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SEED FORGIVENESS OF SOME SPECIES OF THE FAMILY LAMIACEAE INTRODUCED IN TASHKENT BOTANICAL GARDEN

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Abstract: The effects of temperature on seed germination, seed germination energy, and seed yield at different times were studied in the laboratory under 5 species (Origanum vulgare L., Lophanthus anisatus Benth., Hyssopus officinalis L., Lavandula officinalis Chaix., Salvia officinalis L.) belonging to the Lamiaceae family. It was also found that the seeds were lower in field conditions than the germination of seeds sown in autumn and spring. Therefore, it is recommended to sow the seeds of the studied species in the spring in the Uzbekistan climatic conditions.

Keywords: Origanum vulgare, Lophanthus anisatus, Hyssopus officinalis, Lavandula officinalis, Salvia officinalis, seed,seed germination, germination energy.

INTRODUCTION

Today, the world's demand for herbal medicines is growing, and medicinal plants are widely used in medicine. Biologically active substances and extracts from plants are very popular in developed countries such as Japan, France, Germany and Italy. In many developing Asian countries, herbal medicines are important. There is a great need to cultivate many types of essential oil-preserving, spicy, delicious medicinal plants. This makes it necessary to create plantations of medicinal plants and produce raw materials on an industrial scale (Abramchuk et al., 2018).

Today, essential oil plants such as Origanum vulgare, Lophanthus anisatus, Hyssopus officinalis,Lavandula officinalis, Salvia officinalis, Rosmarinus officinalis, Lagochillus inebrians, Melissa officinalis, Mentha arvensis, Nepeta cataria, Stachys betonicaeflora, Thymus serpyllum are a valuable medicinal plant and are grown as a cultivated plant in the CIS countries (Murdakhaev, 1990; Moskvina, 2005; Kalinichenko, 2013).

The turikish scientists were investigated 24 compounds and essential oils of the aerial part of Hyssopus officinalis and Origanum acutidens (Figueredo et al., 2013); In Marocco, the Salvia officinalis were found33 та compounds and investigated essential oil (Bouajaj et al., 2013).

Russian scientists have studied the biological properties of the plant Hyssopus officinalis, its nutritional and medicinal value, agronomic techniques and ways of cultivation (Bespalykoet al., 2016); the pharmaceutical properties of Salvia officinalis, which play an important role in improving health, have been identified (Lemle K.L., 2018).

Essential oils derived from these plants in medicine - have analgesic, analgesic or sedative properties, increase gastrointestinal function, bactericidal properties. Essential oils are also widely used in industry, as a solvent in the production of perfumes, soaps, toothpastes, confectionery, food essences, tobacco flavoring, varnishes and paints.Essential oils are also used in other industries and differ from vegetable oils in their chemical composition, volatility and aroma (Khojimatov, Ollayorov, 1988; Moskvina, 2005; Kalinichenko, 2013).

In the cultivation of plants, the goal is achieved only when the technological methods of cultivation are applied, taking into account the climatic conditions of the soil and its biological properties.One of the main criteria for assessing the biological properties of medicinal plants under the conditions of introduction is the study of seed germination properties.

The aim of the study was to study the seed germination of medicinal, essential oil Origanum vulgare, Lophanthus anisatus, Hyssopus officinalis, Lavandula officinalis, Salvia officinalis in laboratory and field conditions, as well as to determine the effect of temperature on seeds stored at different times and sowing time.The research was conducted in 2018-2020 in the laboratory of medicinal plants of the Tashkent Botanical Garden named after acad. Rusanov under the Institute of Botany of the Academy of Sciences of Uzbekistan.The climatic conditions of the Botanical garden are moderate, the average temperature is 27-29 °C in July, -0.2-10.0 °C in January, the annual rainfallis 351-578 mm.

OBJECT AND METHOD OF RESEARCH

The essential oilsof plants Origanum vulgare, Lophanthus anisatus, Hyssopus officinalis, Lavandula officinalis, Salvia officinalis introduced in Uzbekistan.

