Received: 31.03.2025. Revised: 07.08.2025. Accepted: 10.09.2025

**Bulletin of the Kyrgyz National Agrarian University**

**Vol. 23, No. 3. 2025**

*Journal homepage: https://knau-bulletin.com/en*

UDC 58.084.2

DOI: 10.63621/bknau./3.2025.21

# Study of the bioecological characteristics of some lavender species introduced under the conditions of the Absheron Peninsula

**Vusala Badalova**

Senior Researcher

Ministry of Science and Education of the Republic of Azerbaijan, Institute of Dendrology of the National Academy of Sciences of Azerbaijan

AZ1044, 29 Sharg Str., Baku, Republic of Azerbaijan

https://orcid.org/0000-0001-7208-4141

**Saleh Maharramov**

Doctor of Biology, Professor

Ministry of Science and Education of the Republic of Azerbaijan, Institute of Dendrology of the National Academy of Sciences of Azerbaijan

AZ1044, 29 Sharg Str., Baku, Republic of Azerbaijan

https://orcid.org/0009-0008-7371-3008

**Gullu Aliyeva***

PhD in Biology, Senior Researcher

Ministry of Science and Education of the Republic of Azerbaijan, Institute of Dendrology of the National Academy of Sciences of Azerbaijan

AZ1044, 29 Sharg Str., Baku, Republic of Azerbaijan

https://orcid.org/0000-0001-8020-6583

**Zumrud Mammadova**

Doctor of Biological Sciences, Associate Professor

Ministry of Science and Education of the Republic of Azerbaijan, Institute of Dendrology of the National Academy of Sciences of Azerbaijan

AZ1044, 29 Sharg Str., Baku, Republic of Azerbaijan

https://orcid.org/0000-0001-5116-0520

**Vusala Ismayilova**

PhD in Biology, Associate Professor

Ministry of Science and Education of the Republic of Azerbaijan, Institute of Dendrology of the National Academy of Sciences of Azerbaijan

AZ1044, 29 Sharg Str., Baku, Republic of Azerbaijan

https://orcid.org/0000-0002-4729-3707

**Abstract.** Increasing climate variability and drought have brought the cultivation of low-water-demand plants to the forefront. In this context, lavender – a drought-tolerant plant widely used in various industries such as pharmaceuticals, cosmetics, perfumery, and dye production, has gained particular relevance. Lavender plantations are not only visually appealing but also contribute to the development of the tourism sector. This study investigated the bioecological characteristics of several lavender species introduced in the Absheron region (Azerbaijan) and examined the effects of biotic and abiotic factors on seed propagation. Sowing was carried out in spring (March) and autumn (November and December). During the research, it was observed that the germination rate of lavender seeds varied depending on the sowing depth. It was determined that the optimal sowing depth for *Lavandula angustifolia* L. and *Lavandula intermedia* L. seeds is 2.0 cm. Specifically, the germination rates at different depths

**Suggested Citation:** Badalova, V., Maharramov, S., Aliyeva, G., Mammadova, Z., & Ismayilova, V. (2025). Study of the bioecological characteristics of some lavender species introduced under the conditions of the Absheron Peninsula. *Bulletin of the Kyrgyz National Agrarian University*, 23(3), 21-29. doi: 10.63621/bknau./3.2025.21.

*Corresponding author

were as follows: at 1 cm: 12.9-11.0%, at 2 cm: 75.0-67.0%, at 3 cm: 18.4-17.3%. To ensure a favourable nutrient environment for seedlings, the seeding rate per 1 $m^2$ area was calculated. It was established that the higher the germination capacity, the lower the seeding rate required, and vice versa. Based on the experiments, a seeding rate of 10 grams of seeds per 1 $m^2$ was recommended. Successful germination in open field required the following optimal conditions: average air temperature: 20-25°C, soil temperature: 25-27°C, relative humidity: 75-80%. According to the study results, vegetative propagation of lavender species proves more effective in the Absheron region, where the local soil and climate are well-suited for establishing lavender plantations

**Keywords:** seed propagation; stratification; sowing time; sowing depth; germination rate

## Introduction

Increasing climate variability and drought have highlighted the importance of cultivating plants with low water requirements. The growing use of medicinal and aromatic plants across various sectors of industry, including pharmaceuticals, cosmetics, perfumery, and dye production along with their positive effects on human health, has led to increased interest and demand. Among the industrially important plant species used successfully worldwide, lavender stands out. In addition to its wide range of applications, lavender also contributes to the development of the tourism sector. Especially during the flowering stage of vegetation (in summer), lavender fields attract tourists who enjoy organising photo sessions against the backdrop of the vibrant and colourful landscape.

