

LOCAL PISTACHIO (*PISTACHIO VERA* L.) VARIETIES OF UZBEKISTAN

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Abstract. The article presents the results of scientific research on 13 local varieties of pistachios created in Uzbekistan and their bioecological characteristics. These varieties are divided into varieties according to Turkish standards. According to Turkish standards, Bobotog, Mustaqillik, Pearl of Uzbekistan, Chagmoq and Shirin varieties correspond to the 1st grade, Serhosil, Sitora, Uzbekistan - the 2nd grade, Gallaorol, Tog' Malikasi - the 3rd grade, Faravan, Khursandchilik - the 4th grade.

1. Introduction.

In Uzbekistan, natural pistachio groves are found in all mountain and sub-mountain regions at an altitude of 600-1500 m above sea level. Some individual trees are found even below this level. Pistachio trees form irregularly arranged tree and shrub forests with an average of 100-180 trees per hectare.

Pistachio - *Pistacia vera* L. - belong to the *Pistacia* L. family of the *Anacardiaceae*. Pistachio is a 6-7 (10) m tree or 2-3 m multi-bodied bush of different ages. The trunk is large, thick, spherical, with a diameter of 5-6 m, sometimes 10 m. Most of the body is crooked, the old bodies are bent [Qayimov A., Berdiev E.T., 2012].

Pistachio is a dioecious plant. In the naturally distributed areas, mainly pollinator trees make up 55-70%. It is pollinated by wind.

The root system is characterized by its flexibility, and its distribution under the ground is related to the moisture condition of the soil. The secret of pistachio's drought resistance is its vigorous root system, which penetrates deep underground and spreads widely. Through this root system, it reaches very deep water and allows its growth even in such a hot and dry period. The root system of an 8-12 cm young seedling grows several times faster than the trunk and reaches 100-150 cm. Many scientists claim that the lateral roots of large pistachio trees are located 1.5-1.7 m underground, while the tap roots reach 7-10 m.

In the areas where natural pistachio groves are scattered in Uzbekistan, the work of establishing cultivated pistachio groves began in 1937 (in Bobotog). Central Asian republics have established new pistachio groves from wild pistachios on the basis of natural pistachio groves, and also established new pistachio cultivated forests in semi-arid areas as a result of these scientific researches. It is especially widely used in afforestation around reservoirs [Chernova G.M. et al., 2019].

The fruit is a hard nut with flesh on it. The nut is yellow, 17 mm long. It ripens in August. Almost every tree fruit is different. In all pistachio growing areas, small fruits (up to 12 mm) and large (20

mm and larger) pistachios are found. Another key indicator of the nut is the opening of the mouth of the nut, which also varies from tree to tree (76-100%).

The seeds are pistachio-colored, bilobed nuts. When the number of seeds in 1 kg is 1700, the average weight of 1000 seeds is 588 g.

The pulp contains 55.5-68.0% fat. The seeds are not only morphologically diverse, but also differ in the duration of dormancy and the effects of heat. The germination rate of pistachios in laboratory conditions is 60-80%. The picture of germination of seeds depends on their preparation.

2. Materials and methods

Currently, great importance is attached to selection work, especially mother plantations are being established from valuable fruit forms. Also, the growth and development of pistachio seed varieties brought from abroad is observed in the conditions of Uzbekistan [Hamzayev A. and others, 2020; Kayimov A., et al., 2021]. Work is underway to find and select trees with high nut size, open percentage and taste quality, and to expand the area of cultivated pistachios from them. Forest farms of Uzbekistan are achieving good results in combating soil erosion by establishing cultural pistachio groves. The area of pistachios is expanding every year.

As we know, in countries where pistachio cultivation is developed, pistachios are grown in Iran - Ahmadi, Akbari, Fandugi, Oukhadi, Mumtaz, Kalle Guchi; USA - Kermen; Turkey- Uzun, Kirmizi, Sultani; Syria - Ashori, Ajami; Tunisia – Mateur; Italy - there are world-famous varieties such as Bianca [Ibrahim Basha A. et al., 2007; Tekin H., Akkök F. 1994].

3. Results and discussion

Scientists of Uzbekistan have created 12 seed-bearing and 1 pollinator varieties of pistachios, and these varieties are distinguished by high yield, large-fruited, disease, pest and drought resistance (Table 1): female – “Independence”, “Chagmoq”, “Khursandchilik”, “Uzbekistan”, “Serhosil”, “Shirin”, “Bobotog”, “Sitara”, “Farovon”, “Mountain Queen”, “Gallaorol”, “Pearl of Uzbekistan” varieties; pollinator – “Farkhod” variety. Below is a detailed description of each variety.