In morphological characterization of seeds the generally accepted criteria in botany were used (Artyushenko, 1990). The collected seeds were stored in a dry place at room temperature for various periods.Seed germination was determined in the laboratory at a temperature of 20ºC to 25ºC for 18-20 days, and seed germination and germination energy were carried out in accordance with the international state standard (GOST 30556-98, 2004). Seeding was carried out 4 times in a Petri dish in a light place at a temperature of 20–25 °C. Statistical processing of the obtained data used generally accepted mathematical processing methods (Zaytsev, 1984; Kalinichenko, 2013).

Seed germination in field conditions was determined in spring (February, March, April) and autumn (September, October, November). Seeds were sown in a soil mixture prepared as 1x1x1 (one part soil, one part sand, one part biogumus) to a depth of 0.5-1.0 cm in 3 repetitions.

Origanum vulgare is a perennial valuable medicinal herb, 60-80 cm in height.Homeland - the mountainous regions of Central Asia and East Kazakhstan and Kyrgyzstan, the European part of the CIS, the Caucasus, Siberia, Baikal, the Far East (Akopov, 1977).It grows in dry open meadows, dry forests and forest edges, on hills, slopes, rocks and bushes.The plant has long had medicinal properties and is used as an appetite suppressant, a drug that improves digestion. It also has antimicrobial properties in improving gastrointestinal function, anti-inflammatory, pain relieving.In addition, it is a expectorant, and essential oil is used to relieve toothache (Kholmatov, Habibov, 1967).

It was found that the plant aerial part contains 1.2% of essential oil (Khojimatov, Kobets, 1988).

Origanum vulgare

Lophanthus anisatus

Hyssopus officinalis

Lavandula officinalis

Salvia officinalis

Fig. 1. General view of the studied plants.

Lophanthus anisatus is a perennial herb, 70-100 cm in height. This genus plants is found in Western and Eastern Siberia, Central Asia, and the Far East. In recent years, it has spread to southern European countries. It is propagated in the southern part of the United States and Russia. Grows naturally in North and Central America. Normalizes the metabolic process in the human body. The plant is used in the treatment of many diseases - atherosclerosis, angina, prostatitis, lowering blood pressure, pneumonia, gastritis, liver. In addition, the plant slows down the aging process in the body, increases immunity, eliminates nervousness and physical fatigue, increases performance (Kozak, 2013).

Hyssopus officinalis - perennial herb or subshrub, 20-50 cm in height. According to Borisova (1954), the plant area is adapted from the Iberian Peninsula to the Himalayas, from the southern regions of Norway to the northern coasts of Africa (Tunisia, Morocco, Algeria), to the mountainous regions of the tropics and temperate countries. Distributed in the European part of the CIS, Crimea, Caucasus, Central Asia and Altai. In chest pain, cough, bronchitis, bronchial asthma, as a wound healing agent, it is used in folk medicine in the treatment of gastrointestinal diseases.

Lavandula officinalis - perennial, evergreen subshrub, 30–60 cm in height. Distributed in the southern part of Europe, on the sunny slopes of the Western Mediterranean. It is grown in the Crimea, the North Caucasus, Moldova and the Central Asian republics. The plant is a diuretic, improves the

functioning of the nervous system. In folk medicine, the oil of the plant with a mixture of alcohol is used in headaches, neurosis. It is also used in the perfumery industry from the essential oil - in the manufacture of perfumes and soaps. In pharmaceutics, it is used to improve the odor of ointments and other drugs applied to the surface (Matsku, Kreycha, 1970).

Salvia officinalis is a perennial subshrub, reaching a height of 20-50 cm. Homeland Mediterranean countries. It is not found in the wild in the CIS countries. It is grown in the Republics of Moldova, Ukraine, Krasnodar Krai and Crimea. Preparations of the plant leaf are used as a laxative, disinfectant and anti-inflammatory, hemostatic, anti-inflammatory, antihypertensive, sedative for the central nervous system, for mouth and throat gargling in diseases of the upper respiratory tract (Kholmatov, Habibov, 1967; Akopov, 1977).

RESULTS

Data on seed germination of medicinal plants can be found in the works of L.A. Moskvina(2005), L.V. Kalinichenko(2013), N.I Gordeeva(2015).According to Yu.N.Kurkina, O.G.Pshenichnaya (2011), when seeds are stratified or soaked for several hours in solutions that affect seed germination, an increase in germination rate and germination is noted.The germination energy of seeds depends on mechanical, physical and chemical effects on the seed coat. These effects allow water to pass into the dormant seed pod and allow it to grow (Glukhovtsev et al., 2006).