Lavender is an endemic plant species native to regions surrounding the Mediterranean, the Arabian Peninsula, the Canary Islands, and India. It is widely cultivated under agricultural conditions in countries such as France, Turkey, Bulgaria, Russia, Italy, Spain, the United Kingdom, Iran, Ukraine, China, and others. Due to its essential oil content, lavender is extensively used in the cosmetics industry (Gallotte *et al.*, 2020). One of the most widely used species known as medicinal lavender belongs to the genus *Lavandula* of the family *Lamiaceae*, order *Lamiales*, and is scientifically named *Lavandula angustifolia* L. – commonly referred to as narrow-leaved lavender (Güler & Korkmaz, 2018). Although *L. angustifolia* does not grow naturally in Azerbaijan, it has long been used in various regions for landscape architecture, particularly in greening parks and gardens. In recent years, the cultivation potential of lavender has been increasing rapidly. In particular, lavender species introduced to the Absheron region have shown strong growth dynamics, desirable appearance, and high-quality flowering performance. As a result, the cultivated area allocated for lavender in Absheron continues to expand steadily.

Lavender has been widely used in the fields of health and cosmetics due to its valuable essential oil. Essential oil derived from the lavender plant has been shown to shorten the time required to fall asleep and prolong the duration of sleep. Numerous scientific studies, like those by R. Samuelson *et al.* (2020), S. Kajjari *et al.* (2022), have also demonstrated its effectiveness in promoting wound healing on both human and animal skin. In addition, lavender has been found to possess antimicrobial, anti-inflammatory, antifungal, and larvicidal properties, particularly effective against insect larvae (El Abdali *et al.*, 2022). The amount of essential oil obtained from fresh lavender flowers typically ranges between 1-3%. In general, the most pharmacologically and commercially valuable part of the lavender plant is the colourless to pale yellow volatile oil contained in its flowers, known as *Aetheroleum lavandulae*. According to E. Malloggi *et al.* (2022), lavender essential oil is considered to be one of the most valuable plant-derived essential oils globally. Lavender oil, widely used across various industrial sectors, contains more than 100 volatile compounds primarily belonging to the group of terpenoids. Among the most important of these are linalool, linalyl acetate, cineole, and camphor. Lavender has been used since ancient times by the Greeks and Romans as a cleansing and cosmetic agent. Later, it was introduced to the Royal Gardens in England, and it continues to be widely used in landscape design to this day. Globally, the most commercially utilised lavender species – particularly in terms of essential oil yield and quality are: *Lavandula angustifolia* Mill., *L. officinalis* L., *Lavandula intermedia* Emeric ex Loisel. (*L. hybrida* L.), and *Lavandula spica* – *L. latifolia* Medik.

Lavender is a perennial plant belonging to the group of dicotyledons, characterised by a strong root system. Depending on the environmental conditions of the planting site, its roots can extend to a depth of 80-100 cm in the soil. The stems are quadrangular in shape, either glabrous or hairy, and exhibit a greyish-green colour. The plant produces numerous lateral branches, and as it matures, the older stems gradually become woody. Lavender leaves are attached directly (sessile) to the nodes of upright branches. The leaves are 2-5 cm long, with pointed tips, entire margins, and are often curled inward. The inflorescences are formed at the apical part of the flowering stem and are typically 10-20 cm in length. The flowers are tubular on the inner side, hairy on the outer side, greyish-blue in colour, and approximately 5-6 mm long. Each flower is surrounded by four calyx lobes (Kryuchkova, 2025).

The aim of this research was to investigate the bioecological characteristics of certain lavender species introduced in the Absheron region (Azerbaijan), and to study the influence of biotic and abiotic factors on seed propagation.

## Materials and Methods

The experiments were conducted during the 2024-2025 period at the Experimental Research Site of the Institute of Dendrology, Ministry of Science and Education of the Republic of Azerbaijan, located in Saray settlement. The scientific names of the species and authors are provided according to The Plant List (n.d.) database. The methods for seed propagation, determination of optimal sowing time and sowing depth were based on the methodology proposed by M. Firsova (1955). As plant material, two species from the *Lamiaceae* family were used: *L. angustifolia* Mill. and *L. intermedia* L. Saray settlement is located in the Absheron district, approximately 30-35 km northwest of Baku city. It lies within a semi-desert and dry steppe zone. The soil types in the area include grey-brown (saline) and brown soils. The annual precipitation ranges between 200-350 mm, and the average annual temperature is approximately 14-15°C (Tables 1, 2) (Aliyeva *et al.*, 2025).

