THE STUDY OF POMOLOGICAL AND BIOCHEMICAL ATTRIBUTES OF SOME WALNUT (JUGLANS REGIA L.) GENOTYPES FROM GHAZNI REGION, GHAZNI-AFGHANISTAN

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Abstract. *This study was conducted in 2021 to evaluate the growth and biochemical characteristics of a number of different walnut genotypes collected from Ghazni, Afghanistan. The experiment was conducted in a nested design with four replications. In this study, the genotypes namely Sanghe shamal Kabul, Kaghzie Qarabagh, Jaji ariob and Shahrestani were included. Based on the results of this study, Kaghzie Qarabagh genotype was evaluated in terms of important traits such as number of inflorescences, ease of kernel separation, wood bark thickness, Fruit ripening time and kernel size as a superior genotype among the four walnut genotypes. Also, Jaji Ariob genotype was a weak genotype in terms of evaluated traits among genotypes. Regarding quantitative variables, the results of analysis of variance showed Fruit and kernel weight, kernel volume, Petiole length, fruit diameter and volume, Length to width ratio of fruit, phenol content, flavonoids and vitamin C were affected by different walnut genotypes. The highest fruit weight with an average of 55.57 gr was obtained in Kaghzie Qarabagh genotype and the lowest with an average of 43.9 gr was obtained in Shahrestani genotype. The highest kernel weight with an average of 26.97 gr was related to Kaghzie Qarabagh genotype and the lowest kernel with an average of 19.22 gr was related to Shahrestani genotype. In general, according to the results obtained from the evaluation of pomological and biochemical traits, Kaghzie Qarabagh genotype can be suggested as a suitable genotype for cultivation in Ghazni region.*

Keyword: *genotype, morphological traits, walnut, yield and yield components.*

Walnut by the scientific name of Juglans spp belongs to the Juglandaceae family and genus Juglans. The genus Juglans has 21 species all of which are edible and among these species the Persian walnut (*Juglans regia* L.) is known as the best walnut in terms of edible seed production and is widely cultivated in different parts of the world (McGranahan et al., 1998). All walnut species were native to temperate and subtropical climates (Eskandari, 2014). Walnut is one of the most important nut trees in the broad leaf group which is in 10 to 50 degrees north latitudes and has a high value in terms of edible seed production, forestry and valuable woody tree (Çağlarırmk, 2003). This tree has a multipurpose application so that it is cultivated in fruit growing because of its fruit, in pharmacy as a medicinal plant and in parks as an ornamental plant (Ebrahimi et al., 2009). Walnut has a high calorie level, rich nutrient composition and a special value in traditional Turkish foods ((Gulcan Ozkan & M. Ali Koyuncu 2005; Sen, 1986). The edible part of the walnut is its kernel, which makes up about half the weight of the fruit. The walnut is undoubtedly rich in proteins, fats, minerals and energy. The amount of these substances is very high compared to other foods as well as other dry fruits (Maghsoodi et al,2018). China, Iran, USA and Turkey have the highest cultivation area with respectively 390224, 146565, 141640 and 111775 hectares. Afghanistan with 2201 hectares cultivation area ranks 32nd (FAO, 2017). Due to mostly sexual propagation, there is a great deal of morphological and pomological variation in this fruit tree species around the world, and identifica-