In the laboratory, germination rate and germination energy of Origanum vulgare, Lophanthus anisatus, Hyssopus officinalis, Lavandula officinalis, Salvia officinalis seeds were observed at a temperature of 20-25 ° C (Table 1).

Origanum vulgare seeds are small, dark brown in color. according to the literature, the weight of 1000 seeds is 0.049-0.051 g, seed germination is 49-56% (Gordeeva, 2015).In the laboratory, seed germination was observed after 5 days. The low germination rate and germination energy of the seeds and the germination rate were 36% and the germination energy was 22%.

The fruit of Lophanthus anisatus is a smooth, dark brown nut. According to the literature, the weight of 1000 seeds is 1.2 g (Abramchuk et al., 2014). According to our data, it is 1.0-1.35 g (Fig. 2).

In the laboratory, the germination of seeds was 56%, and their germination began on the 5th day. On days 7-8-9, mass germination was found, with seed germination energy equal to 40%. The seeds do not lose their germination for 2–3 years.

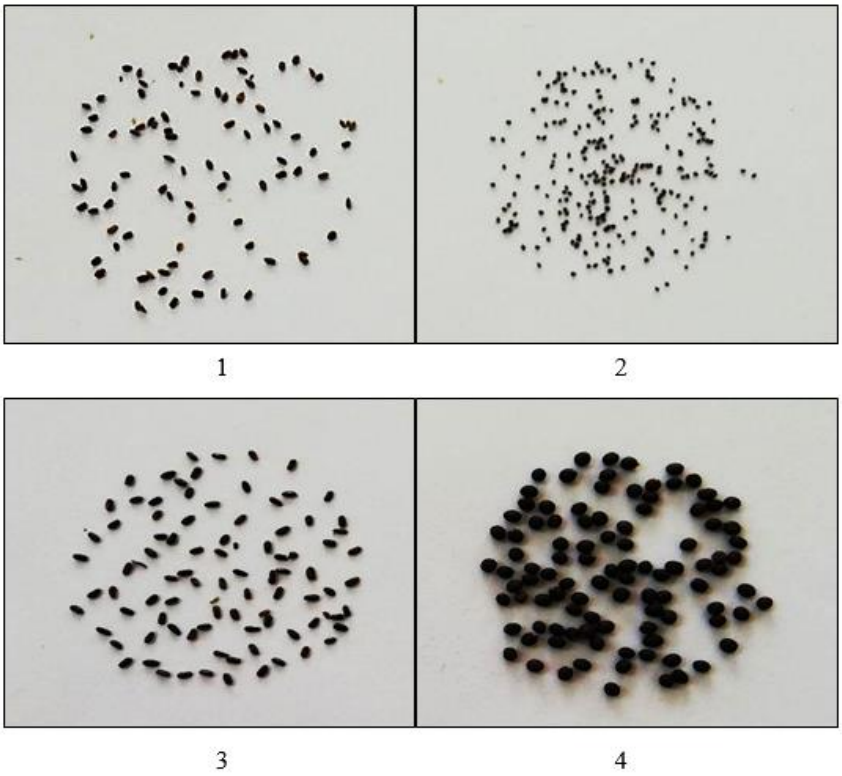

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Figure 2. Appearance of seeds.
(1 – Lophanthus anissatus; 2 – Origanum vulgare; 3 – Lavandula officinalis; 4 - Salvia officinalis; 5 – Hyssopus officinalis).

Table 1.
Germination of seeds under laboratory conditions (20-25 °C), 2018 y.

Plant name	Seed germination rate (days from sowing to germination), days.								Total germinated seeds, %	Seed germination energy, %
	3	5	7	9	11	13	15	17		
Origanum vulgare	-	4	10	12	10	-	-	-	36	22
Lophanthus anissatus	-	3	18	22	7	2	3	1	56	40
Hyssopus officinalis	-	4	31	23	-	3	1	-	62	54
Lavandula officinalis	-	2	5	13	18	12	10	5	65	31
Salvia officinalis	5	60	28	-	-	-	-	-	93	88

According to A.N. Shibko (2011), when Hyssopus officinalis is grown in the foothills of the Crimea, 1000 seeds weigh 0.93-1.24 g, seed germination in the laboratory is 44.4-93.3%, and germination energy is 50.7-98. 8% there.In our experiment, 1000 seeds weighed 0.8-1.1 g, seed germination was 62%, mass seed germination was observed on days 9-11 of sowing, and seed germination energy was 54%.