**Table 1.** Average monthly climate data in Baku (2024-2025)

| Month | Average temperature (°C) | Precipitation (mm) | Average humidity (%) |
|---|---|---|---|
| January | 4.5 | 23 | 74 |
| February | 5.5 | 21 | 72 |
| March | 8.5 | 23 | 70 |
| April | 13.0 | 18 | 72 |
| May | 18.0 | 15 | 71 |
| June | 23.0 | 7 | 70 |
| July | 26.0 | 2 | 68 |
| August | 26.0 | 6 | 70 |
| September | 22.0 | 13 | 72 |
| October | 16.0 | 28 | 75 |
| November | 10.0 | 31 | 76 |
| December | 6.0 | 28 | 76 |

**Source:** compiled by the authors

**Table 2.** Annual climate data in Baku (2024-2025)

| Parameter | Value |
|---|---|
| Annual average temperature (°C) | 14.9 |
| Annual precipitation (mm) | 215.0 |
| Annual average relative humidity (%) | 72.2 |

**Source:** compiled by the authors

Before sowing, soil analysis was carried out to assess the pH level and organic matter content. Soil analysis indicated that the organic matter content in the lavender cultivation area ranged from 2.5% to 3.5%. This level is considered optimal for lavender growth, providing sufficient soil fertility and water retention for healthy seedling establishment and development. The soil pH was measured using a pH meter (Hanna HI 2211 pH meter, Romania) and was recorded between 6.5-7.0. According to K. Adam (2018), lavender is best established on sandy loam soils of pH 6 to pH 8. The fruit (seeds) of lavender are approximately 1 mm in size and have a dark brown coloration. Prior to sowing, the seeds were weighed and their morphological characteristics were recorded. The seed mass was measured using an electronic balance (EK-610i, electronic type scaler) with 0.01 g precision. The total weight of 100 seeds was noted for each species. In the experiment, a total of 2,400 seeds were sown, with 1,200 seeds sown in each season (spring and autumn) to evaluate seasonal effects on germination and seedling growth.

Inflorescences of lavender were collected after full blooming and shade-dried to facilitate seed separation. Dried flowers were manually rubbed to extract the seeds, which were then stored in airtight containers under cool (+4-5°C), dry conditions (relative humidity 30-40%) to preserve germination potential. Prior to sowing, seeds were soaked in water for 24 hours. Both *Lavandula angustifolia* and *Lavandula × intermedia* require cold stratification; seeds were kept in moist sand or vermiculite at 4-5°C for 2-4 weeks to enhance germination, although soaking at room temperature prior to sowing may also be applied, typically resulting in lower germination rates (Urwin, 2008). During the experiment, seeds were sown at different soil depths to determine the optimal sowing depth. Specifically, during the autumn season, seeds were sown at three depth variants: 1 cm, 2 cm, and 3 cm, and the optimal depth was identified accordingly. In order to determine the most favourable sowing season for the studied lavender species, seeds were sown in two different seasons according to V. Kryuchkova *et al.* (2025):

- late autumn: November 15-30, 2024;
- early spring: March 11-20, 2025.

All sowings were performed under open field conditions. Irrigation was provided regularly using a drip irrigation system to maintain optimal soil moisture, ensuring adequate water availability for seed germination and seedling establishment. For sowing, a substrate composed of leaf mould, sand, and soil was prepared in a 1:1:1 ratio and filled into seed beds. To ensure sufficient nutrient availability for seedlings during propagation, the optimal seed sowing rate per square meter (1 m²) was calculated based on the measured germination rate of the seeds (de Oliveira *et al.*, 2021).

The study adhered to the ethical principles outlined in Convention on Biological Diversity (1992) and Convention on International Trade in Endangered Species of Wild Fauna and Flora (1973). Data were analysed using appropriate statistical methods, including analysis of variance (ANOVA) and Student's t-test (Gomez & Gomez, 1984; Zar, 1999). All analyses were performed using SPSS v.26. Results were presented as mean ± standard deviation (SD).

## Results and Discussion

During the experiment, seeds of lavender sown at different depths exhibited varying germination rates. The results revealed that for *Lavandula angustifolia* L. and *Lavandula intermedia* L., the optimal sowing depth was 2.0 cm. Seeds sown at a depth of 1 cm had a germination rate of 11.0-12.9%, while those sown at 2 cm achieved the highest rate of 67.0-75.0%, and seeds sown at 3 cm had a reduced germination rate of 17.3-18.4% (Table 3). As shown in Table 3, seeds sown at a shallow depth (1 cm) demonstrated significantly lower germination rates. This reduction is primarily attributed to rapid evaporation of moisture from the soil surface, causing the seedbed to dry out quickly and limiting the seeds' ability to absorb sufficient water.

