

# The productivity of raw seeds and cuttings (leaf) of *Salvia officinalis* L. medicinal plants

Safargul Ulugova<sup>1</sup>, Umid Ruzmetov<sup>1\*</sup>, Abdushukur Hamzayev<sup>1</sup>, and Askarboy Yunusov<sup>1</sup>

<sup>1</sup>Research Institute of Forestry, 111104 Tashkent, Uzbekistan

**Abstract.** This article highlights the different portions of minerals in fertilizer mixture used for the acceleration of cultivation of the medicinal plant of Sage in soil – climatic conditions of Syrdarya region. The obtained results showed that different portions of minerals in fertilizer mixture have a positive effect on increasing the yield of seedlings and cuttings of the plant. When feeding with different sharings of mineral fertilizers used in an experiment, applying Nitrogen-90, Phosphorus - 60 and Potassium - 40 kg/ha norms has given good results to the rapid growth of plants. This article provides information on the technology of intensive cultivation of seedlings and cuttings of Salvia plant.

## 1 Introduction

Medicinal plants are considered as globally valuable sources of new drugs [1, 2]. Furthermore, up to 80 % of people in developing countries are solely dependent on herbal drugs for their primary healthcare, and over 25 % of prescribed medicines in developed countries are come from the different wild plant species [3]. With the constantly increasing demand for natural health products, and secondary metabolites of medicinal plants, the application of medicinal plants is growing fastly throughout the world [4]. Nevertheless, the production of various medicinal plants has been accompanied by multiple problems (insufficient equipment, insufficient organization, both human and technical, incoherence of science and practice, fragmentation of programs, limited number of cultivated species, unsuitable varieties, small and fluctuating yields, underdeveloped market, unsatisfactory quality etc.) [5, 6]. Nowadays, the situation is gradually changing to the better. Numerous problems have been overcome; the structure of medicinal plant production has been notably improved. New varieties and new species are being introduced and the results of scientific research are being applied more and more [7-10]. The number of commodity producers is increasing both in the individual and social sectors, and the cultivation of medicinal plants is becoming their only or main occupation. The nature of Uzbekistan is distinguished by its uniqueness, fresh water, sun, air and soil. The flora is very diverse and there are more than 4560 species of wild plants of which 577 are medicinal, 103 are dyes and 560 are essential oils. 250 species of such medicinal plants are being used in scientific medicine. Researches are also being conducted in Uzbekistan on the cultivation of medicinal plants in different soil and climatic conditions and the study of their biological properties [11, 12].

Today, 2,500 species of 20,000 land plants found in the territory of the Commonwealth of Independent States have been found to have medicinal properties, of which about 250 species are widely used in scientific medicine. Today, more than 50 species of them are grown as medicinal plants. Now there are more than 4,500 species of wild plants in the territory of the Republic of Uzbekistan. Of these, 600 species have been identified as medicinal properties, of which 50 species are used in scientific medicine [13]. The need for medicines made from medicinal plants is growing day by day. This, in turn, requires a comprehensive study of medicinal plants and their wider use [14].

When the winter is very cold in Uzbekistan, the non-wooded branches of the medicinal Salvia will be frozen. The plant is heat-loving, loves light, drought-resistant. A good yield can be obtained from an established plantation for 13-15 years. Taking into account the biological characteristics, areas are selected for planting, free from weeds, fertile, irrigated, well water leaked, groundwater is deep, away from highways [15].

Medicinal Salvia plant is grown in Moldova, Krasnodar and Ukraine. It is a perennial semi-shrub, reaching 20-50 cm in height. Flowering period is June and July. The content of essential oils in the leaves is 0.5-2.5%. Picking of leaves is carried out during the flowering period of the plant. Salvia plant is widely used in medicine. In particular, it can be used in stomatitis, tooth powder, ulcers, inflammation of the liver, gastritis, hemorrhoids and other diseases [16].

Growing Salvia plant in well-irrigated soils with moderate mechanical content gives good results. Salvia plant is heat-loving, light-loving, drought-resistant, it can get high yields using cultivated lands for 4-5 years. It is recommended to irrigate up to 7-8 times in the first year during the season. It has been suggested that 100-110 kg of nitrogen, 70 kg of

\*Corresponding author: [umid\\_ruzmetov@mail.ru](mailto:umid_ruzmetov@mail.ru)

phosphorus and 50 kg of potassium fertilizers per hectare during the vegetation season give good results for good plant growth and development [17].

## 2 Materials and Methods

The aim of this study was medicinal *Salvia officinalis L.*. Commonly used methods were used in the studies Dospikhov [18]. The phenological observations were conducted by Beydeman method. The initial stages of the main phases of plant development were recorded [19] and carried out according to State Standards (UzStd).

During the study, the yield of medicinal *Salvia* seedlings and cuttings was studied. The research was conducted in 2020 in the Syrdarya State Forestry Area in Syrdarya Region.