Lavandula officinalis - 0.70-0.80 g per 1000 seed weight. Seed germination was 65% and seed germination was observed after 5 days. The germination energy of plant seeds was slightly lower, 31%, and mass germination occurred on days 9-10-11 of sowing.

Salvia officinalis - 1000 seed weight 6.49-7.10 g. The germination rate of the seeds was high and germination started from 3 days. Mass germination was observed on days 5-7 of seed germination, and up to 60 seeds germinated per day, with a germination rate of 93% and seed germination energy of 88% (Table 1; Fig. 3).

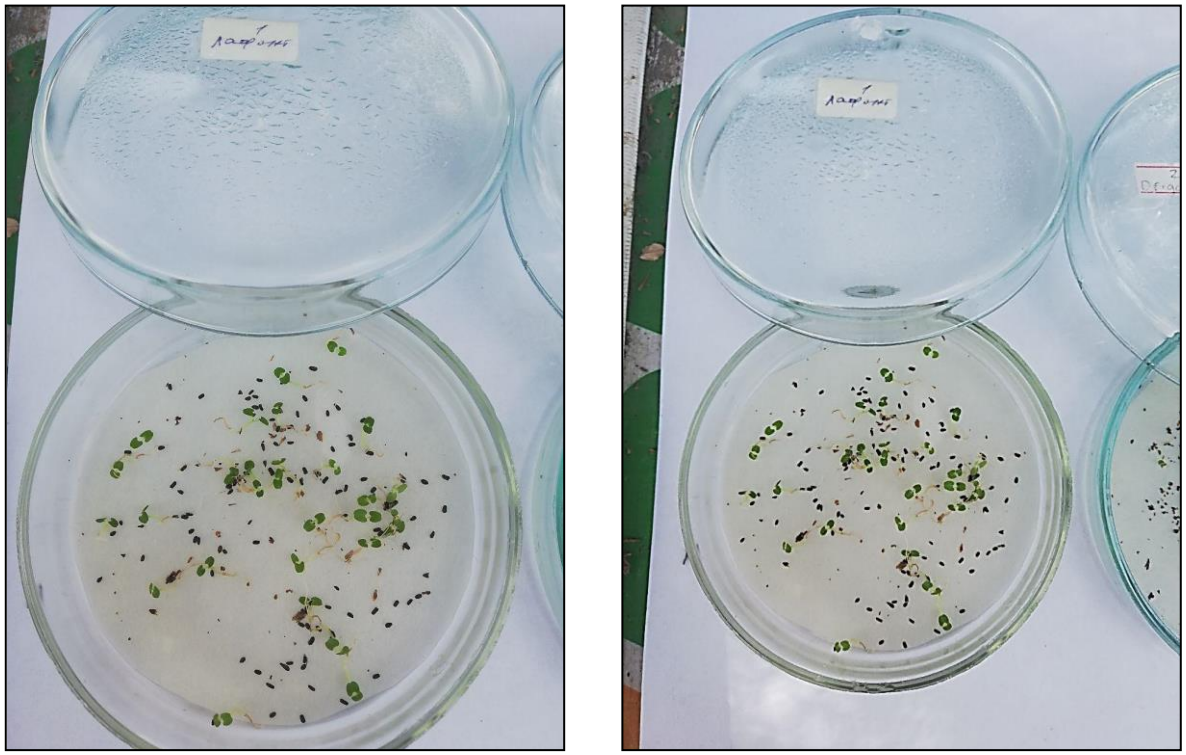

Figure 3.Salvia officinalis seed germination under laboratory conditions.

This means that the optimum temperature for germination of plant seeds is 20-25ºC, and at this temperature at 15-18 days most plant seeds germinate by 60-65%.

When the germination of seeds stored for different periods was determined in 2019, the germination of Origanum vulgare seeds was the lowest, the germination of seeds stored for 6 months averaged 12.2 ± 2.2% at 20-22ºC and 20.2 ± 2.6% at 22-25ºC. Seed germination at temperatures 22–25ºC for 12 and 24 months increased by an average of 38.2 ± 2.5% and 28.7 ± 2.8%, respectively.

