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Effect of Mineral Fertilizers on the Yield of Raw Materials of Salvia *(Salvia Officinalis L)*

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ABSTRACT
In this article, it was observed that different rates of mineral fertilizers were used to accelerate the cultivation of medicinal plants in the soil and climatic conditions of Tashkent city, where have a positive effect on increasing the yield of seedlings and quicksets. The $N_{90}P_{60}K_{40}$ norm gave good results for the rapid growth of plants when fed with different norms of mineral fertilizers used in the experiment. Here is the data on the technology of cultivation of seeds and quicksets of salvia plants.
Keywords: medicinal salvia, agrotechnology, mineral fertilizers, raw materials, soil, cultivation, productivity, growth, and development rate.

INTRODUCTION
Importance of the topic- today, in the world and our country, consistent reforms are being carried out in the establishment of plantations for the cultivation of medicinal, food plants, and their processing.
In later years, the pharmaceutical industry has been developing rapidly in many countries, including the Republic of Uzbekistan. Therefore, the demand for pharmaceutical companies for raw materials for medicinal plants is growing rapidly. To further strengthen the activities in this direction, on May 3, 2017, the President of the Republic of Uzbekistan signed a decree "Nukus-farm", "Zomin-farm", "Kosonsoy-farm", "Syrdarya-farm", "Boysun-farm", "Bustonlik-farm" and Decree P CP-5032 on the establishment of free economic zones "Parkent-farm" was published [1].

The decree identifies the establishment of free economic zones as a priority in the further development of the pharmaceutical industry.
According to the decree, today in Uzbekistan, 146 local pharmaceutical companies produce more than 2000 types of medicines. It was noted that the world pharmaceutical industry produces 8500 types of medicines, 6300 of which are imported for the needs of our people.
Necessary measures have been developed to ensure the implementation of paragraph 1.12 of the reports of the meeting dated January 20, 2015 №5 "On measures to further develop the forestry system, further expand the cultivation, preparation and processing of medicinal and food plant raw materials in 2015-2017" [2].

Also, paragraph 23 of Annex 7 to the Resolution of the President of the Republic of Uzbekistan dated May 11, 2017 No PD-2966 "Implementation of scientific and practical projects for the protection of wild medicinal plants in the conditions of climate change in Uzbekistan and the establishment of plantations of cultivated medicinal plants and their expansion." planned to increase [3].
It is known that 71 out of 350 species of medicinal plants currently used in medical practice are grown on industrial plantations established in the country. This is not enough to continuously produce medicines that are in high demand and demand under local conditions. With this in mind, the establishment of new plantations in areas with productive capacity, clean and ecologically clean is one of the main tasks of the developing pharmaceutical industry.

For the establishment of industrial plantations of medicinal plants, it is necessary to develop agrotechnologies for the selection and cultivation of varieties adapted to local soil and climatic conditions, as well as to create sufficient conditions for the manifestation of the biological potential of plants.
It should also be noted that due to the limited reserves of naturally growing medicinal plants, the growing demand of the pharmaceutical industry for raw materials for medicinal plants in the future can be met mainly through the cultivation of medicinal plants.

As stated in the Resolution of the President of the Republic of Uzbekistan dated April 10, 2020, No. PD-4670 "On measures for the protection, cultivation, processing and rational use of available resources of wild medicinal plants" in later years, the protection of medicinal plants, rational use of natural resources,consistent reforms are underway in the use, establishment, and processing of plantations where medicinal plants are grown [4].
Medicinal plants are one of the main areas of forestry, and it is important to provide the pharmaceutical industry and the population with quality, environmentally friendly medicinal plant raw materials. It is also necessary to establish the cultivation of medicinal plants and the primary processing of raw materials on farms and other forms of ownership.
It should be noted that in our country the raw material for medicinal plants,despite the sharp increase in demand, the technology of growing many medicinal plants have not yet been perfectly developed.

The volume of cultivation of medicinal plants in the country is determined by the level of formation of seed reserves and the lack of regional agro-technologies for their cultivation. Therefore, scientific research is being conducted to determine the biological properties of medicinal plants and to develop effective methods to increase their productivity.
It should be noted that despite the sharp increase in demand for raw materials for medicinal plants in the country, many technologies for growing medicinal plants have not yet been fully developed.
To date, the technology of cultivation of medicinal salvias in the country has not been developed. So far, the recommendations of Russia, Ukraine, and other countries have been used in the cultivation of these plants [5].