**Table 3.** Effect of sowing depth and rate on seed germination percentage of lavender

| | Seed amount per 1 m² (g) | 1 cm sowing depth (%) | 2 cm sowing depth (%) | 3 cm sowing depth (%) |
|---|---|---|---|---|
| *Lavandula angustifolia* L. | 10.0 | 12.9 ± 1.2 | 75.0 ± 2.5 | 18.4 ± 1.8 |
| *Lavandula × intermedia* L. | 10.0 | 11.0 ± 1.0 | 67.3 ± 2.0 | 17.3 ± 1.5 |

**Source:** compiled by the authors

These findings suggest that, under open field conditions, the most effective sowing depth for lavender seeds is 2.0 cm. To ensure favourable nutrient availability during seed propagation, the optimal seed rate per 1 m² was calculated based on seed germination percentage. As germination capacity increases, the required sowing rate decreases, and vice versa (Table 4). Based on results, the optimal seed rate was determined to be 10 grams per square meter. *Lavandula angustifolia* L. were observed earlier than those of the other species, appearing on April 10. In *Lavandula intermedia* L., the first seedlings emerged four days later, on April 14. Mass germination was recorded depending on the species between April 15 and April 22. In the second sowing variant (December 20), the first seedlings were observed between April 18 and April 24.

**Table 4.** Effect of sowing time on seed germination of lavender species

| Species | First emergence | Mass emergence | Germination rate (%) ±SD | First emergence | Mass emergence | Germination rate (%) ±SD |
|---|---|---|---|---|---|---|
| | 20 Nov | 20 Nov | 20 Nov | 20 Dec | 20 Dec | 20 Dec |
| *L. angustifolia* L. | 10.04 | 15.04 | 75.0 ± 2 | 18.04 | 26.04 | 60.5 ± 2 |
| *L. intermedia* L. | 14.04 | 22.04 | 63.0 ± 2 | 24.04 | 03.05 | 52.5 ± 2 |

**Source:** compiled by the authors

In Variant I (sowing on November 20), the seed germination rate ranged between 68-70% and 75-77%, depending on the species. The highest germination rate was recorded in *Lavandula angustifolia* L., ranging from 75-77%. In *Lavandula intermedia* L., the germination rate was relatively lower, ranging between 63-65%. In Variant II (sowing on December 20), the first seedling emergence occurred approximately 8-10 days later compared to Variant I. The germination rate in this variant was also lower: 60-62% for *Lavandula angustifolia* L. and 52-55% for *Lavandula intermedia* L. The results obtained from autumn sowing during the study indicated that the optimal sowing time for the seeds of certain lavender species under Absheron conditions is the second ten-day period of November. Additionally, the germination percentage of seeds sown in spring was also examined. For this purpose, non-stratified seeds were sown in open field conditions during the first ten-day period of March. It is well known that one of the key conditions for successful seed germination in open field environments is an average air temperature of 20-25°C, a soil temperature of 25-27°C, and a relative air humidity of 75-80%. During the study, seeds sown in the first ten-day period of March without stratification or scarification exhibited delayed germination compared to other sowing variants. The first seedlings appeared in the second ten-day period of May, while mass germination occurred in the third ten-day period. As a result, the germination rate of *Lavandula angustifolia* L. and *Lavandula intermedia* L. seeds sown in spring without any pre-treatment ranged between 15-17% and 39-42%.