Agroclimatic indicators show that the Syrdarya region is located in desert, semi-desert and gray soils of Central Asia in terms of zonal-climatic conditions. Summer in the Syrdarya region is hot and dry, winter is moderate, and there are large fluctuations in temperature between daily and annual temperatures. The average annual air temperature in the region is around + 11.70S. The highest temperature is in June-July, it is + 39.30C, and the coldest is in December, January, February, around -3.7-2.30C.

The relative humidity is not large, in April-May the average is 70-64, the minimum humidity is around 47-38%. Monthly precipitation 1; 2; 3; 4; 32.3; 73.7 in 5 months; 10.9; 80.3; 52.9 mm. This state of nature leads to salinization of the soil and an increase in the demand of crops for water.

## 4 Results and Discussions

### 4.1. The effect of mineral fertilizers on medicinal *Salvia* seedlings

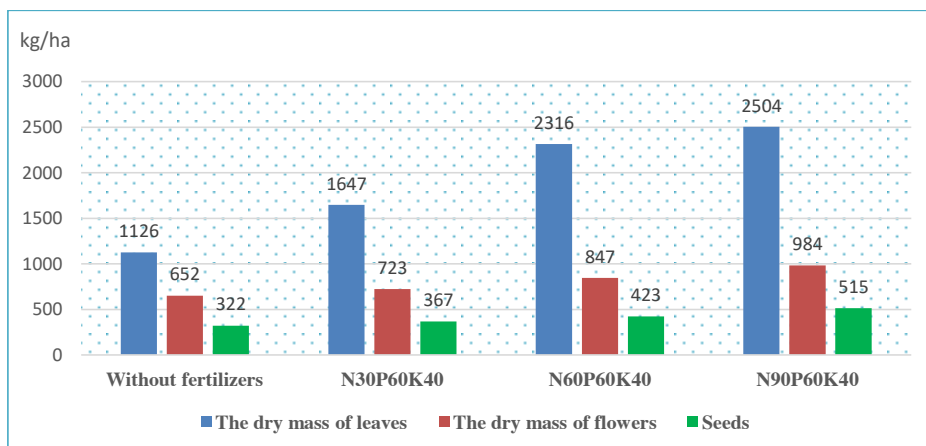
In the second year of the study, when a single model of medicinal *Salvia* seedlings was applied according to the norms of mineral fertilizers for the plant, it was as follows:

in the fertilizer-free control variant, the number of branches was 9, the number of leaves was 158, the root length was 142 cm, and the leaf surface was 11.4 cm<sup>2</sup>. In the second variant, these figures were 10 branches, 176 leaves, 164 cm in root length and 11.9 cm<sup>2</sup> in leaf area. In the third variant, the number of branches was 10, the number of leaves was 210, the root length was 198 cm and the leaf surface was 13.8 cm<sup>2</sup>. In the fourth variant, these figures were 11 branches, 263 leaves, 212 cm in root length and 15.7 cm<sup>2</sup> in leaf area.

**Table 1.** The effect of mineral fertilizers on medicinal *Salvia*

Variants	For a single model plant			
	number of leaves, pcs	number of branches, pcs	root length, sm	Leaf surface, sm <sup>2</sup>
Control	158	9	142	11.4
N <sub>30</sub> P <sub>60</sub> K <sub>40</sub>	176	10	164	11.9
N <sub>60</sub> P <sub>60</sub> K <sub>40</sub>	210	10	198	13.8
N <sub>90</sub> P <sub>60</sub> K <sub>40</sub>	263	11	212	15.7

### 4.2. Productivity indicators of seedlings growth of *Salvia* plant



**Fig. 1.** Yield indicators of leaves, flowers, raw materials, and seeds of seedling development of *salvia* plant

Diagonal method was used to determine the yield in medicinal Salvia plant seedlings in the experimental fields. The yield of medicinal Salvia seedlings was collected based on 4 variants of 3 returns per 1m<sup>2</sup> and measured its wet weight. After determining the wet weight of the raw material, it was dried and re-measured and the yield was determined for an average of 1 kg/ha. The effect of applying different norms of mineral fertilizers on each options of Salvia seedlings was determined. In this case, the dry mass of raw material (leaves) per 1 m<sup>2</sup> of medicinal Salvia seedlings in the control variant was 112.6 g, 1126 kg per hectare in the fourth option, 250.4 gram per 1m<sup>2</sup>, 2504 kg/ha. Compared to the control, the dry mass of the plant increased by 2.2 times, or 222%.

The dry mass of flowers was 65.2 g (652 kg/ha) under control in 1m<sup>2</sup> area, 98.4g per 1m<sup>2</sup>, 9840 kg per hectare in the variant applied with N90P60K40 norms of mineral fertilizers. It was observed that the dry mass of flowers was 1.5 times higher than the control, which was 150% higher.

The result was 32.2 g per 1m<sup>2</sup> of mature seeds of Salvia plant under control version. That is 3220 kg for per hectare. Similarly, in the second and third experiments the figures were 36.7 g, 3670 kg per hectare and 42.3g, (4230 kg/ha) respectively. But in the fourth experiment it was 51.5g (5150 kg/ha). That was 1.5 times or 159 percent higher compared to control version (Fig. 1). That was 1.5 times or 159 percent higher compared to control version (Figure 1.).