Research is also carried out in Uzbekistan on the cultivation of medicinal plants in different soil and climatic conditions, the study of their bioecological properties (N.K.Safarova, E.B.Nikitina, D.A.Abdullaev, K.S.Safarov) [6, 7].
According to D.Yormatova (2000), the medicinal salvia grows well in fertile soils. There is a special area for salvia, which is not included in the rotation, where it is planted for 2-3 years. In the first year, it forms a rosette, in the second year it grows well and gives the raw material for branching. Produces inflorescences and fruits. Salvia is effective against organic and mineral fertilizers. A complete norm of 20 tons of manure and mineral fertilizers (N 30-40, P-50, and K 40 kg) was applied per hectare [8].

N.P. Perepechko (1967) constructed and studied the biology of medicinal salvia, agrotechnical cultivation in the data of his field experiments. Crops grown in early spring loosened the topsoil and cut the plants, resulting in reduced seed production and increased leaf mass by 35–40 percent. All studied medicinal plants are demanding fertilizers. The most effective organic-mineral fertilizer was 20 t / ha and fed with manure or compost of 30–40 t / ha. Nitrogen plays an important role in the growth and development of the vegetative organs of plants. It is also recommended to increase its norms when food is demanding [9].
The Resolution of the President of the Republic of Uzbekistan "On measures to expand the scope of scientific research on the development of cultivation and processing of medicinal plants, their seed production" (No. PD-4901, 26.11.2020) was adopted. According to the decision, the

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direction "Agrotechnology of cultivation of medicinal plants" will be opened in all colleges and technical schools specializing in agriculture [10].

METHODS AND MATERIALS

The object of study was taken as medicinal salvia (Salvia officinalis L.). Commonly used methods were used in the studies (Borisova, Beydeman, Ponomarev, Zaytsev, Yarosh, Terexin, Torikov V.E., et al.) [11]. During the study, the yield of medicinal salvia seeds and quickset was studied. The research was conducted in 2020 in the field of scientific experiments of the laboratory "Introduction of medicinal plants" of the Botanical Garden in Tashkent. The soils of the experimental field are sierozem soils, and according to the agrochemical analysis of the soils, the amount of humus in the tillage layer is 1.122%. Total nitrogen was 6.25%, total phosphorus was 13 mg / kg, and potassium was 221 mg / kg [12].

RESULTS AND DISCUSSION

$N_{30}P_{60}K_{40}$, $N_{60}P_{60}K_{40}$, and $N_{90}P_{60}K_{40}$ mineral fertilizer norms were applied to accelerate the cultivation of seeds and quickset of medicinal salvia plants. itwas obtained as a control option fertilizer-free field. In each variant, protective rows, observable model plants (at least 10) were identified, phenological observations of the medicinal salvia plant, biometric measurements were carried out (Fig. 1).

The effect of mineral fertilizers on medicinal salvia seedlings. When one model of medicinal salvia seedlings planted in the experimental fields was applied according to the norms of mineral fertilizers for the plant, the number of branches was 21, the number of leaves was 315, the root length was 248 cm and the leaf surface was 12.7 cm^2.

Figure 1. An overview of the experimental area propagated from medicinal salvia seeds and quicksets

In the second variant, these figures were 22 branches, 353 leaves, 367 cm in root length, and 13.2 cm^2 in leaf area. In the third variant, the number of branches was 24, the number of leaves was

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412, the root length was 378 cm and the leaf area was 16.4 cm^2. In the fourth variant, these figures were 27 branches, 482 leaves, 393 cm of root length, and 19.3 cm^2 of leaf area. In this case, the number of branches relative to the control was 1.2; the number of leaves and root length 1.5; increased the area of the leaf by 1.5 times, i.e., 151% (Table 1).