A lavender plantation was established at the Saray Experimental Station of the Institute of Dendrology. In general, lavender can be propagated both generatively (by seeds) and vegetatively. During generative propagation, the very small size of the seeds and the requirement for special preparation of seedbeds create certain difficulties. Moreover, since seed germination and seedling development are slow in generative propagation, weed infestation of the sowing area is frequently observed. Therefore, according to N. Urwin (2008), vegetative propagation is considered a more efficient and economically viable method for large-scale lavender cultivation. The lavender species studied are widely distributed across the Southern Hemisphere (Lis-Balchin, 2022). Representatives of the *Lavandula* genus are commonly found in regions such as South Africa, India, and various parts of Eurasia. Some species of *Lavandula* L. are also widely distributed in the southern regions of Russia, Turkey, Georgia, and Crimea. The occurrence of these species in diverse geographical areas with varying soil and climatic conditions indicates their ability to adapt to a broad range of environmental factors (Mokhtarzadeh *et al.*, 2013; Détár, *et al.*, 2020). The adaptability of lavender to different environmental conditions has also been demonstrated by T. Kachanova *et al*. (2023), who found that *L. angustifolia* can be successfully cultivated as an industrial crop under appropriate irrigation regimes and biological treatments. Similar observations have been reported in previous studies. D. Akgül *et al.* (2019) found that autumn sowing led to higher germination rates for *L. angustifolia*, while delayed sowing in winter reduced both germination percentage and speed. G. Koçer & H. Baydar (2022) also noted that seasonal timing and seed pre-treatment (stratification or scarification) significantly influence germination, with late sowing or absence of pre-treatment resulting in delayed and lower germination. M. Firsova (1955) emphasised that lavender seeds exhibit slow germination under natural conditions and that stratification or soaking can improve germination rates. These findings are consistent with the present study, where non-stratified seeds sown in early March showed delayed germination, with first seedlings appearing in the second ten-day period of May and mass germination occurring in the third ten-day period. The germination rates in spring sowings without pre-treatment were 15-17% for *L. angustifolia* L. and 39-42% for *L. intermedia* L., highlighting the importance of both sowing time and seed preparation for successful propagation. Propagation methods for lavender have also been evaluated in previous studies. N. Urwin (2008) concluded that vegetative propagation is often more efficient and economically viable for large-scale cultivation due to slow germination and seedling development in generative propagation. Small seed size and the need for special seedbed preparation create additional difficulties, and weed infestation is commonly observed during generative propagation.

Based on the results of this study, vegetative propagation of lavender species under Absheron conditions proved to be more effective. The soil and climatic conditions of the region are suitable for establishing lavender plantations. In conclusion, the study indicated that the second ten-day period of November is the optimal sowing time for lavender under Absheron conditions, with *L. angustifolia* L. showing higher germination rates compared to *L. intermedia* L. Spring sowings without pre-treatment result in significantly delayed and lower germination. For large-scale cultivation, vegetative propagation is recommended as a more efficient and reliable method, whereas generative propagation requires careful consideration of sowing time and seed pre-treatment to achieve satisfactory germination.

## Conclusions

The study demonstrated that the optimal sowing depth for *Lavandula angustifolia* L. and *Lavandula intermedia* L. is 2.0 cm, where the highest seed emergence rates were observed. At a shallower depth of 1 cm, germination rates were relatively low, reaching only 12.9% for *L. angustifolia* L. and 11.0% for *L. intermedia* L. Increasing the depth to 2 cm significantly improved germination to 75.0% and 67.0%, respectively, while further increasing the depth to 3 cm led to a sharp decline in seedling emergence, dropping to 18.4% and 17.3%. These findings highlight the critical importance of correct sowing depth in optimising seed germination and early seedling establishment. The study also identified 10 grams per square meter as the optimal seeding rate for both species. This balance ensures sufficient seed density for uniform plant establishment while avoiding excessive overcrowding. In general, higher seed viability allows for lower seeding rates, whereas lower germination capacity requires an increased seeding rate to achieve adequate field coverage. Optimal environmental conditions for successful seed germination under open-field conditions were determined as an average air temperature of 20-25°C, soil temperature of 25-27°C, and relative humidity of 75-80%. These conditions are essential to accelerate germination and support early seedling growth, particularly in regions with variable climatic conditions such as Absheron. Despite these findings, generative propagation of lavender under local conditions proved inefficient. The very small seed size, the requirement for specially prepared seedbeds, and the slow germination rate create significant technical challenges. Moreover, delayed seedling growth facilitates weed competition, further reducing the effectiveness of seed-based propagation. Therefore, vegetative propagation is considered a more practical, efficient, and commercially viable method for large-scale lavender cultivation.

Future research should focus on improving seed germination through pre-sowing treatments, such as cold stratification, soaking, or treatment with growth-promoting bioactive compounds. Additionally, studies on optimising vegetative propagation techniques, irrigation management, and soil amendment strategies will contribute to more efficient and sustainable lavender production under varied climatic conditions.

## Acknowledgements

The authors would like to express their gratitude to the staff of the Saray Experimental Station for their assistance during the research.

## Funding

The study was not funded.

## Conflict of Interest

The authors declare that there is no conflict of interest.

