

Biometric Indicators and Introduction Evaluation of *Rubia Tinctorum* L. and *Mentha Piperita* L. in the Soil-Climate Conditions of Khorezm Region

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Abstract This article discusses the results of scientific research on seedling density, growth, development and introduction evaluation of rhizome medicinal plants such as rose madder (*Rubia tinctorum*) and peppermint (*Mentha piperita*), which are grown in moderately saline soils of Khorezm region.

Keywords Rose madder, Peppermint, Growth and development, Fertility, Biometric indicators, Soil-climate condition, Khorezm region

1. Introduction

The increasing need of the pharmaceutical industry for medicinal raw materials obtained from plants on a global scale, furthermore, a sharp decrease in the reserves of wild medicinal plants growing naturally led to the need to cultivate medicinal plants, and laid the foundation for the development of the field of medicinal plant science [1; pp. 96-100].

However, since many rare and valuable medicinal plants are declining in nature or are ecologically inconvenient and unstable, it is not possible to obtain unlimited raw materials from them. However, it should also be noted that before cultivation of introduced medicinal plants, it is necessary to study their biological, physiological, ecological properties, as well as their biochemical composition in detail. Therefore, the cultivation of some rare and valuable introduced medicinal plants, the establishment of large plantations on an industrial scale, and their introduction into pharmaceutical practice are of great practical and scientific importance [2; pp. 59-62].

2. Aim and Methods of the Research

In order to obtain a high and quality raw material from medicinal plants, it is necessary to first of all apply modern agrotechnologies of cultivation through in-depth study of their biological properties.

For this reason, in our scientific research, bioecological properties, growth, development and Introduction resistance of medicinal plants such as rose madder– *Rubia tinctorum* L. and peppermint– *Mentha piperita* L. were studied in the soil-climate conditions of Khorezm region based on biological requirements.

Despite the fact that these rhizome medicinal plants have been studied in other regions of our republic, there is no information about their ecological and biological properties in Khorezm region.

Experiments were conducted in 2020-2022 in the field and laboratory conditions of moderately saline soils of “Mangu-Hayot” farm located in Koshkopir district of Khorezm region and the phenological, morphological and bioecological characteristics of the Rose madder and peppermint plants were studied.

The soil of the land lab in the farm are moderately saline, located close to the Polvon main irrigation system, and the level of water supply is moderate. The thickness of humus layer is around 18-36 cm. According to the soil map, the quality score of the soil is 62. The underground water is at a depth of 187 cm and has a pure salty taste.

The selection of the experimental field and conducting the experiment, taking and analyzing soil and plant samples, and phenological observations were carried out based on the recommendations of the scientists of the Scientific Research Institute of Plant Science of Uzbekistan.

Processing of phenological observation data was carried out according to the method of V.N. Nilov, taking into account the specific features [3; pp. 282-284].

Phenological observations were conducted from the germination process to the maturity of plants. The beginning of the development phase was considered when 10% of the

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plants appeared, and the full phase was determined with the observation of the 75 percent of the plants [4; pp. 50-52].

3. The Obtained Results and Their Discussion

It is known that in the field of medicinal plant science, biometric indicators are aimed at optimizing the process of species and varieties of plants, accelerating their growth and development, increasing productivity, and choosing optimal conditions for cultivation [5; pp. 89-92].

For the purpose of growing on large areas and plantations, each plant must have appropriate biometric indicators in order to obtain its maximum yield from medicinal plants that have been introduced into agriculture, additionally, the number and size of leaves at the beginning and end of different development phases, the development and density of roots and rhizomes, the length of the stem, the number and diameter of fruits, etc. should be taken into account [6; p. 168].

Based on the tasks of scientific research, biometric indicators during the growth and development of bioecological properties of rose madder and peppermint were studied in our experiments during 2020-2022.

In the fields where rose madder rhizomes were transplanted, it was observed that the height of the plant at the end of the development phase was 18.1 cm in 2020, 50.3 cm in 2021, and 91.2 cm in 2022. According to the results of the 3-year research, it was noted that the height of the rose madder was 53.2 cm. The height of the main stem was 17.8 cm in 2020, 26.1 cm in 2021 and 34.0 cm in 2022, and on average, it was 26.0 cm for three years. In terms of the number of lateral branches, 4.2 units in 2020, 7.4 units in

2021, 7.8 units in 2022 were noted, and average results were 6.5 units for three years (Table 1).

When the root length and the number of small rhizomes of rose madder were studied in the experiment, 14.7 cm and 31.8 units in 2020, 19.7 cm and 50.3 units in 2021, 23.9 cm and 64.7 units in 2022 were observed. On average, the results were 19.4 cm and 48.9 units for three years.

Based on the results of long experiments on the biometric indicators and productivity of rose madder, the yield of 7.1 c/ha in 2020, 8.7 c/ha in 2021, and 10.2 t/ha in 2022 were obtained, all in all, it was noted that the total yield was 26.0 c/ha, and the average yield was 8.6 c/ha in 2020-2022 (Table 1).

Based on the observations, at the end of the development phase, the height of peppermint was 30.9 cm in 2020, this figure was 79.6 cm in 2021, and 82.4 cm in 2022. As a result of the average 3-year research, it was found that the height of peppermint was 64.3 cm, and the height of the main stem was 25.0 cm in 2020; 54.3 cm in 2021, 51.1 cm in 2022. According to the average 3-year results, it was noted that the height of the main stem of peppermint was 43.5 cm. In terms of the number of lateral branches, 7.2 units in 2020, 8.7 units in 2021, 7.3 units in 2022 were noted, and it was found that the average 3-year indicators were 7.7 units (Table 2).

