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## BIOLOGICAL BASIS OF HIGH PRODUCTIVITY OF POMEGRANATE PLANT

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## БИОЛОГИЧЕСКИЕ ОСНОВЫ ВЫСОКОЙ ПРОДУКТИВНОСТИ ГРАНАТА

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*Abstract.* *Punica granatum* L. is propagated by seeds and cuttings. Propagation of the plant by cuttings is preferred. The main goal of our experiment is to monitor the process of biological development during the reproduction of pomegranate varieties with cuttings and to compare and reproduce the better developing pomegranate varieties. We conclude from the research that pomegranate grows in any soil. But a better developed root system, high productivity occurs in bushes grown in moist and fertile soils. Also, after transplanting young plants (one-year and two-year) to the open air, watering and cultivation of the plant should be done seriously. For this, more attention should be paid to soil plowing, weeding, and agrotechnical rules in the first 3 months.

*Аннотация.* Гранат (*Punica granatum* L.) размножается семенами и черенками. Предпочтительно размножение растения черенками. Основная цель исследования — проследить процесс биологического развития при размножении различных сортов граната черенками и определить лучшие сорта граната для этого типа развития. Согласно результатам исследования делаем вывод, что гранат растет на любой почве. Но лучше развитая корневая система, высокая продуктивность наблюдается у кустов, выращенных на влажных и плодородных почвах. Также после пересадки молодых растений (однолетних и двухлетних) на открытый воздух следует тщательно следить за поливом и уходом. Рекомендуется вспашка почвы, прополка и другие агротехнические приемы в первые 3 месяца развития растений.

*Keywords:* cuttings, young leaves, species, phytoalexins, flavonoids, tannins.

*Ключевые слова:* черенки, молодые листья, виды, фитоалексины, флавоноиды, таннины.

A highly medicinal, technical, decorative, vitamin-rich plant called pomegranate grows in the very rich and fertile lands of Azerbaijan. The fruits of the plant are very rich in chemical composition. Fruit consists of 25-51% peel, 35-75% juice, and 5-20% seeds. Sour and sweet varieties of pomegranate are widespread in the regions of our republic. More than 500 varieties of pomegranate are known on Earth, and about 60 are spread in different countries of the world. Azerbaijan also ranks first in terms of variety and quantity of pomegranate varieties. Pomegranate is

a plant adapted to a dry subtropical climate. There are widely distributed varieties of pomegranate in Azerbaijan, such as Guloysha, Bala Mursal, Thin peel, Sour peel, Sour pomegranate, Velas and Irigila. Its fruits are of a great importance as they have a high chemical content. Pomegranate is also very rich in microelements. It is rich in 5-10% glucose, 10-12% lemon, malic acid, 14% Vitamin C, Vitamin B, PP, tannin, minerals (Ca, Mg, Co, C), phytoncides and flavonoids. The antioxidant property in the plant more valuable. Pomegranate is also very important for human health from a medical point of view. The bark, fruit and young leaves of the plant are widely used in oral diseases, in the regulation of digestive system work, as an appetite enhancer, in headaches and gastrointestinal disturbances. The flowers and fruits of the plant have high dyeing ability. In the research work, the process of growing the plant of biological basis and the process of root development on different species was carried out, and the species that quickly adopt to the climate and soil fertility were discovered.

Pomegranate (*Punica granatum* L.) is a plant cultivated and used in Azerbaijan since ancient times. Pomegranate cultivated in our republic is distinguished by its quality. The fact that the pomegranate plant is less demanding on soil fertility, high vitamin content, richness in trace elements, has increased the demand and interest in the plant in the last 25-30 years [1].

The juice of a cultivated pomegranate fruit contains 3-5% citric acid, while wild-grown pomegranate contains 6-10% citric acid. In addition to sugar, citric acid, pomegranate fruit is rich in vitamins, dyes, macro and micronutrients. Depending on the type and variety of pomegranate, its fruits are sour and sweet. It is the citric acid in the juice that gives pomegranate sour taste.

Pomegranate grain contains 35.02% water, 1.55% ash, 6.53% fat, 12.64% starch, 34% fiber and 10% nitrogenous substances. Pomegranate juice also has high antioxidant properties. There is 34% vaccine content in the fruit bark, root and root bark of the plant. The bark has been used for treatment since ancient times due to its anthelmintic properties. It is of great importance in gum diseases, women's diseases, inflammatory processes [6].

#### *Experimental part*

The ecological characteristics of the pomegranate plant are based on long-term development. The pomegranate plant belongs to the Punicaceae family. *P. granatum* L. is a cultivated and decorative species. Currently, in Azerbaijan, the pomegranate bush spends the winter at minus 12-16° C in open air conditions. Perennial branches turn at minus 17-18° C. One-year pomegranate tree freezes at minus 15-16° C, and perennial branches freeze at minus 19-20° C. In young plants, due to the effect of frost (in the first autumn frost), the vegetation of the plant stops. Taking into account these characteristics, we placed the seeds that we separated for the purpose of breeding in trenches under closed conditions. Even when the overwintering pomegranate bush is transplanted to the open field, it is less tolerant than plants that winter in the open field. This condition of the plant depends on the condition of the cells and tissues, the temperature and humidity of the environment where the plant lives. Pomegranate plant grows in soils of different composition — sandy, heavy clay, moist and fertile soils [5].