## References

[1] Adam, K.L. (2018). *Lavender production, markets, and agritourism*. Butte: National Center for Appropriate Technology Location.
[2] Akgül, D.T., Göğüş, N., Glaue, Ş., & Akcan, T. (2019). Edible flower: Lavender. In A. Şekeroğlu, H. Eleroğlu & M. Duman (Eds.), *4th international Anatolian agriculture, food, environment and biology congress: Congress book* (pp. 723-728). Afyonkarahisar: TARGID.
[3] Aliyeva, G., Ojaghi, J., Mammadova, Z., Badalova, V., Ismayilova, V., Maharramov, S., & Hasanova, M. (2025). Analysis of the functional traits of some *Quercus* species trees in different ecological conditions in Azerbaijan. *Sylwan*, 169(6), 418-433. doi: 10.26202/sylwan.2025032.
[4] Convention on Biological Diversity. (1992, May). Retrieved from https://www.cbd.int/.
[5] Convention on International Trade in Endangered Species of Wild Fauna and Flora. (1973, March). Retrieved from https://cites.org/eng.
[6] de Oliveira, R.C., Silva, J.R., Luz, J.M.Q., Blank, A.F., Sampaio, T.S., & Silva, S.M. (2021). Production and composition of lavender oil: Nutritional management and cultivation systems. *Boletin Latinoamericano y Del Caribe de Plantas Medicinales y Aromáticas*, 20(6), 649-659. doi: 10.37360/blacpma.21.20.6.46.
[7] Détár, E., Németh, É.Z., Gosztola, B., Demján, I., & Pluhár, Z. (2020). Effects of variety and growth year on the essential oil properties of lavender (*Lavandula angustifolia* Mill.) and lavandin (*Lavandula × intermedia* Emeric ex Loisel.). *Biochemical Systematics and Ecology*, 90, article number 104020. doi: 10.1016/j.bse.2020.104020.
[8] El Abdali, Y., *et al*. (2022). *Lavandula dentata* L.: Phytochemical analysis, antioxidant, antifungal and insecticidal activities of its essential oil. *Plants*, 11(3), article number 311. doi: 10.3390/plants11030311.
[9] Firsova, M.K. (1955). *Methods of research and evaluation of seed quality*. Moscow: Selkhozgiz.
[10] Gallotte, P., Fremondière, G., Gallois, P., Bernier, J.P.B., Buchwalder, A., Walton, A., Piasentin, J., & Fopa-Fomeju, B. (2020). *Lavandula angustifolia* Mill. and *Lavandula × intermedia* Emeric ex Loisel: Lavender and Lavandin. In J. Novak & W.D. Blüthner (Eds.), *Medicinal, aromatic and stimulant plants* (pp. 303-311). Cham: Springer. doi: 10.1007/978-3-030-38792-1_6.
[11] Gomez, K.A., & Gomez, A.A. (1984). *Statistical procedures for agricultural research (2nd ed.)*. New York: John Wiley & Sons.
[12] Güler, K.H., & Korkmaz, M. (2018). Economic analysis of lavender production in forest villages of Isparta province. *Turkish Journal of Forestry*, 19(2), 156-162. doi: 10.18182/tjf.424901.
[13] Kachanova, T., Manushkina, T., & Kovalenko, O. (2023). Features of growth and development of *Lavandula angustifolia* when grown under drip irrigation conditions in the Southern Steppe zone of Ukraine. *Scientific Horizons*, 26(3), 81-91. doi: 10.48077/scihor3.2023.81.
[14] Kajjari, S., Joshi, R.S., Hugar, S.M., Gokhale, N., Meharwade, P., & Uppin, C. (2022). The effects of lavender essential oil and its clinical implications in dentistry: A review. *International Journal of Clinical Pediatric Dentistry*, 15(3), 385-388. doi: 10.5005/jp-journals-10005-2378.
[15] Koçer, G., & Baydar, H. (2022). Determination of agricultural and oil quality characteristics of some camelina (*Camelina sativa* (L.) Crantz.) genotypes in Isparta ecological conditions. *Turkish Journal of Science and Engineering*, 4(1), 7-14. doi: 10.55979/tjse.1048941
[16] Kryuchkova, V., Evtyukhova, A., Avdeev, S., Donskih, V., Shelepova, O., Ladyzhenskaya, O., & Gorbunov, Y. (2025). Lavender: Breeding for winter hardiness in a temperate climate. *Horticulturae*, 11(2), article number 139. doi: 10.3390/horticulturae11020139.
[17] Lis-Balchin, M. (2002). *Lavender: The genus Lavandula*. London: CRC Press.
[18] Malloggi, E., Menicucci, D., Cesari, V., Frumento, S., Gemignani, A., & Bertoli, A. (2022). Lavender aromatherapy: A systematic review from essential oil quality and administration methods to cognitive enhancing effects. *Applied Psychology. Health and Well-Being*, 14(2), 663-690. doi: 10.1111/aphw.12310.