Salvia officinalis seeds were found to have the highest germination, averaging 75.3 ± 3.8% and 91.3 ± 2.9% when stored for one year. For Lophantus anissatus, this indicator averaged 62.5 ± 2.3%, for Hyssopus officinalis 63.8 ± 2.0%, and for Lavandula officinalis 57.8 ± 2.6% (Table 2).

Table 2 also shows the effect of temperature on plant seed germination. Salvia officinalis seeds stored for 6 months averaged 63.6 ± 2.6% at a temperature of 20–22 °C and 75.4 ± 3.5% at a temperature of 22–25 °C, with an increase of 12%. In 12-month-old seeds of Salvia officinalis, this indicator was 16%, and in 24-month-stored seeds, it was 3%.

Table 2. The effect of temperature on the germination of seeds stored at different times in the laboratory (2019 y, %).

Temperature, ^{0}C	Stored periods, months			
	6	12	18	24
Origanum vulgare				
20-22	12,2±2,2	26,2±3,1	24,2±2,8	20,3±2,6
22-25	20,2±2,6	38,2±2,5	35,2±2,3	28,7±2,8
Lophantus anissatus				
20-22	35,5±2,4	58,0±2,5	52,5±3,2	49,1±2,7
22-25	45,8±2,3	60,0±2,6	62,5±2,3	52,1±2,5
Hyssopus officinalis				
20-22	43,5±2,6	60,4±2,9	58,5±3,1	53,1±2,5
22-25	52,8±2,8	63,8±2,0	62,5±2,9	55,1±2,5
Lavandula officinalis				
20-22	33,6±2,8	55,5±3,3	51,6±2,6	48,7±2,8
22-25	38,4±2,5	57,8±2,6	55,2±2,9	50,5±2,7

Salvia officinalis				
20-22	63,6±2,6	75,3±3,8	78,6±2,3	70,1±2,0
22-25	75,4±3,5	91,3±2,9	85,2±3,6	73,5±3,3

At a temperature of 22–25 °C, seed germination increased by 9%, seeds stored for 12 months by 3%, and seeds stored for 24 months by 2%.Hyssopusofficinalis seeds stored for 6 months at a temperature of 22–25 °C, seed germination increased by 9%, in seeds stored for 12 months by 3%, and in seeds stored for 24 months by 2%. In the table we can see the effect of temperature changes on the germination of seeds of Lavandula officinalis, Lophantus anissatus, Origanum vulgare.

Hence, a favorable temperature is important in plant seed germination.

While all environmental factors are controlled for seed germination in the laboratory, the favorable effect of environmental factors on seed germination in field conditions ensures seed germination. When medicinal plants are propagated on an industrial scale, it is important to know when to plant it and get a high yield. Therefore, in the field, the seeds of the research objects were sown at different times, i.e. in spring and autumn.

The germination of seeds sown in the third decade of February (25.II.2019) was observed on the 21st day of sowing (18.III.2019), first in the seeds of Salvia officinalis. In the first half of March, the average temperature in the Tashkent region was +12 +13 °C, the average relative humidity was 65-70%, in the second half of the month the average temperature was +18 +20 °C, the average relative humidity was 60-65%. Seeds of Origanum vulgare, Lophanthus anisatus, Hyssopus officinalis, Lavandula officinalis began to germinate in late March (Table 3).

Table 3.Germination of seeds of the research objects in field conditions (2019).

February			March			April		
1	2	3	1	2	3	1	2	3
Origanum vulgare								
30. III	20,0± 2,3	13,6± 2,8	11.IV	29,6± 2,6	21,2± 2,8	29.IV	30,6± 2,8	24,3± 2,3
Lophanthus anisatus								
30.III	36,3± 2,8	30,8± 3,5	02.IV	62,8± 2,5	48,3± 3,3	23.IV	60,3± 2.5	50,3± 2,8
Hyssopus officinalis								
28.III	40,3± 3,2	28,5± 2,9	30.III	60,3± 3,5	45,6± 2,7	26.IV	62,1± 3,1	48,3± 2,5
Lavandula officinalis								
30.III	31,2± 2,8	21,3± 3,3	30.III	54,6± 3,1	42,8± 2,6	26.IV	55,2± 2,8	43,1± 2,5
Salvia officinalis								
18.III	52,5± 3,1	49,1± 2,2	26.III	78,8± 2,8	67,3± 3,1	23.IV	77,8± 2,6	69,3± 2,8

Note: 1 – germination date; 2 - germination,%; 3 - germination energy,%.