tion of valuable genotypes endemic to studied areas is vital for local growers as well as breeders (Mahmoodi et al., 2019). Morphological diversity resulting from the genetic diversity of a plant can be related to the genetic interactions and environmental conditions in which the plant grows. Therefore, morphological diversity can be considered as a guide for studying genetic diversity (Ebrahimi et al., 2015). The Turkish Standard Institute (TSI) established physical nut and kernel properties of walnut as quality criteria (Gulcan Ozkan & M. Ali Koyuncu 2005**;** Anonymous, 1990; 1991). In China, the walnut breeding program is based on the identification and collection of genotypes crosses, and imports of both cultivars and the rich germplasm's resources are widely used in breeding programs, and desirable genotypes based on early fruiting traits and high yield efficiency have been obtained (Wu et al., 2010). In a study of diversity among native walnut genotypes in Iran, using morphological traits and SSR markers, a high genetic diversity was revealed (Ebrahimi et al., 2011). In an attempt to diversity analysis of forest walnuts in Kyrgyzstan, Mammad Janov (2001) identified and evaluated the top walnut trees in Fars province and selected 101 trees with the desired characteristics. In order to identify genotypes with superior traits, different walnut genotypes in Province of Fars in the Neyriz district were evaluated based on traits such as brain color, fruit shape, fruit end orifice, skin texture, and flesh of the brain, and finally the desirable genotypes were determined (Ebrahimi et al. ,2009). In Afghanistan, there are a large number of endemic valuable walnut genotypes which have not been evaluated through a standard, scientific method. The war condition along with lack of strong scientific attitudes toward horticultural crops is the main reason in this regard. The current study, the first in its kind, was conducted to evaluate and compare the important pomological and biochemical characteristics of some potentially superior walnut genotypes in Afghanistan.

Materials and Methods: This study was conducted in 2021 to evaluate the growth and biochemical characteristics of a number of different walnut genotypes collected from Ghazni, Afghanistan. The experiment was conducted in a nested design with four replications. The genotypes studied in this study included Sanghe shamal Kabul, kaghzie Qarabagh, Jaji Ariob and Shahrestani. Different walnut genotypes were collected after harvesting from Ghazni city in Afghanistan. The genotype collection areas included Qarabagh District, Zarsang, Qaliyaqul and Deh Seyed villages and the distance between these villages was approximately 2 to 3 Kilometers. After collecting the samples, it was transferred to the post-harvest physiology laboratory of the department of Horticulture, faculty of Agriculture, Zanjan University.

The studied traits include: Phenological and leaf characteristics such as leaf bud opening time, leaf size, leaf length and width, time of emergence of male and female flowers; tree characteristics including growth vigor, growth habit, branch density, characteristics; Pomological features include roundness index, fruit bottom shape, fruit tip shape, measure tip protrusion, location of blade edges on longitudinal slit, blade edge protrusion on longitudinal seam, blade edge width on longitudinal slit, depth gaps along the seam on the seam, the surface structure of the bark, the thickness of the bark as well as the fruit volume, fruit size and kernel to fruit ratio. Also traits such as fruit volume with graduated cylinder, fruit size (length, width and diameter) with caliper(Colas), ratio of kernel to fruit with digital scale, measurement of manganese and zinc in the brain statistics studied with atomic absorption apparatus and potassium in the plant with apparatus flame photometer, phosphorus and nitrogen with apparatus spectrophotometer, total fat with apparatus Soaksule (AOAC, 1990), Total flavonoids (Rizik et al., 1998), total phenolics (Malick et al., 1980), vitamin C (Bor et al., 2006), antioxidant capacity were evaluated by DPPH method (Dehghan and Khoshkam, 2012). Data analysis of variance was performed using SAS 9.1.3 software and to compare the means, the least significant difference test at 5% probability level (LSD) was used. The drawing was performed using Excel software.

Results and discussion: Based on the results obtained regarding 4 walnut genotypes collected from Ghazni region of Afghanistan,

