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GERMINATION LEVEL OF TRIGONELLA FOENUM-GRAECUM L. PLANT IN FIELD CONDITIONS: ECOLOGICAL IMPACT OF SOWING TIMES

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Abstract:
In this study, the germination rate of Trigonella foenum-graecum L. (Greek shambala) seeds in the field was studied under different sowing dates and agroclimatic conditions. Based on the results obtained from several sowing dates in 2023/2024, the germination efficiency of seeds was found to be related to factors such as air temperature, soil temperature and relative humidity. The conditions in March and September were the most favorable, and germination rates were moderate to high. These results confirm that March and September are the most suitable times for sowing T. foenum-graecum seeds. However, low temperatures in April and November limited germination and led to low efficiency. The results of the study will help determine the most suitable sowing times for T. foenum-graecum in the field.

Keywords: T. foenum-graecum , seed germination, field conditions, agroclimatic factors, air temperature, soil temperature, relative humidity, sowing time, March, September, April, November, efficiency, crop results, agroecological conditions.

Introduction.

There are more than 4380 species of higher plants in the Republic of Uzbekistan, each of which has ecological and practical significance. Some species of these plants are distinguished by their medicinal properties. More than 750 species of medicinal plants are distributed on the territory of Uzbekistan, and their raw materials are widely used in official medicine. The specific properties and advantages of these plants, as well as their use in medicine, are of great ecological importance.

Medicinal plants are widely used in the fields of medicine, food, cosmetics and pharmaceuticals, and also play a significant ecological role. Their natural resources, which allow the creation of effective means for the treatment of various diseases without causing harm, are a great impetus for the development of these areas. In particular, medicinal products derived from plants play an indispensable role in the healthcare system, and this process plays an important role in maintaining human health. Medicinal plants are also used to prevent many diseases, strengthen the immune system and restore the body naturally.

At the same time, many properties of medicinal plants, the effectiveness and safety of medicines produced from them are being regularly confirmed by scientific research. The active substances contained in medicinal plants are distinguished by various properties, for example, substances with antiseptic, anti-inflammatory, analgesic, antibacterial and

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antiviral properties. As a result, their importance in the pharmaceutical and medical fields is increasing.

In recent years, the demand for medicinal plants has increased, and their importance in medicine is expanding. These changes also indicate the increased interest of society in natural and organic products and the awareness of the importance of developing medicines based on natural resources in medicine. The government of Uzbekistan pays great attention to the development of cultural cultivation, processing and export of medicinal plants. In this regard, a number of projects are being implemented to introduce innovative technologies in the agricultural sector, systematically cultivate medicinal plants and prepare high-quality raw materials from them.

This development in the field of production and processing of medicinal plants, in turn, will help strengthen the country's pharmaceutical industry, effectively manage natural resources and achieve economically beneficial results. At the same time, this sector will serve to ensure sustainable development in the agricultural, ecological and industrial sectors of Uzbekistan. Through the cultivation and use of medicinal plants, it is possible to produce medicines for the domestic market of the country, as well as create opportunities for entering international markets.

Thus, medicinal plants not only provide medical and economic benefits, but are also ecologically important. They allow for the efficient use of natural resources, ensuring the sustainable development of the agricultural and pharmaceutical industries. This serves to increase Uzbekistan's global competitiveness.

Experiment (Research) Object and Methodology

The plant Trigonella foenum-graecum L. (Greek shambala) was chosen as the object of the research . This plant belongs to the family of Legumes (Fabaceae Lindl.) and is distinguished by its high medical and agronomic properties. Greek shambala is of great importance not only as a natural resource, but also in the field of medicine. In addition to food products, the plant T. foenum-graecum is widely used in folk medicine and is known for its health benefits. Also, the study of the morphological, phenological and biometric characteristics of the plant will ensure its effective use in agricultural practice.

The research was conducted in two types of conditions: laboratory and field. In laboratory conditions, experiments were carried out in 4 variants. In each variant, the growth and development processes of plants, seed germination and other important indicators were studied. Also, separate controls and observations were carried out for each variant. In field conditions, experiments were carried out in spring and autumn, based on two repetitions. Field experiments helped to determine the characteristics of plant development in the natural environment, adaptation to soil and climatic conditions, and response to agronomic conditions. Experimental sites were carefully prepared to ensure proper plant growth and accuracy of observations.

Phenological, morphological and biometric observations were widely used in the research process. These methods allowed for a detailed study of changes in the developmental stages of plants. High-precision and methodological approaches were

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used to determine the morphological and ecological characteristics of plants. Through the analysis of soil and plant samples, opportunities were created to study the adaptation of Trigonella foenum-graecum L. to growing conditions.