Seed germination in March and April was higher than seed germination in February.Seeds were sown in the second decade of March and April (19.III.2019; 16.IV.2019).Germination of Salvia officinalis seeds sown in field conditions was higher in all 3 variants than in other plants andseed germination in February averaged 52.5 ± 3.1%, in March 78.8 ± 2.8%, and in April 77.8 ± 2.6%. It was noted that the germination of Origanum vulgare seeds sown in these months was the lowest in all 3 variants compared to the germination of other plant seeds.The average germination of seeds sown in February was 20.0 ± 2.3%, in March 29.6 ± 2.6%, and in April 30.6 ± 2.8%.

In September, October, November 2019, the seeds of the research objects were sown.Of the seeds sown in the first half of September (10.IX.2019), only Salvia officinalis and Lavandula officinalis seeds germinated at the end of this month. This month the air temperature was +22 °C +23 °C, the relative humidity was 50-55%. Some of the species sown in September and the seeds of research objects sown in October and November germinated in the spring of the following year

(2020). At this time, the germination rate of Origanum vulgare seeds was the lowest, 13.8 ± 2.2% in the spring of the following year, 19.8 ± 2.8% in the spring of next year, and 17.8 ± 2.9% in the spring of the following year. accordingly, the seed germination energy was also low.

From plants sown in the fall, the germination of Salvia officinalis seeds and the germination energy of other plant seeds were higher than the germination, germination energy. In September, germination averaged 68.9 ± 2.8%, seed germination energy was 58.5 ± 3.2%, in October seed germination was observed in March of the following year, 52.3 ± 2.7%, of seeds sown in November was 56, 5 ± 2.6%. Germination of Origanum vulgare, Lophanthus anisatus and Hyssopus officinalis seeds sown in September was observed in March of the following year (Table 4).

CONCLUSIONS

Studies have shown that the germination of Salvia officinalis seeds is highest (93%) in the laboratory at a temperature of 20-22 ° C for 3-5 days. It was observed that the germination of seeds stored for one year (12 months) under laboratory conditions was high when the seeds of the plants were stored and sown at different times.Seed germination at 22–25 °C was higher than that of seeds sown at 20–22 °C, increasing from 3% to 15%.

Table 4.
Germination of seeds of research objects in field conditions (2019).

September			October			November		
1	2	3	1	2	3	1	2	3
Origanum vulgare								
25.III	13,8±2,2	10,1±2,5	25.III	19,8±2,8	12,8±2,6	25.III	17,8±2,9	12,6±2,9
Lophantus anissatus								
10.III	50,5±2,5	30,2±2,3	16.III	51,2±2,9	43,6±3,1	16.III	51,6±3,5	42,6±2,8
Hyssopus officinalis								
19.III	48,2±2,8	31,3±2,6	22.III	51,6±3,1	40,5±2,9	25.III	49,8±2,9	39,8±2,6
Lavandula officinalis								
26.IX	39,2±2,3	22,3±2,8	25.III	41,2±2,8	32,9±2,8	25.III	42,1±2,5	33,1±2,8
Salvia officinalis								
20.IX	68,9±2,8	58,5±3,2	16.III	52,3±2,7	40,8±2,6	15.III	56,5±2,6	49,1±2,8

In field condition seed germination of other research objects averaged 60-65%, germination energy averaged 50-51%.ns, it was found that the seeds of plants were lower than the germination of seeds sown in spring when sown in autumn.It was established that seeds planted in autumn have lower germination than planted in spring.Of the spring-sown plants, Origanum vulgare seed germination and seed germination energy were the lowest, with a germination rate of 29.6 ± 2.6% and germination energy of 21.2 ± 2.8% in March.

It was found that the germination of seeds sown in autumn was on average 12-15% lower than the germination of seeds sown in spring.Therefore, it is recommended to sow the studied plants seeds in the soil and climatic conditions of Uzbekistan in the spring (March-April).If using this year's seeds that are fully ripe for planting, it will give a positive effect.

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