### 4.3. The effect of mineral fertilizers on medicinal Salvia seedlings

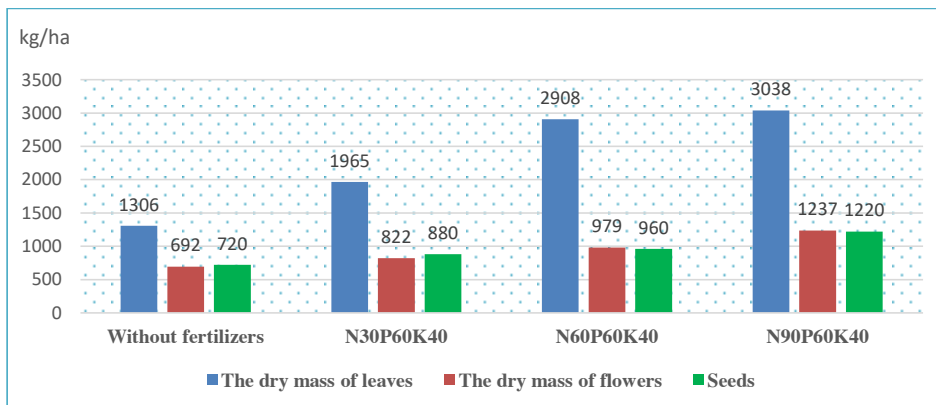
The development of medicinal Salvia cuttings was observed when applied according to the norms of mineral fertilizers for a single model plant as follows: in the fertilizer-free control variant, the number of branches was 10, the number of leaves was 184, the root length was 154 cm, and the leaf surface was 12.2 cm<sup>2</sup>. In the second variant, the number of branches was 11, the number of leaves was 193, the root length was 173 cm, and the leaf surface was 12.8 cm<sup>2</sup>. In the third variant, the number of branches was 13, the number of leaves was 232, the root length was 214 cm, and the leaf surface was 14.0 cm<sup>2</sup>. In the fourth variant, these figures were 14 branches, 284 leaves, 228 cm of root length and 16.2 cm<sup>2</sup> of leaf surface.

As a result, the number of branches relative to the control was 1.4 times increased. The number of leaves, root length and surface area of the leaf were improved by 1.3 times, 1.5 times and 1.4 times respectively (Table 2).

**Table 2.** The effect of mineral fertilizers on medicinal Salvia plant

Variants	For a single model of a plant			
	number of leaves, pcs	number of branches, pcs	root length, sm	Leaf surface, sm <sup>2</sup>
Control	184	10	154	12.2
N <sub>30</sub> P <sub>60</sub> K <sub>40</sub>	193	11	173	12.8
N <sub>60</sub> P <sub>60</sub> K <sub>40</sub>	232	13	214	14.0
N <sub>90</sub> P <sub>60</sub> K <sub>40</sub>	284	14	228	16.2

### 4.4. Productivity indicators of cuttings of Salvia plant



**Fig. 2.** Yield indicators of leaves, flowers, raw materials, and seeds of seedling development of salvia plant

After analyzing the wet weight of the raw material of the cuttings grown in the experiment, they were dried and re-measured and the yield was determined for an average of 1 kg/ha.

In the studies, the effects of applying mineral fertilizers with different norms for the Salvia plant seedlings were identified.

Dry mass of flowers 69.2g, 692 kg/ha under control in 1m<sup>2</sup> area; In the option of mineral fertilizers applied by N90P60K40 norms, the productivity was 123.7g per 1m<sup>2</sup>, 1237g/ha per hectare. It was observed that the dry mass of flowers was 1.7 times higher than the control, which was 178 percent.

A cultivated *Salvia* seed under control was 72g per 1m<sup>2</sup>, which is 720 kg per hectare. In the second and third experiments the results were 88g (880 kg per hectare) and 96g (960 kg/ha) respectively. In the fourth option it was 122g per m<sup>2</sup>, thus 1220 kg/ha. Seeds of the mature plant were found to increase 1.6 times or 169% compared to the control (Fig. 2.).

## 5 Conclusions

Based on the above data, it can be concluded that the application of different standards of mineral fertilizers for the accelerated cultivation of seedlings and cuttings of medicinal plants grown in the soil-climatic conditions of Syrdarya region increased the number of branches by 1.2-1.4 times, the number of leaves by 1.5-1.6 times, leaf surface area by 1.3 times, and the root development by 1.4 times.

When mineral fertilizers are applied to the seeds and cuttings of medicinal *Salvia* with nitrogen-90, phosphorus-60, potassium-40 norms, the dry mass of raw material (leaves) was 227 percent higher than the control, and the dry mass of flowers and seeds was 164% higher than the control.

It was found that the yields were higher in cuttings than in the seedlings of *Salvia* plant grown in the study areas.

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