morphological traits in these 4 genotypes are different, which is the difference between genetically related traits between these populations, which lead to the differentiation of traits. There were significant differences between the four genotypes of Sanghe shamal Kabul, kaghzie Qarabagh, Jaji Ariob and Shahrestani. Among the genotypes studied in this study, the genotype of kaghzie Qarabagh is based on the traits of number of inflorescences and fruits size for the kaghzie Qarabagh genotype with location of most fruit buds (end of annual branches), shape of fruit or roundness index (low), the degree of tip protrusion(low), Surface structure of wood shell (little Grooves), Ease of kernel separation(Very comfortable), Shell thickness (very thin), Fruit ripening time (Medium to medium), Kernel color (bright), Kernel size (big), leaf bud opening time (Medium), emersion time of male flower (Medium), Leaf fall time (Medium), Emersion time of female flowers (Medium), Male flowers emersion time compared to female flowers (protandry), tree growth habit (straight to semi-straight), branches density (dense to very dense) and tree growth (medium to strong). Kaghzie Qarabagh genotype according to all morphological traits was studied. This study is a superior genotype compared to the other three genotypes. Based on quantitative traits in this study showed that the highest fruit weight with an average of 55.57 gr was related to kaghzie Qarabagh genotype which of no significant difference with Jaji Ariob and Sanghe shamal Kabul genotypes, the highest kernel volume with an average of 27.5 cm^3 was related to Kaghzie Qarabagh which of course did not differ significantly from the genotype of Sanghe shamal Kabul. The highest fruit kernel weight with an average of 26.97 gr was related to the Kaghzie Qarabagh genotype. The highest fruit diameter with an average of 1.275 mm was related to Kaghzie Qarabagh genotype, but there was no significant difference between the Sanghe shamal Kabul and Shahrestani genotypes, the highest fruit volume with an average of 97.5 cm^3 was related to Kaghzie Qarabagh genotype which of course did not differ significantly from the Sanghe shamal Kabul genotype. The highest volume of fruit with an average of 1.4 mg/gr of fresh weight was related to Kaghzie Qarabagh, which of course had no significant difference with Jaji Ariob and Shahrestani genotypes. The highest fruit volume with an average of 1.92 mg / gr fresh weight was related to the Sanghe shamal Kabul genotype. Also, the highest amount of vitamin C was with 1.55. Mg / gr fresh weight was related to Shahrestani genotype. Kaghzie Qarabagh genotype has two very important traits in terms of marketability in walnuts, fruit weight and kernel weight, which had the highest values in Kaghzie Qarabagh genotype, which can lead to high yield in these genotypes.

Table 1. Morphological characteristics of different walnut genotypes

Genotypes	FSVS	FSLCL	FS	NMI	SLL	SCS
Sanghe shamal Kabul	Trapezoidal	Wide trapezoid	Little	Medium	Oval	Oval
Kaghzei Qarabagh	Trapezoidal	Trapezoidal	Big	More	Bark oval	Oval
Jaji Ariob	Wide oval	Wide trapezoid	Medium	Low	Oval	Spherical
Shahrestani	Wide trapezoid	Seed egg	Big	Medium	Wide oval	Spherical chamfer

The results of Table 1 showed that based on the shape traits of lateral leaflets (SLL), number of inflorescences (NMI), fruits size (FS), shape in length section corresponding to length dose (FSLCL), Shape in vertical section on fruit seam (FSVS) and shape in cross section (SCS) for Sanghe shamal Kabul genotype respectively (trapezoidal, wide trapezoid, little, medium, oval and oval), for Kaghzei Qarabagh genotype, it was trapezoidal, trapezoidal, big, more, bark oval and oval. Also, the mentioned traits for Jaji Ariob genotype were wide oval, wide trapezoid, medium, low, oval and spherical. In the case of

Shahrestani genotype, the mentioned traits are wide trapezoid, seed egged, big, medium, wide oval and spherical chamfer respectively. Based on the traits studied in this table, the best genotype is related to Kaghzei Qarabagh.

