in the second year after planting (2021 year), the recorded values were 14.9 cm higher than the average values of the trunk diameter recorded by the *Rosseyanka* cultivar. Analyzing the increase of trunk registered by each cultivar, from one year to another, we find that the *Rosseyanka* cultivar registered an annual increase in trunk diameter of 4.60 cm in 2021 year compared to 2020 year and 6.90 cm in 2022 year compared to from the previous year (Table 1). The recorded trunk diameter data were compared with those recorded by Omarov et al. (2022) over a 5-year average, at a planting distance of 6 x 3, and show that the two cultivars developed normally between our data and those recorded in Russia being a difference of only 1.27 cm. Regarding the tree trunk cross sectional (TCSA), an increase from one year to the next is found between 14.45 and 21.66 cm^2, in the case of the *Rosseyanka* cultivar and between 9.11 and 22.6 cm^2, in the case of the *Jiro* cultivar. Comparing the data recorded under the conditions in southern Romania with those recorded by Toplu et al. (2009), in Turkey shows that the *Jiro* cultivar registers under the conditions in Romania an increase of 20.63 cm^2, in the fourth year after planting versus the data registered in Turcia by the same cultivar.

The average fruit production per tree was 8.5 kg in the case of the *Rosseyanka* cultivar, respectively 0.121 kg/cm^2 trunk section and only 0.048 kg/cm^2 in the case of the *Jiro* cultivar. The data on fruit production per cm^2 of the trunk section were compared in the case of the *Jiro* cultivar with those recorded by Toplu & all. (2009), in the 7th year (1.4 kg/cm^2) from planting and show that they are obviously higher with 1.1kg/cm^2 trunk section. The *Rosseyanka* variety recorded a canopy volume of 1.15 cm^3, an average value lower by 1.0 m^3 compared to the canopy volume recorded by the *Jiro* cultivar. In terms of fruit production per ha, the most productive cultivar that stood out was the *Rosseyanka* cultivar registering a higher production by 1.4 t/ha versus to the *Jiro* cultivar (Table 1).

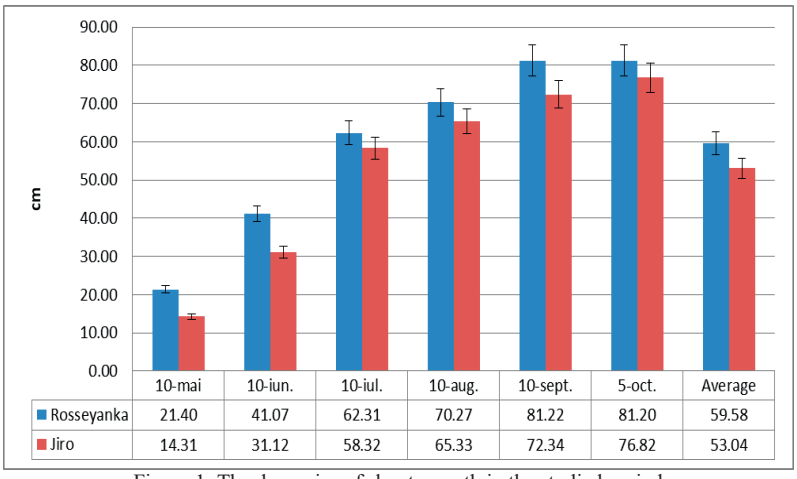
Tabel 1. The evolution of trunk diameter in the studied period and the yield

Cultivar	The trunk diameter			TCSA (cm^2)			CV (m^3)	Yield / tree (kg)	Yield/ cm^2 of TCSA (kg/cm^2)	Yield/ha (t/ha)
	2020	2021	2022	2020	2021	2022	2022	2022	2022	2022
Rosseyanka	10.7	15.3	22.2	33.59	48.04	69.70	1.15	8.5	0.121	3.4
Jiro	23.0	30.2	33.1	72.22	94.82	103.93	2.15	5.0	0.048	2.0
St. Dev.	6.15	7.45	5.45	19.31	23.39	17.11	0.5	1.75	0.036	0.7

The analysis of the growth dynamics of the shoots shows that until September 10, the vegetative growth recorded a monthly increase between 15 and 20 cm for both genotypes, and the vegetative growth stopped only in September. On average over the entire vegetation period, the *Rosseyanka* cultivar recorded an average shoot length of 59.59 cm, and the *Jiro* cultivar recorded an average length of 53.04 cm (Figure 1). The data recorded, in the specific conditions of the sandy soils in the southwest of Romania, were compared with those in the subtropical region of Russia, and it was found that the average length of the annual shoots in the conditions of Romania are with 10.20 cm higher than those recorded by Omarov in 2017 in Russia.