When the root length and the number of small rhizomes were studied, 9.6 cm and 5.3 units in 2020, 13.4 cm and 8.1 units in 2021, 14.9 cm and 8.6 units in 2022 were observed and according to the average results of 3 years, the figure was found to be 12.6 cm and 7.36 units.

When studying peppermint leaf yield in the conditions of moderately saline soils of the Khorezm region, it was noted that 1.2 t/ha in 2020, 1.5 t/ha in 2021, and 1.8 t/ha in 2022 were obtained, during the period of 2020-2022, the total yield was 4.5 t/ha, on average-1.5 t/ha (Table 2).

Table 1. Biometric indicators of Rose madder in 2020-2022

N	Biometric indicators	2020 y	2021 y	2022 y	Three years on average
At the end of the development phase					
1	Plant height, cm	18,16±0,19	50,33±0,23	91,24±0,34	53,24±0,16
2	The height of the main stem, cm	17,82±0,22	26,14±0,28	34,0±0,32	26,0±0,18
3	The number of lateral branches, units	4,4±0,04	7,4±0,08	7,8±0,05	6,5±0,04
4	Root length, cm	14,7±0,04	19,7±0,01	23,9±0,03	19,4±0,01
5	Number of small rhizomes, units	31,8±0,2	50,3±0,1	64,7±0,1	48,9±0,1
6	Productivity, centener/hectares	7,1±0,01	8,7±0,01	10,2±0,01	8,6±0,01

Table 2. Biometric indicators of peppermint in 2020-2022

T/r	Biometric indicators	2020 y	2021 y	2022 y	Three years on average
At the end of the development phase					
1	Plant height, cm	30,9±0,19	79,6±0,26	82,4±0,31	64,3±0,14
2	The height of the main stem, cm	25,0±0,32	54,3±0,42	51,1±0,29	43,5±0,24
3	The number of lateral branches, units	7,2±0,1	8,7±0,09	7,3±0,06	7,7±0,06
4	Root length, cm	9,6±0,15	13,4±0,19	14,9±0,1	12,6±0,09
5	Number of small rhizomes, units	5,3±0,08	8,1±0,09	8,6±0,11	7,3±0,05
6	Productivity, centener/hectares	1,2±0,01	1,5±0,02	1,8±0,01	1,5±0,01

Table 3. Evaluation of rose madder based on the introduction scale

№	Indicators	Level of indicators						Highest rate
I	Salinity resistance	High	30	Average	20	Low	10	30
II	Demand for moisture	Less	15	Average	10	High	5	5
III	High temperature condition	Resistant	15	Average	10	Irresistant	5	15
IV	Low temperature condition	Resistant	15	Average	10	Irresistant	5	15
V	Natural reproduction	Intensive	25	Average	15	non-reproductive	5	25
Total								90

Table 4. Evaluation of peppermint based on the introduction scale

№	Indicators	Level of indicators						High rate
I	Salinity resistance	High	30	Average	20	Low	10	20
II	Demand for moisture	Low	15	Average	10	High	5	10
III	High temperature condition	Resistant	15	Average	10	Irresistant	5	15
IV	Low temperature condition	Resistant	15	Average	10	Irresistant	5	10
V	Natural reproduction	Intensive	25	Average	15	non-reproductive	5	25
Total								80

Introduction evaluation is the final stage of studying to grow certain introduced plants, aiming at determining the most promising plant species or varieties for use in this area, and their resistance to various stress factors (cold, winter, salinity, drought) [7; pp. 97-102].

Currently, the demand for raw materials of medicinal plants is increasing in pharmaceutical practice and in the production of natural medicines. and due to this, the introduction of medicinal plants and their evaluation on introduction resistance is of great scientific and practical importance [8; p. 20].

This evaluation was based on scientific research tasks, in the moderately saline soil and climate conditions of the Khorezm region, the introduction of medicinal plants with rhizomes such as rose madder and peppermint was evaluated based on a five-point scale developed by B.Y. Tokhtayev for medicinal plants in saline soils.

The introduction evaluation of the rose madder plant in the moderately saline soil-climate conditions of the Khorezm region showed was proven to be strong, its demand for moisture is high, it is resistant to high and low temperatures, and its natural reproduction is fast (Table 3).

It was found that the introduction evaluation of peppermint in moderately saline soil-climate conditions of Khorezm region is somewhat weak. In particular, it was observed that resistance to salinity and humidity is average, it is resistant to high temperature, but its resistance to low temperature is average, its natural growth is intensive (Table 4).

4. Conclusions

In general, it was concluded from the results of scientific research and experiments that the studied rhizome medicinal plant rose madder were noted to grow well under the conditions of moderately saline soils of the Khorezm region.

Furthermore, it was observed to have higher results during the second and third years in terms of the height of the plant, the height of the main stem, the length of the root and the number of small rhizomes, as well as the yield. It was found that peppermint rhizomes could not adapt to moderately saline soils in the first year, but showed their adaptive properties in the second and third years. From the results of the scientific experiment conducted on the introduction evaluation, it was concluded that the results for rose madder is very high, and it was found that it has an average scale of 90 points. Peppermint was found to be slightly weaker than rose madder and was noted to have an average score of 80 on the scale.

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