Table 1
Effect of mineral fertilizerson the medicinal salvia

Options	For a single model plant			
	number of leaves, piece	number of branches, piece	length of root, cm	Leaf area, cm^2
Control	315	21	248	12,7
$N_{30}P_{60}K_{40}$	353	22	367	13,2
$N_{60}P_{60}K_{40}$	412	24	378	16,4
$N_{90}P_{60}K_{40}$	482	27	393	19,3

Yield indicators of seedling development of salvia plant. The diagonal method was used to determine the yield of medicinal salvia seedlings in the experimental fields. The yield of medicinal salvia seedlings was collected based on 4 variants of 3 repetitions per $1m^2$ and measured wet. After the wet weight of the raw material was determined, it was dried and re-measured and the yield was determined for an average of 1 kg/ha.
The effect of salvia seedlings on variants in the application of different rates of mineral fertilizers was determined. In this case, the dry mass of raw material per 1 m^2 (leaf) of medicinal salvia seed is 714.0 g in the control variant, 7140 kg per hectare, in the fourth variant in $1m^2$, 1392.5 g per area; 13925 kg/ha. Compared to the control, the dry mass of the plant increased by 1.9 times or 195%.
The dry mass of flowers is 136.6 g, 1366 kg/ha under control in a $1m^2$ area; in the variant applied by the norms of mineral fertilizers, $N_{90}P_{60}K_{40}$ was 284.8 g per $1m^2$, 2848 kg per hectare. It was observed that the dry mass of flowers was 2.0 times higher than the control, which is 208% higher.
cultivated salvia seeds under control were 67.7 g per 1 m^2, 677 kg per hectare; in the second variant, it was 78.6 g, 786 kg per hectare; in the third variant, the indicator was 114.6 g, 1146 kg/ha; in the fourth variant, it was 125.1 g, i.e. 1251 kg/ha (Table 2).

Table 2
Yield indicators of leaves, flowers, raw materials, and seeds per 1 m^2 of seedling development of salvia plant

Options	The dry mass of leaves		The dry mass of flowers		Seeds	
	per $1м^2$, g	kg/ha	per $1м^2$, g	kg/ha	per $1м^2$, g	kg/ha
Fertilizer-free	714,0	7140	136,6	1366	67,7	677
$N_{30}P_{60}K_{40}$	934,7	9347	187,0	1870	78,6	786
$N_{60}P_{60}K_{40}$	1076,1	10761	212,3	2123	114,6	1146
$N_{90}P_{60}K_{40}$	1392,5	13925	284,8	2848	125,1	1251

The yield of seedlings of salvia plant cut in spring. Seeds of the salvia plant were cut by 5-8 cm in spring each year and their yield was determined. Accordingly, it was observed that the yield of raw material was higher than that of the uncut variants of the salvia plant.

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Table 3
The yield of the raw material of medicinal salvia seed per 1m^2 (leaf)

Options	wet mass, g		dry mass, g	
	per 1m^2, g	kg/ha	per 1m^2, g	kg/ha
Fertilizer-free	1974,2	19742	863,5	8635
$N_{30}P_{60}K_{40}$	2986,3	29863	1050,4	10504
$N_{60}P_{60}K_{40}$	3446,7	34467	1126,4	11264
$N_{90}P_{60}K_{40}$	4570,5	45705	1476,3	14763

Accordingly, the yield of raw material per 1 m^2 of area (leaf) of medicinal salvia seed was 863.5g, 8635 kg/ha in dry mass control; in the second variant, it was found 1050.4 g, 10504 kg/ha; in the third variant, it was 1126.4g, 11264 kg/ha; in the fourth variant, it was 1476.3 g, 14763 kg/ha (Table 3).

Seedlings are grown from quicksets of the salvia plant. The results obtained for the seedlings of the salvia plant grown in the experimental areas were found to be higher in quicksets (Fig. 2).

Figure 2. The period of mass flowering of seedlings grown from quicksets of salvia plant

The effect of mineral fertilizers on medicinal salvia seedlings. When one model of medicinal salvia quicksets planted in the experimental areas was applied according to the norms of mineral fertilizers for the plant, the following was observed: in the fertilizer-free control variant the number of branches was 36, the number of leaves was 1038, the root length was 326 cm and the leaf area was 12.2 cm^2.

Table 4
The effect of mineral fertilizers on medicinal salvia

Options	For a single model plant			
	number of leaves, piece	number of branches, piece	root length, cm	Leaf area, cm^2

Control	1038	36	326	12,2
$N_{30}P_{60}K_{40}$	1059	38	367	12,9
$N_{60}P_{60}K_{40}$	1483	40	433	14,3
$N_{90}P_{60}K_{40}$	1560	42	512	18,3

In the second variant, the number of branches was 38, the number of leaves was 1,059, the root length was 367 cm, and the leaf area was 12.9 cm^2. In the third variant, the number of branches was 40, the number of leaves was 1483, the root length was 433 cm, and the leaf area was 14.3 cm^2. In the fourth variant, these figures were 42 branches, 1560 leaves, 512 cm in root length, and 18.3 cm^2in leaf area. In this case, the number of branches relative to the control is 1.1; increased the number of leaves and root length as well as the leaf surface by 1.5 times (Table 4).