The analysis of the fruits biometric characteristics showed that the average values of the calix compared to the fruit diameter, in the case of the *Rosseyanka* cultivar, cover 45.3% of the fruit diameter, and in the case of the *Jiro* variety, the calix covers only 37.8% of the fruit diameter (Table 2). For four of the three biometric indicators studied, the *Jiro* cultivar recorded the highest values. The comparison of fruit firmness data shows that both at picking and at maturity *Rosseyanka* cultivar recorded values 0.62 (kgf/cm^2) higher than the *Jiro* cultivar, and at maturity the difference between the two varieties was only 0.03 kgf/cm^2 (Table 2). Regarding the fruit color measured in the Hunter system, in the case of fruits brightness (L*), the data show that at the time of harvest the *Rosseyanka* cultivar recorded the higher value by 4.9% versus the *Jiro* cultivar.

The recorded data were compared with those of Senica et al. (2016) show that under the Romanian conditions the recorded values are higher by 10.9% in the case of the *Jiro* cultivar and by 13.9% in the case of the *Rosseyanka* cultivar. But these differences in brightness can also be influenced by the device with which the determinations were made, these being different. The comparison of the brightness data at the time of harvest and at maturity shows that in the case of the *Jiro* cultivar the values did not change, on the other hand, in the case of the *Rosseyanka* cultivar the values at the consumption maturity were 2.8 units lower than those recorded at harvest (Figure 2). The calculation of the color index shows that to both cultivarss the values of both index (h and C) increase at consumpion maturity by 13.54 and by 28.3 in the case of the hue angle, and in the case of the Chroma index the values increased by 3.15 and respectively 27.75 (Figure 2).

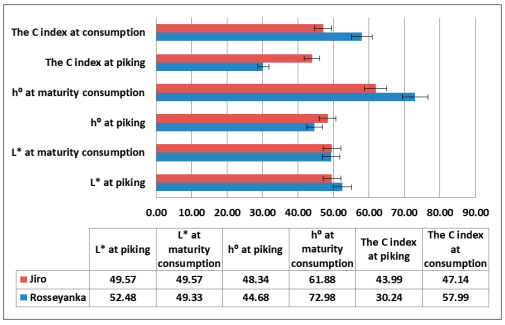


	10-mai	10-iun.	10-iul.	10-aug.	10-sept.	5-oct.	Average
Rosseyanka	21.40	41.07	62.31	70.27	81.22	81.20	59.58
Jiro	14.31	31.12	58.32	65.33	72.34	76.82	53.04

Figure 1. The dynamics of shoot growth in the studied period

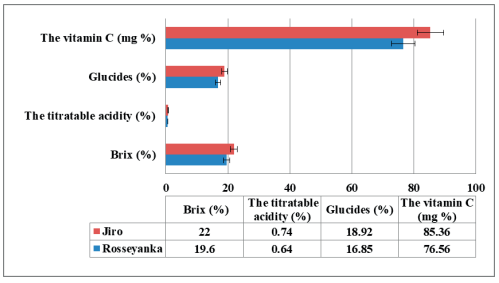
Table 2. The biometric fruits characteristics

Variety	Average fruit weight (g/fruit)	Fruit firmness (Kgf/cm^2)		The fruit height (mm)	The fruit diameter (mm)	The calix (mm)
		at picking	at consumption maturity			
Rosseyanka	76.9	1.61	0.18	40.59	50.803	27.77
Jiro	182.3	0.99	0.21	49.07	69.443	43.14
STDEV	74.53	0.44	0.02	6.00	13.18	10.87



	L* at piking	L* at maturity consumption	h° at piking	h° at maturity consumption	The C index at piking	The C index at consumption
Jiro	49.57	49.57	48.34	61.88	43.99	47.14
Rosseyanka	52.48	49.33	44.68	72.98	30.24	57.99

Figure 2. The biochemical characteristics of the fruits



	Brix (%)	The titratable acidity (%)	Glucides (%)	The vitamin C (mg %)
Jiro	22	0.74	18.92	85.36
Rosseyanka	19.6	0.64	16.85	76.56

Figure 3. The fruits colour index

The evaluation of the biochemical characteristics of the fruits highlighted the *Jiro* cultivar that recorded the highest values for all 4 biochemical properties of the fruits (Figure 3).

