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# Fruit and cold-pressed oil characteristics of some walnut (*Juglans regia* L.) cultivars

**Radmila Ilić*, Gorica Paunović, Mirjana Radovanović, Ivan Glišić, Tomo Milošević, Katarina Jevremović**

*University of Kragujevac, Faculty of Agronomy in Čačak, Cara Dušana 34, 32000 Čačak, Republic of Serbia*
**E-mail: radmila.nikolic@kg.ac.rs*

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**Abstract.** This study examines the morphometric (fruit dimensions and weight, kernel weight, and yield) and sensory (color of the shell, surface texture of the shell, breakage of the shell, color of the kernel, fullness of the kernel, and ease of kernel removal) characteristics of fruit, as well as cold-pressed oil content and sensory characteristics (color, smell, and taste) of eight walnut cultivars ('Chandler', 'Pieral Lara', 'Tulare', 'Champion', 'Rasna', 'Cheinovo', 'Geisenheim 139', and 'Ovčar') in the Stalać region. Significant variability was observed among the cultivars regarding the investigated fruit morphometric parameters and oil content. Cultivars such as 'Champion', 'Pieral Lara', and 'Tulare' exhibited the highest fruit weights (15.13 g, 15.02 g, and 14.54 g, respectively). Additionally, the 'Tulare' cultivar exhibited the highest kernel weight (7.81 g) and kernel yield (53.88%), while 'Geisenheim 139' had the highest oil content (68.17%). Based on the results of the sensory analysis, the cold-pressed oils of the investigated walnut cultivars were categorized into the following quality groups: i) oils of medium quality ('Rasna' and 'Cheinovo'); ii) oils of good quality ('Tulare', 'Geisenheim 139', and 'Ovčar'); iii) oils of excellent quality ('Chandler', 'Pieral Lara', and 'Champion'). These findings highlight the potential for optimizing walnut production through the selection of cultivars with desirable traits, contributing to improved yields and high-quality oil production.

**Key words:** walnut, cultivar, kernel, oil, morphometric and sensory traits.

## Introduction

The production of walnuts in Serbia fluctuates greatly from year to year. The highest yields were achieved in 2009 with a total of 25,172 metric tons, and the lowest in 2021 with only 7,646 metric tons (FAOSTAT, 2023). According to the same data source, the average production over the last five years was 9,296.8 metric tons.

Walnuts are mainly grown for the high quality of the kernel. The walnut kernel has a high energetic, nutritional, and dietary value. It contains 50–70% oil, which is separated by cold pressing (Christopaulos & Tsantili, 2015). The oil has 85–92% unsaturated fatty acids and belongs to the category of high-quality vegetable oils (Paunović & Miletić, 2013). The edible nut oil is obtained by cold pressing, and the remainder of the kernel after pressing (cake) can be used as animal

feed or to produce various foods. Walnut oil is edible and is mostly used as an ingredient in cold dishes, in cosmetics, and in the pharmaceutical industry (Gao et al., 2022). Walnut kernels are not only used fresh but also in the confectionery industry, for home-made cookies, cosmetics, etc. (Gauhar & Alam, 2024). Young walnut fruits are used for the production of brandy, walnut schnapps, and for sweets (Jakopic et al., 2007).

Recently, interest in the cultivation of walnut trees has increased. 'Rasna' and 'Cheinovo' are the most common cultivars in older orchards, which, with 'Geisenheim 139', are recommended for planting in new plantations (Lukić et al., 2016). Although much work has been done in Serbia on the selection of walnuts and production technology, a major change should be made in the technology and the structure of the assortment. Modern cultivation technology and a new walnut assortment are a great opportunity for fruit growing in Serbia.

The aim of this study was to examine the morphological and sensory characteristics of both the fruit and kernel, as well as the content and sensory attributes of cold-pressed oils, from eight walnut cultivars grown in the Stalać region.

