Efficiency of choosing promising walnut forms in the case of Uzbekistan

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Abstract. Walnut (Juglans regia L) is one of the most important tree species in Uzbekistan. Natural walnuts have a valuable gene pool, among which there are many forms with different bioecological properties. In particular, biodiversity in terms of kernel quality is highly variable within the species. This article provides information on the analysis of quality indicators of walnut kernels in natural and local nuts. Among the indicators of kernel quality in the selected forms, the yield of walnut kernels was of high importance as the main indicator, and in the selected forms this indicator was 38.2-63.3. According to international indicators, Parkent-2, Boysun-1 and Humson-5 forms are recommended for wide use, given that the form with a yield rate of more than 50% is promising.

1. Introduction

Record global walnut production and trade are forecast. Production continues to expand to 2.3 million tons in-shell basis, with China and the United States accounting for over 75 percent of total output. World exports, dominated by the United States, are expected to rise 14 percent to 946,000 tons. World ending stocks are forecast 20 percent higher to a record 140,000 tons on a sharp buildup in the United States [1, 2].

In order to adequately supply the population with the kernels of walnuts, it is necessary to establish plantations of their valuable varieties and forms, it would be expedient to use modern agricultural techniques. The local population is engaged in the isolation of their valuable economic forms in natural walnut or chards, which are characterized by high quality and high yield of kernels of these forms. The construction of industrial plantations of walnut began in 1970 to preserve existing walnut groves, promote their restoration, establish walnut culture forests on mountain slopes, create new large and fertile forms and varieties of walnuts [2, 3, 4]. The merits of such scientists as S.Kalmykov [5], U. Kholdorov [6] are exceptionally considerable.

Walnut has a long history of cultivation and use and the country considered as one of the main walnut origin and distribution centers in the world. So, it is possible to find some walnut trees with more than 1000-years old in the traditional orchards [7]. The walnut orchards could classify into the traditional and new orchards. In traditional orchards, walnut is usually cultivated on the borders of other fruit tree orchards [8]. In recent years, new walnut orchards have been established using foreign (‘Chandler’ and ‘Fernor’) and Iranian commercial cultivars and superior genotypes [9, 10].

In Uzbekistan and on the border of South Kazakhstan, walnut forests are located in small areas on the western edge of the Tien Shan, mainly at an altitude of 750-1250 m above sea level, on the slopes and oases of the Pskom and Ugam mountain ranges. Sometimes individual trees grow even at altitudes
of 1700 m. The largest forest of walnut forests is in the basin of the Pskom River. Natural coconut groves can be found in the basins of the Aksakata, Nurakota, Topalangdarya and Obizarang rivers [1, 6].

Natural walnut forests in Central Asia perform major reclamation functions in the mountains, such as storing and regulating water, soaking the soil from leaching. Walnut trees growing on mountain slopes hold the soil firmly with their well-branched root system. Especially in the Fergana mountain range and Osh, Jalal-Abad (Kyrgyzstan) walnut orchards are of great scientific importance, and their forest reclamation significance is great. It is no exaggeration to call them regulators that conserve and regulate the water sources that irrigate the eastern part of the Fergana Valley [4, 9, 10].

Scientists of the Central Asian Forestry Research Institute have created such varieties as Durmon-1, Durmon-2, Tashkent-2, Tashkent-3, Ideal. The kernels of these varieties are full of essence and taste. In the natural dendroflora of Central Asia, walnut ranks 2nd after maple in terms of size and longevity. In nature, specimens with a projection of 900 m² have been recorded [3, 5].

VS Shevchenko [5] isolated more than 220 forms of walnut, 6 of which (Ak-Tereksky, Gavinsky, Sladkiy, Osh, Ostrovershinsky, Uyghur) were accepted for state testing.

Scientists from the Forestry Research Institute have developed basic criteria for selecting valuable forms of walnut. According to him, when choosing fertile forms, their branches should be round, the diameter is approximately equal to the height, the branches are thick, the leaves are not damaged, there is no rot on the body. It is stated that the crop should be present not only in the three parts of the branches, but also in the side branches [8].

2. Materials and Methods
The main part of natural coconut forests in the territory of the Republic is located in the Western Tien Shan region, and by studying the existing trees in these areas, it will be possible to select forms with different bioecological characteristics. The research was conducted in 2018-2019 in Tashkent, Jizzakh and Surkhandarya provinces of the Republic on the basis of route monitoring. Laboratory experiments on the analysis of kernel quality indicators of the selected forms were conducted at the Department of Forestry of Tashkent State Agrarian University.

Selection evaluation of walnut forms was carried out in accordance with the method "Program and methods of sorting of fruit, berry and orexoplodnykh cultures" developed in 1973 [9].