CONCLUSIONS

The vegetative growth of the trees as well as the production recorded in the 4th year after planting are consistent with the specialized literature.

From the productive point of view, the Rosseyanka variety stood out, and from the fruit quality point of view, the Jiro variety stood out by the appearance of the fruits (average fruit weight over 150g/fruit) as well as by the analyzed biochemical properties.

As a result of the study, it was found that both persimmon varieties found favorable conditions for growth and fruiting in the specific conditions of the sandy soils at SCDCPN Dabuleni.

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REFERENCES

Abbott, J.A. (1999). Quality measurement of fruits and vegetables. *Postharvest Biology Techn*., 15:207-225.

Bellini, E. and Giordani, E. (2003). Germplasm conservation of persimmon in Europe. *Acta Hortic*. 601, 37-46, doi: 10.17660/ActaHortic.2003.601.4

Croitoru M. (2021). *Chimie și biochimie vegetală, lucrari practice de laborator*. Editura Sitech , Craiova.

Direito, R., Rocha, J., Sepodes , B., Eduardo-Figueira, M. (2021). From Diospiros Kaki L. (persimmon) Phytochemical Profile and healt impact to new product perspectives and waste valorization. *Nutrients* 2021,13,3283. https: //doi.org/10.3390/nu13093283.

Lopez, C.A.F., and Gomez P.A. (2004). Comparison of color indexes for tomato ripening. *Hortic. Bras*., 22(3),3.

George, A.P., Niessen, RJ. (1990). Persimmon. In Fruits: tropical and subtropical, *TKBose, and Mitra* eds. (Calcutta: Naya Procash), p.469-489.

Lim T.K. (2012). Diospyros kaki. In Edible Medicinal and Non-Medicinal Plants (Dordrecht: Springer), p.428-443 10.1007/978-94-007-1764-0-58.

Omarov, M.D. (2018). Harvest of different varieties of oriental persimmon in the humid subtropics of the Russian federation. *Subtropical and decorative gardening*, 65.37-141.

Omarov M.D., Kulyan R.V., Omarova Z.M. (2018). Oriental persimmon in Russian research institute of floriculture and subtropical crops collection is the basis for the identification of valuable economical features. *Pomiculture and small fruits culture in Russia*. 2018;55:46-53.

Omarov, M., Belous, O., Omarova, Z. (2022). The influence of the planting scheme on the development and productivity of persimmon (*Diospyros kaki* Thunb.) in the humid subtropics of Russia, Proc. VII International Symposium on Persimmon. *Acta Hortic.*1338.ISHS 2022.DOI 10.17660/Acta Hortic.2022.1338.19. J. Crop Hort. Sci., 24, 115–120.

Senica, M., Veberic, R., Grabnar, J.J., Stampar, F., Jakopic J. (2016). Selected chemical compounds in firm and mellow persimon fruit before and after the drying process. *J. Sci. Food Agric., 96*(9), 3140-3147.https: // doi.org/10.1002/jsfa.7492. PubMed.

Toplu, C., Kaplankiran M., Demirkeser, T.H., Demir, E., Candir E.E, Yldiz E. (2009). The performance of persimmon (*Diospyros kaki* Thunb.) Cultivars under Mediterranean Coastal conditions in Hatay, Turkey. *Journal of the American Pomological Society*, 63(2):33-41.

Yesiloglu, T. and Cimen, B. (2022). Persimmon growing in Turkey. *Acta Hortic*., 1338, 11-16, doi: 10.17660/ActaHortic.2022.1338.3

Samarina LS, Malyarovskaya VI, Reim S, Koninskaya NG, Matskiv AO, Tsaturyan GA, Rakhmangulov RS, Shkhalakhova RM, Shurkina ES, Kulyan RV, Omarova ZM, Omarov MD, Ryndin AV. Genetic Diversity in Diospyros Germplasm in the Western Caucasus Based on SSR and ISSR Polymorphism. Biology (Basel). 2021 Apr 19;10(4):341. doi: 10.3390/biology10040341. PMID: 33921840; PMCID: PMC8073590.

Guan, C., Zhang, Y., Zhang, P., Chachar, S., Wang, R., Du, X., Yang Y. (2020). Germplasm conservation, molecular identity and morphological characterization of persimmon (Diospyros kaki Thunb.) in the NFGP of China. *Scientia Horticulturae*, Vol. 272, ://doi.org/10.1016/j.scienta.2020.109490