## Materials and Methods

The thirty fruits in three replicates of eight different walnut cultivars ('Chandler', 'Pieral Lara', 'Tulare', 'Champion', 'Rasna', 'Cheinovo', 'Geisenheim 139', and 'Ovčar') grown on the teritory of Stalać town (43°40′24" N latitude; 21°24′29" E longitude) and collected in the fall of 2022 were used for the study.

The study included measurement of the morphometric properties of the fruit, extraction of the cold-pressed oil, sensory analysis of the fruit and the cold-pressed oils, and determination of the oil content in the walnut kernel.

The following morphometric properties were analyzed: fruit weight (g), fruit dimensions (height, width and thickness in mm), kernel weight (g) and yield (%). Fruit and kernel weight were determined by measurement on a technical scale KERN FCB (Kern & Sohn GmbH, Belingen, Germany) with an accuracy of ± 0.1 g. Fruit height, width, and thickness were determined using a Starrett 727 series digital caliper (Athol, MA, USA). The kernel yield was determined by measuring the percentage of kernel weight in relation to the total fruit weight.

The evaluation of sensory characteristics of the walnut shell (color of the shell, surface of the shell and breakage of the shell) and walnut kernel (color of the kernel, fullness of the kernel and removal of the kernel) were performed according to the methodology given by Şen (1980), Kazankaya et al. (2001), and Dogan et al. (2005).

Walnut kernels were used to obtain cold-pressed oil. The kernels are first coarsely crushed. Pressing was carried out using an OP 650 W electric rail press (Gorenje, Slovenia). After pressing, all oils were left to separate the sediment overnight to obtain clear oils. The clear oils were obtained by decanting and separating the crude oil from the sediment. The percentage of crude and cold-pressed oil was calculated. Also, the percentage of the obtained by-product, flour, was calculated. A sensory analysis of the cold-pressed oils was carried out according to the methodology described by Dimić & Turkulov (2000). More precisely, the sensory properties (color, smell and taste) were evaluated by a three-member panel. A scoring system from 0 to 5 was used to assess color and smell, while taste was evaluated using a scale from 0 to 10. In both cases, the lowest score represented unacceptable quality, and the highest score represented optimal quality. The individual scores were summed to obtain a total score, which was then used to determine the qualitative category of the oil. The oil content of the walnut kernel was determined by extraction using the Operating Manual SER148 extraction apparatus (Velp Scientifica, Italy) without prior hydrolysis of the sample. The oil content of walnut karnel was calculated using formula:

$$\text{Oil content (\%)} = \frac{\text{mass of extracted oil (g)}}{\text{mass of the chopped walnut kernel sample (g)}} \text{ x } 100$$

The data were statistically processed by analysis of variance (ANOVA) of a one-factor experiment using the Microsoft Excel software package (Microsoft Corporation, Roselle, IL, USA), and were presented as mean±standard error. Differences between means at the $P \leq 0.05$ level were compared using the Fisher's Least Significant Difference (LSD) Test.

## Results and Discussion

*Morphometric fruit characteristics.* The size of the walnut fruit, as an important pomological feature, is characterized by the height, width and thickness of the fruit. The obtained results showed that walnut fruit dimensions varied between cultivars (Table 1). The smallest height (36.55 mm), width (29.17 mm) and thickness (31.23 mm) of the fruit were recorded in the 'Cheinovo' cultivar. The 'Champion' cultivar had the highest height of the fruit (48.92 mm), while the 'Tulare' and 'Pieral Lara' cultivars had the largest width (36.37 mm) and thickness (37.79 mm) of the fruit, respectively.

Mitrović (1996), examining the biological and pomological characteristics of 23 cultivars and selections of walnuts, stated that as far as fruit morphometry is concerned, the highest fruit height and thickness is in the 'Champion' cultivar (50.4 mm and 36.2 mm), which is in agreement with our results. In the study of Jaćimović et al. (2020), walnut fruit height of investigated cultivars ranged from 33.51 mm to 50.08 mm, width from 27.12 mm to 36.89 mm, and thickness from 27.38 mm to 36.89 mm, which is within the limits of the results of our research.