2.1 Determination of walnut dimensions
To determine the size of the walnut kernel, the selected shape nuts were carried out under laboratory conditions. In this case, the kernel in the selected shapes was evaluated on a 5-point (5 is the lowest) scale based on the length, ring and side diameters. Experimental work was carried out on 100 kernel indicators obtained from each form (Table 1).

| # | Length | Diameter | Points |
|---|--------|----------|--------|
| 1 | 41.1 > | 34.1 > | 5 |
| 2 | 38.1-41.0 | 32.1-34.0 | 4 |
| 3 | 35.1-38.0 | 30.1-32.0 | 3 |
| 4 | 32.1-35.0 | 28.1-30.0 | 2 |
| 5 | 32.0 < | 28.0 < | 1 |

2.2 Determination of walnut kernel weight
The selected forms of walnuts were weighed using the method of weighing the weight of 1 walnut and the level of kernel yield after determining the kernel size. Based on the results obtained, the selected forms were evaluated on a 5-point scale (Table 2).
Table 2. Kernel weight and core yield rating scale

| Groups          | Weight of 1 walnut, g | Points | Groups          | Core output, % | Points |
|-----------------|-----------------------|--------|-----------------|----------------|--------|
| Extra small     | 6.1-8.0               | 1      | Extra large core| 56.0 <         | 5      |
| Small           | 8.1-10.0              | 2      | Large core      | 53.1-56.0      | 4      |
| Medium          | 10.1-12.0             | 3      | Medium core     | 49.1-53.0      | 3      |
| Large           | 12.1-14.0             | 4      | Small core      | 45.1-49.0      | 2      |
| Extra large     | 14.1 <                | 5      | Extra small core| 45.1 >         | 1      |

Based on the results obtained, it can be recommended to produce forms with a score of 4 and 5 on the core output index as a promising form.

3. Results and Discussion
Walnut is naturally widespread in the Central Asian republics and has already been cultivated by the local population. In the natural and cultivated forests of the walnut, walnuts have formed different shapes according to the shape and size of the kernel. Therefore, they play an important role in the production of varieties, choosing valuable forms as a huge selection area. For this reason, the walnut gene pool has been the subject of research for many years. At the Uzbek Research Institute of Forestry, many forms have been selected and studied. [2].

The selection of promising forms was carried out on the selected forms from the existing coconut groves in Bostanlyk, Parkent, Kibray, Ahangaron, Boysun districts of Tashkent province, Surkhandarya province, as well as Jizzakh province. When analyzing the kernel sizes of the selected forms, it was found that their length ranged from 2.9 ± 0.04 cm to 4.0 ± 0.22 cm, and the indicators of the forms collected from Jizzakh province were high (3.5 ± 0.09 – 4.0 ± 0.22 cm). In the samples selected from Tashkent province, this figure ranged from 2.9 ± 0.004 to 3.7 ± 0.08 cm. The figure in the form selected from the territory of Surkhandarya province was 3.5 ± 0.04 cm (Table 3).

Figure 1. Weight indicators of promising forms of walnut
Table 3. Results of selection of promising forms of walnut