Table 2. Morphological characteristics of different walnut genotypes

Genotypes	DT	SSTL	Shell (SBL)	Shell (R)	FBL	SSWS
Sanghe shamal Kabul	medium	Apex sharp	Level	Less	All over annual branches	Many grooves
Kaghzei Qarabagh	Low	Round	Round	Less	End of annual branches	Little grooves
Jaji Ariob	medium	Level	Level	Medium	All over annual branches	medium grooves
Shahrestani	Much	Top sharp	Edged	Much	All over annual branches	Many grooves

Based on the results of Table 2, the traits of most location fruit buds (FBL), shell (roundness index), Shell (The shape of the bottom of the fruit is perpendicular to the length), Shape of the shell tip is perpendicular to the length. The degree of tip protrusion and shell wood surface structure includes the following for the studied genotypes respectively Sanghe shamal Kabul genotype, all over the one-year branches, Kaghzei Qarabagh at the end of the one-year branches, Jaji Ariob and Shahrestani genotypes in all over of the one-year branches of fruit buds form. The amount of shell among the genotypes was respectively such that Sanghe shamal Kabul and Kaghzei Qarabagh have less roundness. The Jaji Ariob genotype was medium round and genotype Shahrestani has much round. Genotypes are studied based on look of Shell (the shape of the bottom of the fruit is perpendicular to the length) level, round, level and Edged. Regarding the Shape of the shell, tip is perpendicular to the length respectively with Apex sharp, round, level and top sharp. Regarding the degree of tip protrusion, the genotypes respectively were medium, low, medium and much. Regarding the trait of Surface structure of wood shell for genotypes respectively were many grooves, little groove, medium groove and many grooves. Among these genotypes, the Kaghzei Qarabagh had more desirable characteristics.

Table 3. Morphological characteristics of different walnut genotypes

Genotypes	Kernel color	Fruit ripening time	Shell two half pastiness (Nut)	Shell thickness	Ease of kernel separation	Kernel size
Sanghe shamal Kabul	Very bright	Early to medium	Much	Medium	Between	Little
Kaghzei Qarabagh	Bright	Medium to medium	Very little	Very thin	Very comfortable	Large
Jaji Ariob	Bright	Medium to late	Medium	Medium	Between	Very small
Shahrestani	Dark	Medium	Much	Thick	Comfortable	Medium

The studied morphological traits of local walnut genotypes presented in Table 3 are in terms of Ease of kernel separation, Shell thickness, Shell two half pastiness (Nut), Fruit ripening time, Kernel color and Kernel size for Sanghe shamal Kabul genotype were respectively Between, medium, Much, Early to medium, very bright and little. For the Kaghzei Qarabagh, above-mentioned traits are very comfortable, very thin, very little, medium to medium, bright and large. These traits were respectively for Jaji Ariob genotype Between, medium, medium, medium to late, bright and very small. In the Shahrestani genotype, these traits respectively are comfortable, thick, much, medium, dark and medium. Based on the mentioned characteristics for this group genotypes, Kaghzei Qarabagh genotype seems to be a desirable genotype due to its suitable traits and large kernel.

Table 4. Morphological characteristics of different walnut genotypes

Genotypes	Emersion time of female flowers	Leaf fall time	Emersion time of male flowers	Leaf bud opening time	Green cover durability	Male flowers emersion time compared to female flowers
Sanghe shamal Kabul	Medium to late	Late	Soon or medium	Medium to late	No durability	Protandry
Kaghzei Qarabagh	Medium	Medium	Medium	Medium	Semi-durability	Protandry
Jaji Ariob	Medium	Medium	Soon or medium	Medium	Semi-durability	Protandry
Shahrestani	Medium to late	Late	Soon or medium	Medium to late	No durability	Protandry

Results of studies on morphological traits of different walnut genotypes in Table 4 for Green cover durability on the tree after falling, Leaf bud opening time, emersion time of male flowers, Leaf fall time, Emersion time of female flowers and Male flowers emersion time compared to female flowers for the Sanghe shamal Kabul were no durability, medium to late, soon or medium, late, medium to late ad Protandry respectively. The Kaghzei Qarabagh genotype respectively was Semi-durability, medium, medium, medium, medium and protandry. Also, for Jaji Ariob genotype was respectively semi-durability, medium, soon or medium, medium, medium and protandry. In the case of Shahrestani genotype, the mentioned traits were respectively no durability, medium to late, soon or medium, late, medium to late and protandry. Based on these results the genotype of Kaghzei Qarabagh was with a better genotype followed by the Jaji Ariob genotypes. The morphological characteristics of different walnut genotypes are also detailed in Table 5.