[19] Mokhtarzadeh, S., Hajyzadeh, M., Ahmad, H.A., & Khawar, K.M. (2013). The problems in acclimatisation of in vitro multiplied plants of *Lavandula angustifolia* Miller under field conditions. *Acta Horticulturae*, 988, 71-76. doi: 10.17660/ActaHortic.2013.988.6.
[20] Samuelson, R., Lobl, M., Higgins, S., Higgins, S., Clarey, D., & Wysong, A. (2020). The effects of lavender essential oil on wound healing: A review of the current evidence. *Journal of Alternative and Complementary Medicine*, 26(8), 680-690. doi: 10.1089/ACM.2019.0286.
[21] The Plant List. (n.d.). Retrieved from http://www.theplantlist.org/tpl1.1/search.
[22] Urwin, N. (2008). Lavender breeding for commercial yield. *Combined Proceedings International Plant Propagators Society*, 58, 78-84.
[23] Zar, J.H. (1999). *Biostatistical analysis* (4th ed.). Upper Saddle River: Prentice Hall.

# Апшерон шартына интродукцияланган айрым лаванда түрлөрүнүн биоэкологиялык өзгөчөлүктөрүн изилдөө

**Вусала Бадалова**

Улуу илимий кызматкер
Азербайжан Республикасынын Илим жана Билим берүү министрлиги, Дендрология институту
AZ1044, Шарк көч., 29, Баку ш., Азербайжан Республикасы
https://orcid.org/0000-0001-7208-4141

**Салех Махаррамов**

Биология илимдеринин доктору, профессор
Азербайжан Республикасынын Илим жана Билим берүү министрлиги, Дендрология институту
AZ1044, Шарк көч., 29, Баку ш., Азербайжан Республикасы
https://orcid.org/0009-0008-7371-3008

**Гүллү Алиева**

Биология боюнча философия доктору, улуу илимий кызматкер
Азербайжан Республикасынын Илим жана Билим берүү министрлиги, Дендрология институту
AZ1044, Шарк көч., 29, Баку ш., Азербайжан Республикасы
https://orcid.org/0000-0001-8020-6583

**Зүмрүт Мамедова**

Биология илимдеринин доктору, доцент
Азербайжан Республикасынын Илим жана Билим берүү министрлиги, Дендрология институту
AZ1044, Шарк көч., 29, Баку ш., Азербайжан Республикасы
https://orcid.org/0000-0001-5116-0520

**Вусала Исмайылова**

Биология боюнча философия доктору, доцент
Азербайжан Республикасынын Илим жана Билим берүү министрлиги, Дендрология институту
AZ1044, Шарк көч., 29, Баку ш., Азербайжан Республикасы
https://orcid.org/0000-0002-4729-3707

**Аннотация.** Климаттык өзгөрүүлөрдүн күчөшү жана кургакчылык суу аз талап кылган өсүмдүктөрдү өстүрүүнү алдыңкы планга чыгарууда. Ушул контекстте ар кандай тармактарда – фармацевтикада, косметикада, парфюмерияда жана боек өндүрүшүндө кеңири колдонулган кургакчылыкка чыдамкай лаванда өзгөчө мааниге ээ болууда. Лаванда плантациялары кооздугу менен гана эмес, туризм тармагынын өнүгүшүнө кошкон салымы менен да баалуу. Бул изилдөөдө Абшерон аймагына (Азербайжан) интродукцияланган бир нече лаванда түрүнүн биоэкологиялык өзгөчөлүктөрү жана биотикалык, абиотикалык факторлордун уруктан көбөйүүгө тийгизген таасири изилденди. Эгүү иштери жазында (март) жана күзүндө (ноябрь, декабрь) жүргүзүлдү. Изилдөө учурунда лаванданын уругунун өнүп чыгышы анын көмүлүү тереңдигине жараша өзгөрөрү аныкталды. *Lavandula angustifolia* L. жана *Lavandula intermedia* L. уруктары үчүн оптималдуу себүү тереңдиги 2,0 см деп табылды. Ар кандай тереңдикте өнүп чыгуу көрсөткүчтөрү мындай болду: 1 смде – 12,9-11,0 %, 2 смде – 75,0-67,0 %, 3 смде – 18,4-17,3 %. Өркүндөр үчүн азыктандыруучу чөйрөнүн шарттарын камсыз кылуу максатында 1 м² аянтка урук себүү нормасы эсептелди. Жыйынтыгында белгиленгендей, өнүп чыгуу жөндөмдүүлүгү канчалык жогору болсо, керектелүүчү себүү нормасы ошончолук төмөн болот жана тескерисинче. Тажрыйбанын негизинде 1 м² аянтка 10 г урук себүү сунушталды. Ачык талаада ийгиликтүү өнүп чыгуу үчүн оптималдуу шарттар төмөнкүлөр болду: абанын орточо температурасы 20-25 °C, топурактын температурасы 25-27 °C, салыштырмалуу нымдуулук 75-80 %. Изилдөөнүн жыйынтыгына ылайык, Абшерон аймагында лаванда түрлөрүн вегетативдик көбөйтүү ыкмасы натыйжалуу болуп чыкты, анткени жергиликтүү топурак-климаттык шарттар лаванда плантацияларын түзүүгө абдан ылайыктуу