Table 1

Authors of pistachio varieties created in Uzbekistan, certificate of Agricultural Crops Varieties Testing Center and plant variety patent numbers of the Intellectual Property Agency

No.	Name of varieties	Authors	Certificate number	Patent number
1	Bobotog	A.Kh. Khamzayev, G.M. Chernova, E.K.Botman, L.V.Nikolyai, T.E.Tulyaganov	№672	NAP 00300
2	Gallaorol	A.K. Khamzayev, G.M. Chernova, E.K.Botman, L.V.Nikolyai, T.E.Tulyaganov, B.I.Eshankulov	№666	NAP 00301
3	Independence	A.K. Khamzayev, G.M. Chernova, E.K.Botman, L.V.Nikolyai, T.E.Tulyaganov, B.I.Eshankulov	№673	NAP 00302

4	Serkhosil	A.K. Khamzayev, G.M. Chernova, E.K.Botman, L.V.Nikolyai, T.E.Tulyaganov	№664	NAP 00303
5	Sitora	A.K. Khamzayev, G.M. Chernova, E.K.Botman, L.V.Nikolyai, T.E.Tulyaganov, D.E.Glushchenko	№669	NAP 00304
6	Queen of the Mountain	A.K. Khamzayev, G.M. Chernova, E.K.Botman, L.V.Nikolyai, T.E.Tulyaganov, B.I.Eshankulov	№667	NAP 00305
7	Uzbekistan	A.K. Khamzayev, G.M. Chernova, E.K.Botman, L.V.Nikolyai, T.E.Tulyaganov, D.E.Glushchenko	№670	NAP 00306
8	Pearl of Uzbekistan	A.H. Khamzayev, G.M. Chernova, E.K. Botman, L.V. Nikolyai, T. E. Tulyaganov, D. E. Glushchenko	№665	NAP 00307
9	Faravon	A.K. Khamzayev, G.M. Chernova, E.K.Botman, L.V.Nikolyai, T.E.Tulyaganov, D.E.Glushchenko	№668	NAP 00308
10	Farkhod	A.K. Khamzayev, G.M. Chernova, E.K. Botman, L.V. Nikolyai, T. E. Tulyaganov, B. I. Eshankulov, A.A. Normatov, M.M. Inomova	№674	NAP 00309
11	Khursandchilik	A.K. Khamzayev, G.M. Chernova, E.K. Botman, L.V. Nikolyai, T. E. Tulyaganov, B. I. Eshankulov, A.A. Normatov, M.M. Inomova	№671	NAP 00310
12	Chaqmoq	A.K. Khamzayev, G.M. Chernova, E.K.Botman, L.V.Nikolyai, T.E.Tulyaganov, B.I.Eshankulov	№663	NAP 00311
13	Shirin	A.H. Khamzaev, G.M. Chernova, E.K. Botman, L.V. Nikolyai, T. E. Tulyaganov, B. I. Eshankulov, A.A. Normatov, M.M. Inomova	№662	NAP 00312

"Bobotog" variety. The female tree - fast-growing and upright, with wide and dense branches. The average height of the tree is 4 m, the trunk diameter is 35 cm, the diameter of the branches is up to 4 m.

The ripening of fruits is considered very late and, depending on the climatic conditions, corresponds to the third ten days of September. 100 seeds weigh 115.9 g, size 21.6x11.9x12.2 mm.

The degree of openness of fruits is average, rising to 85% depending on the climatic conditions. The average weight of the kernel is 0.7 g, 60% of the total weight of the kernel.

After grafting, it enters the harvest in 4-5 years. The yield is stable, depending on the climatic conditions (the amount of annual precipitation is of main importance), it yields every year. When planted in an 8x8 m scheme, the yield per 1 ha is 12 centner.

It is resistant to fungal diseases and fruit damage; drought and extreme temperature rise in summer. It is recommended to plant in dry lands with medium supply of moisture (annual rainfall is not less than 300 mm).

"Gallaorol" variety. The female tree is fast growing and has upright, broad and moderately thick branches. The average height of the tree is 4 m, the trunk diameter is 35 cm, the diameter of the branches is up to 4.5 m.