Fruit weight is a very significant pomological indicator, and kernel yield is one of the most important pomological characteristics (Sutyemez, 2016). Paunović & Miletić (2013) reported that the walnut cultivars grown in the orchards of Western Serbia are distinguished by fruit weight from 8.1 g to 18 g, kernel weight from 5.4 g to 8.7 g, and kernel yield from 41.6 to 65.6%. Results concerning the abovementioned parameters obtained in this study are shown in Table 1. Regarding the weight of the fruit, the studied walnut cultivars can be divided into two groups. The cultivars 'Pieral Lara', 'Tulare' and 'Champion' can be classified in the group with significantly higher fruit weight (15.02 g; 14.54 g and 15.13 g, respectively). All other ctivars belong to the group of lower fruit weight, with no significant differences between them. The karnel weights ranged between 5.16 g ('Ovčar') and 7.81 g ('Tulare'), and karnel yields were between 44.26% ('Rasna') and 53.88% ('Tulare').

Different data can be found in the literature regarding the fruit weight of walnut genotypes. Thus, Jaćimović et al. (2020) reported an interval of 8.43 g to 13.84 g, and Jaćimović & Božović (2017) an interval of 9.4–13.1 g, which are slightly lower values compared to the results of our study. In contrast, in the study of Koc et al. (2019), the weight of walnut fruits ranged from 12 g to 18 g, which are significantly higher values compared to our results. Those differences are a result of different walnut cultivars used in the experiment and different climatic conditions as well. On the other hand, Mitrović (1996) and Mitrović & Miletić (2007) noted fruit weight values of the 'Cheinovo', 'Champion', 'Ovčar' and 'Geisenheim 139' cultivars, which are in agreement with our results. Similar results to the results obtained in this study were reported by Aslantaş (2006) for some Turkish walnut genotypes. Previous research made an assessment of some Romanian walnut cultivars showed that average kernel yield has varied between 48.0% and 53.0% (Botu et al., 2010), while kernel yield of some walnut genotypes from central Iran ranged from

Table 1. Morphometric fruit characteristics of investigated walnut cultivars
*Tabela 1. Morfometrijske osobine ploda proučavanih sorti oraha*

| Cultivar<br>*Sorta* | Fruit height<br>*Visina ploda*<br>(mm) | Fruit witdh<br>*Širina ploda*<br>(mm) | Fruit thickness<br>*Debljina ploda*<br>(mm) | Fruit weight<br>*Masa ploda*<br>(g) | Kernel weight<br>*Masa jezgre*<br>(g) | Kernel yield<br>*Randman jezgre*<br>(%) |
|---|---|---|---|---|---|---|
| 'Chandler' | 41.53 ± 1.58 c* | 32.85 ± 1.49 c | 34.77 ± 1.28 c | 12.31 ± 1.29 b | 6.32 ± 0.65 c | 51.37 ± 2.38 b |
| 'Pieral Lara' | 38.13 ± 1.68 d | 35.01 ± 1.19 b | 37.79 ± 1.40 a | 15.02 ± 1.11 a | 7.49 ± 0.65 b | 50.19 ± 5.07 b |
| 'Tulare' | 42.90 ± 2.11 bc | 36.37 ± 1.28 a | 36.75 ± 1.29 b | 14.54 ± 1.09 a | 7.81 ± 0.56 a | 53.88 ± 4.66 a |
| 'Champion' | 48.92 ± 1.94 a | 36.12 ± 1.43 a | 35.97 ± 1.07 bc | 15.13 ± 1.31 a | 7.73 ± 0.85 a | 51.06 ± 2.57 b |
| 'Rasna' | 44.83 ± 2.30 b | 32.81 ± 1.26 c | 34.88 ± 1.35 c | 12.26 ± 1.02 b | 5.43 ± 0.75 d | 44.26 ± 4.72 c |
| 'Cheinovo' | 36.55 ± 1.96 d | 29.17 ± 0.92 e | 31.23 ± 1.81 f | 11.27 ± 6.91 b | 5.22 ± 0.68 de | 50.64 ± 10.02 b |
| 'Geisenheim 139' | 39.79 ± 2.19 cd | 31.95 ± 1.70 d | 33.86 ± 1.32 d | 12.34 ± 1.05 b | 6.10 ± 0.72 c | 49.45 ± 4.94 b |
| 'Ovčar' | 38.24 ± 1.65 d | 32.20 ± 1.44 cd | 32.40 ± 1.35 e | 11.61 ± 1.24 b | 5.16 ± 0.68 e | 44.53 ± 5.93 c |