In studying the bioecological properties of plants, the scientific methods of scientists such as TA Rabotnov [6], AA Uranov [8] and IG Serebryakov [7] were used. Their approaches were of great importance in determining the ecological adaptability of plants and how they grow in natural conditions. Through the methodology of these scientists, the bioecological properties of T. foenum-graecum L. were thoroughly studied and the results were presented in a scientifically sound manner.

The experimental site was located in the experimental site of the State Agricultural University, organized by the Information and Advisory Center (Extension center) of the Tashkent State Agrarian University, which had suitable conditions for studying plants. Extensive data were collected on the basis of biometric and phenological data obtained during the study. Biometric and bioecological observations allowed obtaining accurate results through statistical analysis. Statistical data were processed using MS Excel, and plant development indicators were analyzed.

The results of the experiment helped to better understand the agricultural uses of Trigonella foenum-graecum L., its agronomic and ecological properties. It also allowed the development of new approaches and methods, which made it possible to compare the plant with similar plants. The results obtained in the study deepen the knowledge about the growth and development processes of the plant and show the possibilities of its application in agricultural practice.

The obtained data will serve to determine the ability of T. foenum-graecum L. to adapt to various soil and climatic conditions of Uzbekistan. In the future, there is a possibility of cultivating this plant on an industrial scale, which is expected to contribute to the development of the pharmaceutical industry in our country. Also, cultivating the plant and exporting products from it can increase the competitiveness of Uzbekistan in international markets.

Experimental (research) results and their discussion

In this study, the germination rate of T. foenum-graecum (Greek shambala) seeds in field conditions was studied at different sowing dates and under different agroclimatic conditions. The results presented in the table below include the specific conditions of each date and the observed germination indicators.

Table 1 T. foenum-graecum under d ala conditions

Sowing time	Number of seeds sown, pcs.	Air temperature, t ° C	Relative humidity, (%)	Soil surface temperature, t ° C	Germinated seeds,%
10.02.20 23	100x4	2 6	5 5 , 5	1 7 , 6	50.5 - 58.0
1 0 .03.20 23	100x4	15	5 9 , 0	1 8 , 0	80.0 - 89.0
10.0 4 .20 23	100x4	1 3	7 1 , 2	1 6 ,7	51.0 - 63.0
1 0.11.20 24	100x4	6	6 3 .8	16, 6	4 6.0 - 48.0
1 0 .10.20 24	100x4	2 5	60, 9	17.9	57.0 - 69.0
10 .09.20 24	100x4	3 1	61 .0	20 ,1	90.0 - 92.0

10.02.2023 (February): The air temperature was 26°C and the soil temperature was 17.6°C, which is one of the least effective conditions for seed germination. The relative humidity was 55.5%, and its higher value did not ensure proper germination. Thus, the germination rate was in the range of 50.5-58.0%. These results indicate that the conditions used for T. foenum-graecum seeds in February are not very effective.

10.03.2023 (March): The air temperature was 15°C and the soil temperature was 18.0°C, which was favorable for germination in March. The relative humidity was 59.0%, which was moderate, but germination was in the range of 80.0-89.0%. These results indicate that March is the optimal sowing time for T. foenum-graecum seeds.

10.04.2023 (April): The air temperature was 13°C and the soil temperature was 16.7°C, which was the lowest germination rate in April. The relative humidity was 71.2%, which was an excessive barrier to seed germination due to air and soil conditions. Seed germination was in the range of 51.0-63.0%, and its low level was due to the lack of agrotechnical conditions.

10.09.2024 (September): In September, when the air temperature was 31°C and the soil temperature was 20.1°C, the highest germination rate reached 90.0-92.0% , creating the most favorable conditions for T. foenum-graecum . The relative humidity was 61.0%, and these conditions provided high efficiency for the seeds. At the same time, the germination results in September indicate that the timing of autumn sowing also gives very good results.

10.10.2024 (October): Germination in October was in the range of 57.0-69.0% with air temperature of 25°C and soil temperature of 17.9°C. Relative humidity was 60.7%, providing some comfort and balanced moisture conditions in October. However, the lower germination in October led to long-term overall changes.

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10.11.2024 (November): The germination rate in November, with an air temperature of 6°C and a soil temperature of 16.6°C, was 46.0-48.0%. This indicates that the low air temperature in November does not have a positive effect on seed germination.

1. Appearance of a plant of T. foenum-graecum grown from seeds in the field




Research results this shows that T. foenum - graecum seeds sprout output for March and September months the most comfortable This is at times relative humidity and soil temperature seeds for comfortable to be , to be high to efficiency take The low results reported in the article were due to low temperatures and conditions in April and November. The results of this study will help determine the most appropriate planting times for T. foenum-graecum in the field.

Conclusion:

The results from the experiment confirm that March and September are the most favorable months for germination of T. foenum-graecum seeds. These sowing dates resulted in high yields, while conditions in other months resulted in reduced germination rates. This study is important in determining the optimal sowing times to ensure maximum plant yield.

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