| #   | Walnut shapes         | The length of the nut (cm) | Walnut diameter, (cm) | Walnut weight, (g) | Weight of walnut kernels, (g) | Core output rate, (%) |
|-----|-----------------------|----------------------------|-----------------------|--------------------|-------------------------------|-----------------------|
| 1   | Parkent -3            | 2.9±0.04                   | 2.9±0.05              | 7.8±0.29           | 4.1±0.15                      | 51.6±0.59             |
| 2   | Boysun –1             | 3.5±0.04                   | 3.4±0.04              | 17.0±0.47          | 10.4±0.15                     | 61.6±2.04             |
| 3   | Gazalkent –1          | 3.1±0.07                   | 2.9±0.04              | 9.4±0.15           | 5.1±0.09                      | 54.9±0.79             |
| 4   | Gazalkent –2          | 3.3±0.07                   | 3.0±0.08              | 12.1±1.3           | 4.8±0.45                      | 39.8±1.84             |
| 5   | Gazalkent –3          | 3.4±0.05                   | 3.2±0.23              | 14.1±0.71          | 6.1±0.50                      | 43.3±1.72             |
| 6   | Sijjak –1             | 3.4±0.09                   | 3.6±0.03              | 16.3±0.53          | 6.2±0.28                      | 38.2±0.58             |
| 7   | Humson –1             | 3.4±0.12                   | 2.9±0.02              | 9.7±0.50           | 5.1±0.42                      | 51.9±2.75             |
| 8   | Humson –2             | 3.5±0.06                   | 3.0±0.03              | 9.4±0.15           | 4.7±0.36                      | 50.6±4.33             |
| 9   | Humson –3             | 3.7±0.08                   | 3.1±0.09              | 12.3±1.24          | 5.5±0.47                      | 45.4±1.35             |
| 10  | Humson –4             | 3.1±0.10                   | 3.0±0.09              | 9.6±0.64           | 4.7±0.37                      | 49.2±1.27             |
| 11  | Humson –5             | 3.2±0.10                   | 3.0±0.07              | 8.3±0.44           | 4.8±0.29                      | 58.0±1.40             |
| 12  | Parkent –1            | 3.7±0.05                   | 3.1±0.07              | 11.8±0.44          | 5.8±0.11                      | 47.6±1.28             |
| 13  | Parkent –2            | 3.5±0.09                   | 3.1±0.04              | 8.8±0.78           | 6.3±0.02                      | 63.3±1.53             |
| 14  | Jizzakh –1            | 3.7±0.13                   | 2.9±0.02              | 12.3±0.38          | 4.7±0.09                      | 38.7±0.27             |
| 15  | Jizzakh –2            | 3.7±0.04                   | 3.5±0.12              | 15.2±0.35          | 7.8±0.14                      | 51.2±1.57             |
| 16  | Jizzakh –3            | 4.0±0.22                   | 3.0±0.12              | 13.0±1.38          | 5.5±0.05                      | 43.6±4.77             |
| 17  | Jizzakh –4            | 3.5±0.10                   | 3.1±0.08              | 12.8±0.80          | 4.7±0.08                      | 35.1±0.69             |
| 18  | Kibray –1             | 3.7±0.07                   | 3.3±0.09              | 12.1±0.63          | 6.1±0.17                      | 47.5±1.36             |
| 19  | Kibray –2             | 3.4±0.11                   | 2.9±0.14              | 11.3±0.40          | 4.9±0.06                      | 44.0±0.94             |
| 20  | Ahangaron –1          | 3.2±0.07                   | 3.1±0.06              | 10.9±0.56          | 4.8±0.05                      | 41.3±0.27             |
When analyzing the kernel weight of the selected forms, Boysun-1, Gazalkent-3, Sijjak-1 and Jizzakh-2 forms had a higher value than other forms (kernel weight 14.1 ± 0.71 - 17.0 ± 0.47 grams each). Their kernel weight was found to be 1.4–2.09 times higher than other selected forms. The selected Humson-2, Humson-5 and Parkent-2 forms had the lowest kernel weight, i.e., 7.8 ± 0.20 - 9.4 ± 0.15 grams. This indicates that their selection score is 2 points. This shows that the biodiversity of nuts in the Tashkent oasis is high (Figure 1).

Due to the high biodiversity of nuts, it is necessary to study them, to select promising forms. One of the main indicators in the selection of nut forms is the degree of yield of walnut kernels. In terms of the yield of walnut kernels, it is very important to choose forms with an index higher than 56.0% (Figure 2).

When analyzing the selected forms, the indicators in the selected shawls from the Tashkent oasis and Surkhandarya province ranged from 58.0% to 63.3%.

![Figure 2](image)

**Figure 2.** Kernel yield indicators of promising forms of walnut

At the same time, 61.6 ± 2.04 in the selected forms from Surkhandarya province in the form of Boysun-1, 58.0 ± 1.40 and 63.3 ± 1.53 in the forms of Humson-5 and Parkent-2 growing in the Tashkent oasis. was equal. This makes it possible to study these forms (Boysun-1, Humson-5, and Parkent-2) as promising forms due to their high brain output levels (56.0 and above) (Figure 2).

These figures are compared with the varieties Sadko, Yakisnyy-1, Porig, Suzirya, Petyrya and Shukhevich grown in Ukraine [12] (kernel length 35 mm, average diameter 30 mm), kernel length of Boysun-1, Parkent-2 and Humson-5 forms and we can see that the average diameter is affirmative. In terms of core yield, which is 49% of varieties in Ukraine, these forms (Boysun-1, Humson-5 and Parkent-2) can be studied as a promising form due to the high core yield (56.0 and above).

4. Conclusions

Biodiversity is very high in the natural walnut forests of the country, and it is very important to choose the most valuable forms. As with other species, the selection of promising forms of walnut required an assessment of the yield of walnut kernels. The study selected Boysun-1 (61.6 ± 2.04) from Surkhandarya province, as well as Humson-5 (58.0 ± 1, from the Tashkent oasis). 40) and Parkent-2
(63.3 ± 1.53), which have a score of 5 (56.0% and above), so they can be recommended as a promising form.

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