The ripening of fruits is late and, depending on the climatic conditions, corresponds to the third of August and the first ten days of September. 100 seeds weigh 96.2 g, size 19.3x9.7x11.0 mm.

The degree of openness of fruits is average, rising to 90% depending on the climatic conditions. The average weight of the kernel is 0.5 g, 52% of the total weight of the kernel.

After grafting, it enters the harvest in 4-5 years. The yield is stable, depending on the climatic conditions (the amount of annual precipitation is of main importance), it yields every year. When planted in an 8x8 m scheme, the yield per 1 ha is 12-14 centner.

It is resistant to fungal diseases and fruit damage, drought and extreme temperature rise in summer. It is recommended to plant in dry lands with medium supply of moisture (annual rainfall is not less than 300 mm)

"Independence" variety. The female tree is a fast-growing and erect, wide and dense branch. The average height of the tree is 4 m, the trunk diameter is 35 cm, the diameter of the branches is up to 4.5 m.

The ripening of fruits is considered mid-term and, depending on the climatic conditions, corresponds to the third day of August and the first ten days of September. 100 seeds weigh 124.8 g, size 20.8x10.9x11.9 mm. The degree of openness of fruits is average, rising to 90% depending on the climatic conditions.

The average weight of the kernel is 0.7 g, 56.5% of the total weight of the kernel. After grafting, it enters the harvest in 4-5 years. The yield is stable, depending on the climatic conditions (the amount of annual precipitation is of main importance), it yields every year. When planted in an 8x8 m scheme, the yield per 1 ha is 12-14 centner.

It is resistant to fungal diseases and fruit damage, drought and extreme temperature rise in summer. Planting in well-drained or irrigated soils is recommended.

"Serkhosil" variety. The female tree - fast-growing and upright, with wide and dense branches. The average height of the tree is 4 m, the trunk diameter is 35 cm, the diameter of the branches is up to 4.5 m.

The ripening of fruits is considered medium-term and, depending on the climatic conditions, corresponds to the first ten days of September. 100 seeds weigh 107 g, size 20.9x10.3x11.9 mm. The degree of openness of fruits is average, rising to 95% depending on the climatic conditions.

The average weight of the kernel is 0.7 g, 61.5% of the total weight of the kernel. After grafting, it enters the harvest in 4-5 years. The yield is stable, depending on the climatic conditions (the amount of annual precipitation is of main importance), it yields every year. When planted in an 8x8 m scheme, the yield per 1 hectare is 15-16 centner.

It is resistant to fungal diseases and fruit damage, drought and extreme temperature rise in summer. Planting in well-drained or irrigated soils is recommended.

"Sitora" variety. The female tree is a slow-growing tree with branches of medium thickness. The average height of the tree is 4 m, the trunk diameter is 35 cm, the diameter of the branches is up to 5 m.

Fruit ripening is considered late and, depending on the climatic conditions, corresponds to the first and second ten days of September. 100 seeds weigh 105.3 g, size 21.3x9.2x11.8 mm.

The degree of openness of fruits is average, rising to 90% depending on the climatic conditions. The average weight of the kernel is 0.5 g, 50% of the total weight of the kernel.

After grafting, it enters the harvest in 4-5 years. The yield is stable, depending on the climatic conditions (the amount of annual precipitation is of main importance), it yields every year. When planted in an 8x8 m scheme, the yield per 1 ha is 16-17 centner.

It is resistant to fungal diseases and fruit damage, drought and extreme temperature rise in summer. Planting in well-drained or irrigated soils is recommended.

"Queen of the Mountain" variety. The female tree is a medium-sized, densely branched tree. The average height of the tree is 3.5 m, the trunk diameter is 30 cm, the diameter of the branches is up to 4 m. The ripening of fruits is very early and, depending on the climatic conditions, corresponds to the second ten days of August. 100 seeds weigh 86.3 g, size 20.4x9.7x11.2 mm.

The degree of openness of fruits is average, rising to 90% depending on the climatic conditions. The average weight of the kernel is 0.4 g, 50% of the total weight of the kernel.

After grafting, it enters the harvest in 4-5 years. The yield is stable, depending on the climatic conditions (the amount of annual precipitation is of main importance), it yields every year. When planted in an 8x8 m scheme, the yield per 1 ha is 10-12 centner.

It is resistant to fungal diseases and fruit damage, drought and extreme temperature rise in summer. It is recommended to plant in dry lands with medium supply of moisture (annual rainfall is not less than 300 mm).