Productivity indicators of quicksets of salvia plant development. In the studies, the quicksets of the cultivated plant were dried and re-measured after determining the wet weight of the raw material and the average yield was determined for 1 kg/ha.

The effect of salvia seedlings on variants in the application of different rates of mineral fertilizers was determined. At the same time, the dry mass of raw material per 1 m^2 (leaf) of medicinal salvia quicksets is 940.7 g per hectare in the control variant, 9407 kg per hectare, in the fourth variant per 1 m^2, it was found 1918.5 g per area; 19185 kg/ha. Compared to the control, the dry mass of the plant increased by 1.9 times or 195%.

The dry mass of flowers was 168.8g, 1688 kg/ha under control in 1m^2 area; in the variant applied with $N_{90}P_{60}K_{40}$rates of mineral fertilizers was 310.3g / ha per 1m^2, 3103 kg/ha. It was observed that the dry mass of flowers was 1.8 times higher than the control, which is 183% higher.
cultivated salvia seeds under control were 150.9 g per 1m^2, 1509 kg per hectare; in the second variant, it was 163.3g, 1633 kg per hectare; in the third variant, it was 181.2g, 1812 kg/ha; in the fourth variant, it was 186.8 g, i.e. 1868 kg/ha (Table 5).

Table 5
The yield of leaves, flowers, raw materials, and seeds of quicksets of medicinal salvia in 1m^2 area, c / ha

Options	the dry mass of leaves		the dry mass of flowers		Seeds	
	per 1 m^2, g	kg/ha	per 1 m2, g	kg/ha	per 1 m2, g	kg/ha
Fertilizer-free	940,7	9407	168,8	1688	150,9	1509
$N_{30}P_{60}K_{40}$	1169,6	11696	223,2	2232	163,3	1633
$N_{60}P_{60}K_{40}$	1626,1	16261	262,8	2628	181,2	1812
$N_{90}P_{60}K_{40}$	1918,5	19185	310,3	3103	186,8	1868

The yield of quicksets of salvia plant cut in spring. The quicksets of the Salvia plant were cut by 5-8 cm every spring and the yield was determined. Accordingly, it was observed that the yield of raw material was higher than that of the uncut variants of the salvia plant.

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Figure 3. The appearance of plant growth and development according to the variants of salvia plant (cut 5-8 cm in spring)

Accordingly, the dry mass of raw material per 1 m^2 area (leaf) of medicinal salvia quicksets was 1024.6 g, 10246 kg/ha; in the second variant, it was found 1234.6 g, 12346 kg/ha; in the third variant, it was 1735.8 g, 17358 kg/ha; in the fourth variant, it was 1845.3 g, 18453 kg/ha (Table 6, Fig. 3).

Table 6
The yield of raw material per 1 m^2 of a leaf (cut into 5-8 cm)

Options	wet mass, g		dry mass, g	
	per 1 m^2, g	kg/ha	per 1 m^2, g	kg/ha
Fertilizer-free	3203,2	32032	1024,6	10246
$N_{30}P_{60}K_{40}$	3566,7	35667	1234,6	12346
$N_{60}P_{60}K_{40}$	5485,6	54856	1735,8	17358
$N_{90}P_{60}K_{40}$	5684,3	56843	1845,3	18453

CONCLUSIONS

Based on the above data, it can be concluded that in the soil and climatic conditions of the Tashkent Botanical Garden, the application of different rates of mineral fertilizers for the accelerated cultivation of seedlings and quicksets of medicinal salvia increased the number of plant branches by 1.2 times, number of leaves, leaf area and root development by 1.5 times, i.e., 151% compared to controls.

When mineral fertilizers were applied to the medicinal salvia with the $N_{90}P_{60}K_{40}$norms, the yield increased by 1.9 times, i.e 195%, compared to the control, the dry mass of raw material per 1m^2 (leaf).

It was noted that the yield of the dry mass of flowers of plants was 208% higher than the control per 1m^2 area, and the yield of seeds was 184% higher.

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