*The different letters in the column indicate significant differences at $P \leq 0.05$ according to the LSD test/*Različita slova u kolonama označavaju značajne razlike za $P \leq 0,05$ prema LSD testu.*

38.4% to 79.6% (Arzani et al., 2008). Six walnut cultivars grown in Pakistan exhibited kernel ratios ranging from 43.19% to 65.14% (Ali et al., 2010). Chinese cultivars demonstrated higher kernel ratios, ranging from 51 to 70% (Baojun et al., 2010).

*Sensory characteristics of the walnut shell and kernel.* The shell of the nut should be smooth and well closed and it should not make up more than 50% of the weight of the fruit (McGranahan & Leslie, 2012). According to the same authors, fruits should belong to the category of large or very large. Results of traits related to shell color, shell surface and shell breakage obtained in the present study are shown in Table 2.

The 'Chandler', 'Pieral Lara' and 'Ovčar' cultivars had a light shell color, which is an appreciated feature, while the other cultivars had a dark shell color. Cerović et al. (2014) point out that walnuts with a darker shell are less valued on the market. The majority of walnut genotypes included in the research of the cited authors were characterized by easy separation as well as a light-colored shell. The surface of the shell of the studied walnut cultivars in our study was moderately rough to rough. Shell breakage varied from easy ('Tulare', 'Cheinovo' and 'Gasenheim 139') through moderately ('Chandler' and 'Pieral Lara') to medium ('Champion', 'Rasna' and 'Ovčar'). All cultivars, except the 'Ovčar', had a good shell filling with the kernel. A half of the walnut genotypes studied were characterized by a light kernel color ('Chandler', 'Pieral Lara', 'Tulare' and 'Ovčar'). The same tendency of results for the mentioned parameter was already obtained by Muradoğlu (2005), who examined the kernel color of 50 walnut genotypes. In the 'Chandler' and 'Tulare' cultivars, the kernel was removed easily from the shell, while in the others, the kernel separation from the shell was medium. The lightness of the kernel color is important for the quality of the walnut kernel. Lightness of kernel color depends on genetic factors, but if the relative humidity of the air ratio increases, the darkening of walnuts also increases and decreases as the moisture decreases (Şen, 2011). In the research of Jaćimović & Božović (2017), out of 21 walnut genotypes, nine genotypes had a very light kernel, seven had a light kernel, four genotypes had a medium light kernel, and one genotype had a dark kernel. The walnut genotypes included in the study of Bayazit et al. (2019) had light yellow and yellow kernel colors, while Simsek & Osmanoglu (2010) recorded the light yellow color of the kernel in all studied genotypes in their research. In the experiment of Koc et al. (2019) a light kernel color and easy kernel removal were the most prevalent properties of the studied genotypes. McGranahan & Leslie (2012) point out that the kernels should be large and light-colored, weighing about 8–9 g and easy to remove from the shell.