Table 5. Morphological characteristics of different walnut genotypes

Genotypes	Annual shoots color	Branch density	Tree growth habit	Leaves color	Petiole color	Leaf shape	Tree power growth
Sanghe shamal Kabul	Light coffee to arrow coffee	Dense to the middle	Semi straight to wide ten	light green	dark green	Oval	**Medium to very strong**
Kaghzei Qarabagh	Light coffee to arrow coffee	Dense to very dense	Straight to semi straight	light green	dark green	Wide oval	**Medium to strong**
Jaji Ariob	Light brown to blackish	Dense to open	Semi straight to wide ten	light green	dark green	Oval thin	**Strong to very strong**
Shahrestani	Light brown to dark yellow	Dense to open	Semi straight to wide ten	light green	dark green	Oval	**Strong to very strong**

Based on these results, leaf shape, petiole color, leaf color, tree growth habit, Branch density, Annual shoots color and Tree power growth for the genotype of Sanghe shamal Kabul respectively introduced the traits of oval, dark green, light green, Semi straight to wide ten, Dense to the middle, Light coffee to arrow coffee and medium to very strong. In the genotype of Kaghzei Qarabagh, these traits were respectively wide oval, dark green, light green, Straight to semi straight, dene to very dense, Light coffee to arrow coffee, and Medium to strong. This genotype is superior to the other three genotypes according to all the morphological traits studied in this study. But genotype of Jaji Ariob based on the mentioned traits were respectively oval thin, green dark, light green, semi-straight to wide, dense to open, Light brown to blackish and strong to very strong. Finally, about the genotype of Shahrestani, these traits respectively are oval, dark green, light green, semi-straight to wide, Dense to open, Light brown to dark yellow and strong to very strong.

Quantitative traits examined in this research

Table 6. Results of analysis of variance related to quantitative fruit traits of different walnut genotypes

Source of change	Degrees of freedom	Fruit weight	Kernel volume	Kernel weight	Petiole
	3	68/10*	72/38**	74/45**	06/205*
	9	42/24	67/4	12/1	11/55
	-	61/90	80/8	59/4	49/5

***, * and ns are significant at the level of 1 and 5% probability and non-significance, respectively*

The results have shown that there was a significant difference between different walnut genotypes in terms of fruit weight at the level of 5% probability. The results of comparing the mean of this trait showed that the highest fruit weight with an average of 55.57 gr was related to Kaghzei Qarabagh genotype which of course did not differ significantly from Jaji Ariob and Sanghe shamal Kabul genotypes and the lowest with an average of 43.9 gr belonged to the Shahrestani genotype. There was a significant difference in terms of kernel volume at the level of 1% probability. The results of mean comparisons related to this trait showed that the largest kernel volume with an average of 27.5 cm^3 related to Kaghzei Qarabagh, which of course did not differ significantly from the genotype of Sanghe shamal Kabul and the lowest amount with an average of 21.75 cm^3 was related to the Shahrestani genotype which was not significantly different from the Jaji Ariob genotype. There was a significant difference in kernel weight at the level of 1% probability. The results of mean comparisons related to this trait showed the highest kernel weight with an average of 26.97gr was related to the Kaghzei Qarabagh genotype and the lowest with an average of 19.22gr was related to the Shahrestani genotype. There was a significant difference in petiole length at the level of 1% probability. The results of mean comparisons related to this trait showed that the highest petiole length with an average of 143.5 mm was related to Jaji Ariob genotype but there was no significant difference between Kaghzei Qarabagh and Sanghe shamal Kabul genotypes and the lowest with an average of 126.00 mm was related to Shahrestani genotype.