"Uzbekistan" variety. The female tree is medium-sized, its branches are medium-thick and have a crazy shape. The average height of the tree is 3.5 m, the trunk diameter is 30 cm, the diameter of the branches is up to 3.5 m.

The ripening of fruits is considered medium-term and, depending on the climatic conditions, corresponds to the third day of August and the first ten days of September. 100 seeds weight 110 g, size 19.9x11.2x11.4 mm

The degree of openness of fruits is average, rising to 90% depending on the climatic conditions. The average weight of the kernel is 0.7 g, 66.6% of the total weight of the kernel.

After planting the seed, it is harvested 10-12 years. The yield is stable, depending on the climatic conditions (the amount of annual precipitation is of main importance), it yields every year. When planted in an 8x8 m scheme, the yield per 1 ha is 18-20 centner.

It is resistant to fungal diseases and fruit damage, drought and extreme temperature rise in summer. Planting in well-drained or irrigated soils is recommended.

"Pearl of Uzbekistan" variety. The female tree is a fast-growing and erect, wide and dense branch. The average height of the tree is 3.5 m, the trunk diameter is 30 cm, the diameter of the branches reaches 4.5 m.

The ripening of fruits is considered late and, depending on the climatic conditions, corresponds to the second ten days of September. 100 seeds weigh 113.4 g, size 20.5x11.0x11.3 mm.

The degree of openness of fruits is average, depending on the climatic conditions, it rises to 80%. The average weight of the kernel is 0.6 g, 53% of the total weight of the kernel.

After grafting, it enters the harvest in 4-5 years. The yield is stable, depending on the climatic conditions (the amount of annual precipitation is of main importance), it yields every year. When planted in an 8x8 m scheme, the yield per 1 ha is 12-15 centner.

It is resistant to fungal diseases and fruit damage, drought and extreme temperature rise in summer. It is recommended to plant in dry lands with medium supply of moisture (annual rainfall is not less than 300 mm).

"Faravon" variety. The female tree is a medium-sized tree with medium-thick branches. The average height of the tree is 3 m, the trunk diameter is 25 cm, the diameter of the branches is up to 3.5 m.

The ripening of fruits is very early and, depending on the climatic conditions, corresponds to the second ten days of August. 100 seeds weigh 77.4 g, size 17.9x10.0x10.4 mm.

The degree of openness of fruits is average, depending on the climatic conditions, it rises to 80%. The average weight of the kernel is 0.4 g, 51.7% of the total weight of the kernel.

After grafting, it enters the harvest in 4-5 years. The yield is stable, depending on the climatic conditions (the amount of annual precipitation is of main importance), it yields every year. When planted in an 8x8 m scheme, the yield per 1 ha is 10-14 centner.

It is resistant to fungal diseases and fruit damage, drought and extreme temperature rise in summer. It is recommended to plant in dry lands with medium supply of moisture (annual rainfall is not less than 300 mm).

"Farkhod" variety. The pollinator tree is fast-growing and upright, with wide and dense branches. The average height of the tree is 4 m, the trunk diameter is 35 cm, the diameter of the branches is up to 4 m.

Male flowers are elliptic in shape and yellow-brown in color. Compared to other pollinator varieties and forms, it is distinguished by its long and continuous flowering, high quality and large number of pollinators. It begins to bloom 4-5 years after grafting. Regardless of the climatic conditions, flowering is stable and continuous.

It is resistant to fungal diseases and fruit damage, drought and extreme temperature rise in summer. Mixed planting is recommended in dry lands with medium moisture supply (annual rainfall is not less than 300 mm) in the required proportion to seed trees.

This pollinator variety is superior to other pollinator trees in that it has a long flowering period and completely covers the duration of flowering of seed trees.

"Khursandchilik" variety. The female tree is a slow-growing tree with rare craggy branches. The average height of the tree is 3.5 m, the trunk diameter is 25 cm, the diameter of the branches is up to 3 m.

The ripening of fruits is very early and, depending on the climatic conditions, corresponds to the first ten days of August. 100 seeds weigh 75.8 g, size 17.5x11.1x11.6 mm.

The degree of openness of fruits is average, rising to 90% depending on the climatic conditions. The average weight of the kernel is 0.4 g, 53% of the total weight of the kernel. After grafting, it enters the harvest in 4-5 years. The yield is stable, depending on the climatic conditions (the amount of annual precipitation is of main importance), it yields every year. When planted in an 8x8 m scheme, the yield per 1 ha is 10-12 centner.