*Walnut oil characteristics.* Recently, the technology of cold-pressed oil production has been used to produce the highest quality specialty oils, such as virgin and various gourmet oils, where aroma and flavor are particularly desirable characteristics. The quality of cold-pressed oils largely depends on the raw material (Dimić, 2005). The oil obtained through cold pressing fully retains all the nutrients, especially essential fatty acids, with which the seeds are naturally rich. Table 3 shows data on the percentage of crude oil, the percentage of oil after decantation and the percentage of the obtained by-product, flour.

Table 2. Sensory characteristics of the shell and the kernel of the studied walnut cultivars
*Tabela 2. Senzorne osobine ljuske i jezgre proučavanih sorti oraha*

| | Sensory properties of the shell<br>*Senzorne osobine ljuske* | | | Sensory properties of the kernel<br>*Senzorne osobine jezgre* | | |
|---|---|---|---|---|---|---|
| Cultivar<br>*Sorta* | Color<br>*Boja* | Roughness<br>*Hrapavost* | Breakage<br>*Lomljivost* | Color<br>*Boja* | Fullness<br>*Punoća* | Removal<br>*Odvajanje* |
| 'Chandler' | light | moderately rough/*umereno hrapava* | moderately/*umerena* | light/*svetla* | good/*dobra* | easy/*lako* |
| 'Pieral Lara' | light | rough/*hrapava* | moderately/*umerena* | light/*svetla* | good/*dobra* | medium/*srednje* |
| 'Tulare' | dark | moderately rough/*umereno hrapava* | easy/*laka* | light/*svetla* | good/*dobra* | easy/*lako* |
| 'Champion' | dark | moderately rough/*umereno hrapava* | medium/*srednja* | dark/*tamna* | good/*dobra* | medium/*srednje* |
| 'Rasna' | dark | rough/*hrapava* | medium/*srednja* | dark/*tamna* | good/*dobra* | medium/*srednje* |
| 'Cheinovo' | dark | moderately rough/*umereno hrapava* | easy/*laka* | dark/*tamna* | good/*dobra* | medium/*srednje* |
| 'Gazenheim139' | dark | moderately rough/*umereno hrapava* | easy/*laka* | dark/*tamna* | good/*dobra* | medium/*srednje* |
| 'Ovčar' | light | moderately rough/*umereno hrapava* | medium/*srednja* | light/*svetla* | medium/*srednja* | medium/*srednje* |

Table 3. The level of obtained cold-pressed oil and by-product (%) of the studied walnut cultivars
*Tabela 3. Udeo dobijenih hladno ceđenih ulja i nus proizvoda proučavnih sorti oraha*

| Cultivar/*Sorta* | Cold-pressed oil *Hladno ceđeno ulje* (%) | | Flour/*Talog* |
|---|---|---|---|
| | Crude oil/*Sirovo ulje* | Clear oil/*Bistro ulje* | |
| 'Chandler' | 48.00 ± 0.88 cd* | 34.00 ± 0.54 a | 39.00 ± 0.56 c |
| 'Pieral Lara' | 51.00 ± 0.91 b | 32.00 ± 0.44 b | 36.00 ± 0.58 d |
| 'Tulare' | 49.00 ± 0.65 c | 28.00 ± 0.38 c | 38.00 ± 0.59 c |
| 'Campion' | 47.00 ± 0.74 d | 31.00 ± 0.56 b | 39.00 ± 0.45 c |
| 'Rasna' | 40.00 ± 0.56 e | 24.00 ± 0.22 d | 44.00 ± 0.62 b |
| 'Cheinovo' | 52.00 ± 0.89 ab | 34.00 ± 0.28 a | 35.00 ± 0.29 e |
| 'Gazenhajm 139' | 53.00 ± 0.88 a | 33.00 ± 0.46 ab | 34.00 ± 0.36 e |
| 'Ovčar' | 29.00 ± 1.15 f | 17.00 ± 0.25 e | 46.00 ± 0.64 a |