As we know, the pomegranate plant is propagated by cuttings from one-year young shoots. In order for the root system to develop well, it is necessary to have various factors: soil fertility, crop size, planting period, etc. Sometime after the seedlings are planted, roots develop from the lower leaf node. Most of the developed root's bend and go into the deeper layers of the soil. We observe the first noticeable branching from the more curved part of the roots. As a result, relatively large roots formed in well-developed annual plants acquire an umbrella-like structure.

When we observe annual cuttings, we see that the roots formed in the horizontal direction are

mostly straight and thin. Relatively well-developed large roots are directed towards other cuttings nearby. When there is 30-40 cm between rows and 15-20 cm between plants, the root system of one-year cuttings in the transeria is directed towards other neighboring cuttings.

Most of the root system of the pomegranate bush has a very branched and blunt structure. Annual plants can grow up to 90-110 cm in length if well cared for. The main part of the developed root goes 10-30 cm into the soil. Small roots emerge from the developed large roots [2, 3].

When we examine the results of the research conducted in the first year of planting, we observe that the root system is formed in the part where the cutting is placed — in the more nutritious and fertile part of the soil. If we look at the development of cuttings in the first period, we see that in the first year, 5-8 roots with a diameter of 4-5 mm are formed in cuttings. Lateral roots emerge from these roots. When we examine the distance where the root system spreads, we see that it is located at a distance of 5-30 cm from the crown of the pomegranate bush.

Table 1

NUMBER AND LENGTH OF BRANCHES  
 IN DIFFERENT SPECIES OF POMEGRANATE PLANT

Variety	A group of young branches	The number of branches by zones			The length of the branches by zones		
		I	II	III	I	II	III
1 Bala-Mursel	Large	3.7	4.9	0.1	17.1	19.7	0.6
	Medium	12.5	30.4	6.1	12.4	31.7	6.1
	Small	8.2	18.7	4.1	3.2	3.2	1.4
2 Shah pomegranate	Large	4.1	8.2	0.2	20.7	24.9	0.6
	Medium	12.1	42.3	5.8	29.3	30.3	4.5
	Small	5.2	14.3	1.7	3.6	3.7	0.3
3 Red bark	Large	4,6	23.7	—	28.3	17.3	—
	Medium	12.5	35.3	3.7	12.4	31.1	2.6
	Small	8.6	21.7	3.4	2.3	5.3	0.2
4 Guloyshе	Large	3.4	4.3	1.3	25.7	16.1	0.9
	Medium	14.5	38.1	4.2	14.1	30.7	3.1
	Small	9.7	19.6	3.4	2.1	4.1	0.5
5 Sweet pomegranate	Large	3.1	3.9	2.5	21.3	18.3	—
	Medium	12.7	32.1	4.7	11.5	12.4	—
	Small	7.2	20.2	1.8	1.6	3.7	0.2

From our research and observations, it is known that the growth of cuttings is different in 5 varieties of pomegranate plant. So, by making daily and weekly observations, we recorded the branching, age, and length of the branch. A young pomegranate bush has the ability to form a branch. One-year-old branches of the pomegranate bush develop mainly from the top and middle shoots, while branches that are more than one year old develop from the middle and lower shoots. Annual branches develop from 35% tip shoots. From branches older than one year, 4-5% of new branches are formed. With the increase in age, there is a weakening in the increase in the number of branches [2].

In connection with the development of the branches, thorns are formed at the ends of the branches. The thorn-like parts (up to 3-5 cm) at the ends of the branches develop and branch throughout the year. Culms formed from thorns grow up to 10-30 cm. The shape of a pomegranate bush depends on the amount of branches formed. The more thorns branches formed on the plant, the larger the size of the bush [4].

According to their morphological characteristics and biological characteristics, we divide the branches formed on the pomegranate bush into 3 groups:

1. Large branch — 1 m in size and relatively large, develop until autumn.

2. Medium — length branches are up to 10-40 cm, sometimes forming 5-8 cm branches. Development and length of branches occur until the mass flowering of the bush. Branches that produce flowers develop in this part of the bush.

3. Small branch — no more than 10 cm in length. (The branches smaller than 3 cm form a thorn at the tip)

In our research on different varieties of the pomegranate bush, it is known that bushes are formed that do not have the same structure. A year after planting, the cuttings begin to form a bush. Columns of the pomegranate bush develop from the treated branches. The branches formed in the first row (3-5 branches) form the base of the bush at a height of 30-40 cm. The base of the structure of the bush is well branched, and the formation of the bush continues as the period of fruit formation. Pomegranate young bushes have the ability to form a strong branch, which lasts as long as the fruit is formed.

### Result

Research shows that pomegranate (*Punica granatum* L.) is propagated by seeds and cuttings. Propagation of the plant by cuttings is preferred. The main goal of our experiment is to monitor the process of biological development during the reproduction of pomegranate varieties with cuttings and to compare and reproduce the better developing pomegranate varieties (Table 2). We conclude from the research that pomegranate grows in any soil. But a better developed root system, high productivity occurs in bushes grown in moist and fertile soils. Also, after transplanting young plants (one-year and two-year) to the open air, watering and cultivation of the plant should be done seriously. For this, more attention should be paid to soil plowing, weeding, and agrotechnical rules in the first 3 months.

Table 2

VARIETY DEVELOPMENT DATA

Variety	The amount of the branches		The length of the branches	
	main	branched	main	branched
1 Bala mursel	4	2	47.3	31
2 Shah pomegranate	5	3	51.2	34
3 Red bark	2	—	38	—
4 Guloyshе	3	1	42	29
5 Sweet pomegranate	2	—	46	—

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