Table 7. Results of analysis of variance related to quantitative fruit traits of different walnut genotypes

Source of change	Degrees of freedom	Fruit diameter	Fruit volume	Kernel diameter	Distance two leaves	Length to width ratio (fruit)
Walnut genotypes	3	008/0 *	75/464**	$003/0^{ns}$	$89/10^{ns}$	045/0 **
Error	9	002/0	02/60	004/0	11/6	002/0
Coefficient of Variation (%)	-	84/3	46/9	84/6	14/4	18/4

***, * and ns are significant at the level of 1 and 5% probability and non-significance, respectively*

The results of the measured traits indicated that there was a significant difference between different walnut genotypes in terms of fruit diameter at the level of 5% probability (Table 7). The results of mean comparisons related to this trait showed that the highest fruit diameter with an average of 1.275 mm was related to Kaghzei Qarabagh genotype although there was no significant difference between Sanghe shamal Kabul and Shahrestani genotypes. And the lowest amount with an average of 1.175 mm was related to Jaji Ariob genotype. There was a significant difference in terms of fruit volume at the level of 1% probability. The results of mean comparisons related to this trait showed that the highest fruit volume with an average of 97.5 cm3 was related to Kaghzei Qarabagh which of course did not differ significantly from the Sanghe shamal Kabul genotype. And the lowest amount with an average of 72.75 cm3 was related to Jaji Ariob genotype which was not significantly different from the Shahrestani and Sanghe shamal Kabul genotypes. The results of analysis of variance showed that there was no significant differ-

ence between different walnut genotypes in terms of kernel diameter. Walnut did not differ significantly in terms of distance between two leaves.

Table 8. Results of analysis of variance related to quantitative fruit traits of different walnut genotypes

Source of change	Degrees of freedom	ratio of length to width (kernel)	Ratio of length to width (leaf)	Phenol	Flavonoids	Antioxidants
Walnut genotypes	3	18/0^{ns}	04/0^{ns}	017/0 *	96/1 **	001/0^{ns}
Error	9	23/0	04/0	002/0	004/0	001/0
Coefficient of Variation (%)	-	85/35	62/8	97/3	87/5	33/8

***, * and ns are significant at the level of 1 and 5% probability and non-significance, respectively*

The Study indicated that there was a significant difference between different walnut genotypes in terms of the ratio of length to width of the kernel at the level of 1% probability. The results of mean comparisons related to this trait showed that the highest ratio of length to width of the kernel with an average of 1.275 % was related to Kaghzei Qarabagh and the lowest with an average of 1.02 % was related to genotype of Sanghe shamal Kabul which was significantly different from Jaji Ariob genotype. There was no significant difference in the ratio of length to width of the kernel and leaves. There was a significant difference in phenol at the level of 1% probability. The results of mean comparisons related to this trait showed that the highest phenol with an average of 1.4 mg / gr fresh weight was related to Kaghzei Qarabagh which of course did not have a significant difference with Jaji Ariob and Shahrestani genotypes. The lowest amount with an average of 1.25 mg / gr fresh weight was related to the genotype of Sanghe shamal Kabul. There was a significant difference in Flavonoids at the level of 1% probability. The results of mean comparisons related to this trait showed that the highest Flavonoids with an average of 1.92 mg / gr fresh weight was related to the genotype of Sanghe shamal Kabul and the lowest with an average of 0.3 mg / gr fresh weight was related to Jaji Ariob genotype. The results of analysis of variance showed that there was no significant difference between different walnut genotypes in terms of antioxidant content.

Table 9. Results of analysis of variance related to quantitative traits of different walnut genotypes

Source of change	Degrees of freedom	potassium	Phosphorus	Nitrogen	Manganese	zinc	fat (%) t	Vitamin C
Walnut genotypes	3	08/180339^{ns}	56/48996^{ns}	7/ 81053^{ns}	72/ 6^{ns}	33/35^{ns}	74/47^{ns}	10/0 **
Error	9	36/82081	72/146945	28/102620	95/2	11/22	89/19	0/009
Coefficient of Variation (%)	-	87/6	23/4	00/3	66/12	81/6	54/6	37/7

***, * and ns are significant at the probability level of 1% and 5% and non-significant, respectively*

The results of analysis of variance showed that there was a significant difference between different walnut genotypes in terms of vitamin C at the level of 1% probability. The results of mean comparisons related to this trait showed that the highest amount of vitamin C with 1.55 mg / gr fresh weight was related to the Shahrestani genotype and the lowest with an average of 1.17 mg / gr fresh weight was related to the Kaghzei Qarabagh genotype. The results of analysis of variance also showed that there was no significant difference between different walnut genotypes in terms of fat percentage and nutrients.