**Негизги сөздөр:** уруктан көбөйтүү; стратификация; себүү мөөнөтү; себүү тереңдиги; өнүп чыгуу көрсөткүчү

# Изучение биоэкологических особенностей некоторых видов лаванды, интродуцированных в условиях Апшерона

**Вусала Бадалова**

Старший научный сотрудник
Министерство науки и образования Азербайджанской Республики, Институт Дендрологии НАН Азербайджана
AZ1044, ул. Шарк, 29, г. Баку, Азербайджанская Республика
https://orcid.org/0000-0001-7208-4141

**Салех Магеррамов**

Доктор биологических наук, профессор
Министерство науки и образования Азербайджанской Республики, Институт Дендрологии НАН Азербайджана
AZ1044, ул. Шарк, 29, г. Баку, Азербайджанская Республика
https://orcid.org/0009-0008-7371-3008

**Гюллю Алиева**

Кандидат биологических наук, старший научный сотрудник
Министерство науки и образования Азербайджанской Республики, Институт Дендрологии НАН Азербайджана
AZ1044, ул. Шарк, 29, г. Баку, Азербайджанская Республика
https://orcid.org/0000-0001-8020-6583

**Зюмруд Мамедова**

Доктор биологических наук, доцент
Министерство науки и образования Азербайджанской Республики, Институт Дендрологии НАН Азербайджана
AZ1044, ул. Шарк, 29, г. Баку, Азербайджанская Республика
https://orcid.org/0000-0001-5116-0520

**Вусала Исмаилова**

Кандидат биологических наук, доцент
Министерство науки и образования Азербайджанской Республики, Институт Дендрологии НАН Азербайджана
AZ1044, ул. Шарк, 29, г. Баку, Азербайджанская Республика
https://orcid.org/0000-0002-4729-3707

**Аннотация.** Усиление климатической изменчивости и засушливости выдвигает на первый план возделывание растений с низкой потребностью во влаге. В этом контексте лаванда – засухоустойчивое растение, широко используемое в фармацевтической, косметической, парфюмерной и красильной промышленности, приобретает особую актуальность. Лавандовые плантации не только обладают высокой декоративной ценностью, но и способствуют развитию туристического сектора. В данном исследовании были изучены биоэкологические особенности нескольких видов лаванды, интродуцированных в Абшеронском регионе (Азербайджан), а также влияние биотических и абиотических факторов на семенное размножение. Посев осуществлялся весной (март) и осенью (ноябрь и декабрь). В ходе исследования было установлено, что всхожесть семян лаванды зависит от глубины заделки. Оптимальная глубина посева для семян *Lavandula angustifolia* L. и *Lavandula intermedia* L. составила 2,0 см. Всхожесть семян при различной глубине посева была следующей: при 1 см – 12,9-11,0 %, при 2 см – 75,0-67,0 %, при 3 см – 18,4-17,3 %. Для обеспечения благоприятных условий питания всходов была рассчитана норма высева на 1 м² площади. Установлено, что чем выше всхожесть, тем ниже необходимая норма высева, и наоборот. На основании опытных данных рекомендована норма высева 10 г семян на 1 м². Для успешного прорастания в открытом грунте оптимальными условиями были: средняя температура воздуха 20-25 °C, температура почвы 25-27 °C, относительная влажность 75-80 %. Согласно полученным результатам, в условиях Абшеронского региона более эффективным оказалось вегетативное размножение лаванды, так как местные почвенно-климатические условия благоприятны для закладки лавандовых плантаций

**Ключевые слова:** семенное размножение; стратификация; сроки посева; глубина посева; всхожесть