*The different letters in the column indicate significant differences at $P \leq 0.05$ according to the LSD test*/Različita slova u kolonama označavaju značajne razlike za $P \leq 0,05$ prema LSD testu.*

Walnut oil is obtained by cold pressing raw walnut kernels. It has a distinct nutty flavor and aroma. With a smoke point of 160° C, it is used exclusively cold (not for cooking or baking) for drizzling over salads and already prepared dishes. The highest percentage of crude oil was obtained by pressing the fruits of 'Gazenheim 139' and 'Cheinovo' cultivars. Cultivars 'Chandler', 'Cheinovo' and 'Geisenheim 139' had the highest percentage of clear oil. The cultivar that gave the lowest level of cold-pressured oils and the highest percentage of by-product flour was 'Ovčar'. Cultivars that yield the most oil also yield the least by-products, and vice versa.

Based on the results of the sensory analysis (Table 4), it was determined that cold-pressed oils of the cultivars 'Chandler', 'Pieral Lara' and 'Champion' belong to the excellent quality category. Oils of the cultivars 'Tulare', 'Geisenheim 139' and 'Ovčar' belong to the category of good oils. Oils of the cultivars 'Rasna' and 'Cheinovo' had slightly worse scores of sensory evaluations and belonged to the medium quality category.

Oil is the most abundant substance in walnut kernels and the results of the present work related to the oil content in walnut kernels are given in table 5. It can be seen that the 'Geisenheim 139' cultivar had the highest oil content (68.17%) in the kernel, while the lowest content was recorded in the 'Chandler' cultivar (56.80%). Most cultivars have a lower oil content compared to literature data (Savage, 2001; Poggetti et al., 2018) because the sample was not hydrolyzed, so only free oil content was measured. Paunović & Miletić (2013) pointed out that the kernels of 'Champion' and 'Ovčar' cultivars contain 67% oil which is in agreement with our results.

According to Mitrović (1996), the cultivars 'Šejnovo', 'Geisenheim 139', 'Ovčar' and 'Champion' contain 66.94%, 71.54%, 66.62% and 64.62% oil,

Table 4. Sensory characteristics of cold-pressed oils of the studied walnut cultivars
*Tabela 4. Senzorne karakteristike hladno ceđenih ulja proučavanih sorti oraha*

| Cultivar *Sorta* | Color *Boja* | Smell *Miris* | Taste *Ukus* | Total points *Ukupna ocena* | Quality category *Kategorija kvaliteta* |
|---|---|---|---|---|---|
| Chandler' | 2.8 | 4.8 | 10.6 | 18.2 | excelent |
| 'Pieral Lara' | 2.8 | 4.5 | 10.8 | 18.1 | exelent |
| 'Tulare' | 2.6 | 4.5 | 9.9 | 17.0 | good |
| 'Champion' | 2.8 | 4.7 | 10.7 | 18.2 | exelent |
| 'Rasna' | 2.3 | 4.2 | 8.1 | 14.6 | medium |
| 'Cheinovo' | 2.3 | 4.5 | 8.3 | 15.1 | medium |
| 'Geisenheim 139' | 2.5 | 4.5 | 9.6 | 16.6 | good |
| 'Ovčar' | 2.2 | 4.5 | 9.2 | 15.9 | good |

respectively. The cultivars 'Šampion' and 'Ovčar' reached similar values in our study, while the cultivars 'Geisenheim 139' and 'Šejnovo' had a slightly lower oil content. It is known that, in addition to the cultivar, the oil content of the walnut is influenced by the location, extraction conditions and storage conditions (Rébufa et al., 2022).