Final conclusion: The results of this study showed that the effect of treatment (difference between different genotypes of walnuts collected from Ghazni region) on all traits studied in this study except the number of fruit weight, kernel weight, diameter fruit and

kernel, the ratio of length to width of the kernel and leaf and levels of flavonoids, phenol and vitamin C were significant. But other traits were not significant. Among the studied genotypes, Kaghzei Qarabagh genotype with an average of 55.57 gr per had the highest fruit weight and Shahrestani genotype with an average of 43.9 gr had the lowest fruit weight. The results of comparing the mean of this trait showed that the highest kernel weight with an average of 26.97 gr was related to the Kaghzei Qarabagh genotype and the lowest with an average of 19.22 gr was related to the Shahrestani genotype. The study also showed that the Kaghzei Qarabagh genotype in terms of effective traits such as the number of inflorescences (high), ease of separation of the kernel (very comfortable), thickness of wood bark (very thin), ripening time (medium) and kernel size (large) is considered as a superior genotype among the 4 walnut genotypes under study. Also, among the studied genotypes, each of the genotype has some attractiveness to choose in breeding issues to introduce a suitable cultivar, which in case of breeding, can aggregate the differences between traits in one cultivar appearance. Therefore, this research can be a way to introduce a new walnut cultivar.

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ИЗУЧЕНИЕ ПОМОЛОГИЧЕСКИХ И БИОХИМИЧЕСКИХ ПРИЗНАКОВ НЕКОТОРЫХ ГЕНОТИПОВ ГРЕЦКОГО ОРЕХА (JUGLANS REGIA L.) ИЗ РЕГИОНА ГАЗНИ, ГАЗНИ-АФГАНИСТАН

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Аннотация. *Это исследование было проведено в 2021 году для оценки роста и биохимических характеристик ряда различных генотипов грецкого ореха, собранных в Газни, Афганистан. Эксперимент проводился по гнездовой схеме в четырехкратной повторности. В это исследование были включены генотипы, а именно Sanghe shamal Kabul, Kaghzie Qarabagh, Jaji ariob и Shahrestani. На основании результатов этого исследования генотип Кагзи Карабах был оценен с точки зрения важных признаков, таких как количество соцветий, легкость отделения ядра, толщина древесной коры, время созревания плода и размер ядра, как лучший генотип среди четырех генотипов грецкого ореха. Кроме того, генотип Jaji Ariob был слабым генотипом с точки зрения оцениваемых признаков среди генотипов. Что касается количественных переменных, результаты дисперсионного анализа показали, что разные генотипы грецких орехов влияли на вес плода и ядра, объем ядра, длину черешка, диаметр и объем плода, соотношение длины и ширины плода, содержание фенолов, флавоноидов и витамина С. Самая высокая масса плодов, в среднем 55,57 г, была получена у генотипа Кахзи Карабах, а самая низкая, в среднем 43,9 г, была получена у генотипа Шахрестани. Самая высокая масса ядра, в среднем 26,97 г, была связана с генотипом Кахзи Карабах, а самая низкая масса ядра, в среднем 19,22 г, была связана с генотипом Шахрестани. В целом, по результатам оценки помологических и биохимических признаков, генотип Кагзи-Карабах может быть предложен как подходящий генотип для возделывания в Газнинском районе.*

Ключевые слова: *генотип, морфологические признаки, грецкий орех, урожайность и компоненты урожайности.*