It is resistant to fungal diseases and fruit damage, drought and extreme temperature rise in summer. It is recommended to plant in dry lands with medium supply of moisture (annual rainfall is not less than 300 mm).

"Chaqmoq" variety. The female tree is a fast-growing and erect, wide and dense branch. The average height of the tree is 4 m, the trunk diameter is 30 cm, the diameter of the branches is up to 4 m.

The ripening of fruits is considered late and, depending on the climatic conditions, corresponds to the second ten days of September. 100 seeds weigh 113.7 g, size 21.3x10.6x12.3 mm.

The degree of openness of fruits is average, rising to 90% depending on the climatic conditions. The average weight of the kernel is 0.7 g, 61.5% of the total weight of the kernel.

After grafting, it enters the harvest in 4-5 years. The yield is stable, depending on the climatic conditions (the amount of annual precipitation is of main importance), it yields every year. When planted in an 8x8 m scheme, the yield per 1 ha is 12-15 centner.

It is resistant to fungal diseases and fruit damage, drought and extreme temperature rise in summer. Planting in well-drained or irrigated soils is recommended.

"Shirin" variety. The female tree is a fast-growing and erect, wide and dense branch. The average height of the tree is 4 m, the trunk diameter is 30 cm, the diameter of the branches is up to 4.5 m.

The ripening of fruits is considered late and, depending on the climatic conditions, corresponds to the second ten days of September. 100 seeds weigh 121.4 g, size 20.3x9.3x10.3 mm.

The degree of openness of fruits is average, depending on the climatic conditions, it rises to 70-80%. The average weight of the kernel is 0.7 g, 58% of the total weight of the kernel.

After grafting, it enters the harvest in 4-5 years. The yield is stable, depending on the climatic conditions (the amount of annual precipitation is of main importance), it yields every year. When planted in an 8x8 m scheme, the yield per 1 ha is 15-18 centner.

It is resistant to fungal diseases and fruit damage, drought and extreme temperature rise in summer. Planting in well-drained or irrigated soils is recommended.

Table 2

Evaluation method of pistachios according to Turkish standards

No.	Varieties	Gramm	Piece
1.	1	100	90 pieces and less
2.	2	100	91-100
3.	3	100	101-120
4.	4	100	More than 121

Several methods have been developed to evaluate the quality indicators of pistachios. Today, pistachio-growing countries are evaluated based on their own developed methods. For example, in Turkey, the size of the pistachio nuts is taken as a quality sign (Table 2), if the nuts are 90 or less per 100 g - 1 variety, 90-100 per 100 g - 2 varieties, 100-120 per 100 g in - 3 varieties, if 120 and more - 4 varieties [Tekin H., Akkok F., 1994].

According to Turkish standards, it was determined that “Bobotog”, “Mustaqillik”, “Pearl of Uzbekistan”, “Chaqmoq” and “Shirin” varieties correspond to the 1st grade, “Serkhosil”, “Sitara”, “Uzbekistan” - the 2nd grade, “Gallaorol”, “Queen of the Mountain” - the 3rd grade, “Farovan”, “Khursandchilik” - the 4th grade.

Table 3

Assessment of local pistachio varieties of Uzbekistan according to Turkish standards

No.	Varieties	Weight of 100 fruits, g	Number of fruits in 100 g, pcs	Quality grades
1.	Bobotog	115,9	86	1
2.	Gallaorol	96,2	104	3
3.	Independence	124,8	80	1
4.	Serkhosil	107,5	93	2
5.	Sitara	105,3	95	2
6.	Queen of the Mountain	86,3	116	3
7.	Uzbekistan	110,0	91	2
8.	Pearl of Uzbekistan	113,4	88	1
9.	Faravon	77,4	129	4
10.	Farkhod	-	-	-
11.	Khursandchilik	75,8	132	4
12.	Chaqmoq	113,7	88	1
13.	Shirin	121,4	82	1

4. Conclusions

The Uzbek varieties of pistachios were divided into different groups according to the size of the fruit, the weight of 100 pieces of fruit, and the number of fruits per 100 g. The highest rate was observed in the varieties "Independence" and "Shirin" (grade 1), and the lowest rate was recorded in "Farovon" and "Khursandchilik" (grade 4). According to the results of this evaluation, it is possible to recommend the 1-2 quality pistachio varieties for use in plantation establishment.

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