Table 5. Oil content in walnut kernels (%) of the studied walnut cultivars
*Tabela 5. Sadržaj ulja u jezgri oraha (%) proučavanih sorti oraha*

| Cultivar/*Sorta* | Content of oil/*Sadržaj ulja* (%) |
|---|---|
| 'Chandler' | 56.80 ± 1.53 e |
| 'Pieral Lara' | 59.19 ± 1.45 d |
| 'Tulare' | 61.04 ± 1.12 c |
| 'Šampion' | 66.84 ± 1.32 b |
| 'Rasna' | 59.25 ± 0.98 d |
| 'Cheinovo' | 66.91 ± 1.18 b |
| 'Geisenheim 139' | 68.17 ± 1.64 a |
| 'Ovčar' | 66.66 ± 1.49 b |

*The different letters in the column indicate significant differences at $P \leq 0.05$ according to the LSD test/*Različita slova u kolonama označavaju značajne razlike za $P \leq 0,05$ prema LSD testu*.

## Conclusion

This study demonstrates the variability in fruit characteristics and oil content among different walnut cultivars grown in Serbia. Cultivars such as 'Champion', 'Pieral Lara' and 'Tulare' exhibited the highest fruit weight, while 'Geisenheim 139' had the highest oil content. Sensory evaluations of the cold-pressed oils revealed that the oils made from the kernels of the cultivars 'Chandler', 'Pieral Lara', and 'Champion' belong to the highest quality category. These results indicate that cultivar selection plays a crucial role in enhancing both fruit yield and oil quality. Optimizing the assortment and applying modern cultivation techniques could significantly benefit the walnut industry in Serbia, aligning it with market demands for high-quality products.

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# KARAKTERISTIKE PLODOVA I HLADNO CEĐENIH ULJA NEKIH SORTI ORAHA (*Juglans regia* L.)

**Radmila Ilić*, Mirjana Radovanović, Gorica Paunović, Ivan Glišić, Tomo Milošević**

*Univerzitet u Kragujevcu, Agronomski fakultet u Čačku, Cara Dušana 34, 32000 Čačak, Republika Srbija*

## Rezime

U radu su ispitivane morfometrijske (masa i dimenzije ploda, kao i masa i randman jezgre) i senzorne (boja, tekstura i lomljivost ljuske, boja, punoća i lakoća odvajanja jezgre) osobine, kao i sadržaj hladno ceđenog ulja i njegove senzorne karakteristike (boja, miris i ukus) kod osam sorti oraha (Chandler, Pieral Lara, Tulare, Champion, Rasna, Cheinovo, Geisenheim 139 i Ovčar) gajenih na teritoriji Stalaća. Uočena je značajna varijabilnost među sortama u pogledu ispitivanih morfometrijskih parametara i sadržaja ulja. Sorte kao što su Champion, Pieral Lara i Tulare su se odlikovale najvećom masom ploda (15,13 g, 15,02 g, i 14,54 g, po redosledu). Osim navedenog, sorta Tulare je postigla i najveću masu jezgre (7,81 g) i randman jezgre (53,88%), dok je sorta Geisenheim 139 imala najveći sadržaj ulja (68,17%). Na osnovu rezultata senzorne analize, hladno ceđena ulja ispitivanih sorti oraha kategorisane su u tri grupe prema kvalitetu. U grupu srednjeg kvaliteta svrstana su ulja dobijena od plodova sorti Rasna i Cheinovo, dok su ulja sorti Tulare, Geisenheim 139 i Ovčar svrstana u grupu dobrog kvaliteta. Ulja dobijena od sorti Chandler, Pieral Lara i Champion su svrstana u grupu odličnog kvaliteta. Rezultati proučavanja naglašavaju važnost izbora odgovarajućih sorti u unapređenju proizvodnje oraha u Republici Srbiji. Sortiment oraha ima ključnu ulogu ne samo kao važan činioc za kvantitet i kvalitet proizvedene jezgre, već i za proizvodnju orahovih ulja vrhunskog kvaliteta, koja bi mogla dodatno unaprediti konkurentnost domaće proizvodnje oraha na svetskom tržištu visokokvalitetnih proizvoda.

**Ključne reči**: orah, sorta, jezgra, ulje, morfometrijske i senzorne osobine