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The Effect of Mineral Fertilizers on the Yield of Raw Materials of Prospective Medicinal Plants of the Asteraceae Family

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Abstract
This article discusses the effectiveness of the use of mineral fertilizers in the soil and climatic conditions of Tashkent region in the intensive cultivation of medicinal calendula, chamomile and red echinacea. Along with this, the optimal ratio of nutrients - nitrogen, phosphorus and potassium was determined. It is reported that the use of mineral fertilizers leads to an increase in plant development, yield of raw materials, the efficiency of biomass accumulation.
Keywords:calendule, chamomile, echinacea, agro-technics, mineral fertilizers, yield, soil, cultivation, growth and development acceleration.

INTRODUCTION

(Relevance of the topic),It is known that more than half of the medicines produced in the world are made from the raw materials of medicinal plants. In particular, 77% of medicinal preparations used in the treatment and prevention of cardiovascular diseases, 74% of medicinal preparations used in the treatment of liver and gastrointestinal diseases, 73% of expectorants, 60% of hemostatic drugs are produced on the basis of medicinal plants[Mikhaylov I.V. (2003)], [1].

Currently, about 20,000 plant species grow in the CIS countries, and 4,500 species occur in Uzbekistan [2]. There are about 600 species of wild (natural) medicinal plants registered in the country and the biochemical composition of which has been studied. Most of them are distributed in forests. The raw materials of 230 species of these medicinal plants are prepared for the needs of the pharmaceutical industry, most of which are cultivated and more than 300 medicinal products are prepared on the basis of their raw materials.

The raw material reserves of medicinal plants in nature lag behind the needs of the pharmaceutical industry. An effective way to create a sustainable stockpile of raw materials for the preparation of plant-derived drugs is to create industrial plantations of medicinal plants. It also allows you to protect the natural resources of medicinal plants and get a quality product.
The volume of cultivation of medicinal plants in the republic is determined by the lack of seed reserves and the lack of regional agro-technologies for their cultivation.

In later years, the pharmaceutical industry has been developing rapidly in many countries, including the Republic of Uzbekistan. Therefore, the demand of pharmaceutical companies for raw materials for medicinal plants is growing rapidly. In order to further strengthen the activities in this direction,

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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 PD-5032 on the establishment of free economic zones "Parkent-farm" was published [3].
According to the decree, today in Uzbekistan, 146 local pharmaceutical companies produce more than 2,000 types of medicines. It was noted that the world pharmaceutical industry produces 8,500 types of medicines, 6,300 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 minutes 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" [4].

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 and the establishment of cultivated plantations and expansion of their areas in Uzbekistan, taking into account climate change." planned to increase [5].

The main indicator of the development and independence of the local pharmaceutical industry is the cultivation and production of raw materials for import-substituting and export-oriented medicinal plants in these areas. In this area, in recent years, as stated in the Decree of the President of the Republic of Uzbekistan dated April 10, 2020 "On the protection, cultivation, processing and rational use of available resources of medicinal plants growing in the wild" № PD-4670, Consistent reforms are being carried out in the rational use of natural resources, the establishment and processing of plantations for the cultivation of medicinal plants [6].

In various regions of the Russian Federation, numerous studies are carried out on the bio-ecological properties of medicinal plants, methods of their cultivation, the effect of various biologically active substances, measures to combat diseases and pests, as well as the influence of abiotic factors on the growth and development of medicinal plants (Kostilev, 2000; Zagumennikov, 2002; Toskaya, 2011).), [7, 8, 9].

At present, the question arose of providing the pharmaceutical industry with a sufficient amount of medicinal raw materials. For these purposes, it is necessary to create industrial plantations of medicinal plants, the formation of their primary seed production, the development of various agricultural technologies for their cultivation adapted to specific soil and climatic conditions.

Karpinskaya E.V. (2008) found that the use of mineral fertilizers in the crop $N_{60}P_{90}K_{120}$ kg (pure substance) increases the phytomass of the calendule by 10-30% and the yield by 1.5-4.5 kg / ha. It is noted that sowing cloves according to the 70x16 cm scheme increases the yield by 30-35%. The effect of mineral fertilizers on the biomass of medicinal calendula is somewhat reduced [10].

Nikolskaya E.O. (2008) studied the effect of the first year of Baykal EM-1 microbiological fertilizer on the productivity of echinacea plants. Studies have shown that microbiological fertilizer is preserved even in the second year of the echinacea plant. The highest yield of green mass when processed on Baykal EM-1 was 32.4 t / ha, which is 28.3% higher than the control variant. When

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using the preparation in soil and plant cultivation, the green mass yield was 32.3 t / ha, and the dry mass was 9.72 t / ha [11].

Murdakhayev Y.M. (1983), the growth and development of medicinal chamomile is close to the growth and development of plants in non-saline (irrigated and dry) soils, in saline soils. Yield of flower raw materials is 0.65-0.70 t / ha [12]. In saline soils, the flowering raw material of medicinal chamomile reached 0.55-0.09 t / ha.

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 plants.

METHODS AND MATERIALS

The object of study were medicinal calendule (Calendula officinalis L.), chamomile (Chamomillarecutita L.) and red echinacea (Echinacea purpurea (L.) Moench). The research used generally accepted methods, B.A.Dospekhov [13], Biometric measurements and analyzes (Borisova, Ponomarev, Zeytsev, Yarosh, Terekhin, etc.),phenological observations were carried out by the method of I.N.Beydeman. The initial stages of the main phases of plant development were recorded [14] and carried out according to State Standards.

The experimental area planted with medicinal plants is located on the territory of the scientific experimental farm "Darkhon" of the Forestry Research Institute. The soils of the experimental area are typical sierozem soils with a humus content of 1.6% of the driving layer; total nitrogen 0.12%; phosphorus 47.3 mg / kg; the amount of potassium is 756 mg / kg.

Medicinal calendule, chamomile and red echinacea were carried out in 4 variants of 3 repetitions. Planting scheme calendula was 10; 15; 20 kg / ha, chamomile was 4; 6; 8 kg / ha, red echinaceaPlanted in 60x15; 60x20; 60x25 cm schemes.

Mineral fertilizers were used in the following variants: variant 1 -control (without fertilizer); variant 2 -$N_{30}P_{60}K_{40}$; variant 3 -$N_{60}P_{60}K_{40}$; variant 4 -$N_{90}P_{60}K_{40}$.

The agro-climatic indicators of Tashkent region show that the region has hot and dry in summer, moderate winters, as well as large fluctuations in temperature between daily and annual temperatures. The average monthly air temperature is around $+16.3^0$C. The highest temperature was in July-August, + 34.7-39^0C, and the coldest was in December and January, -6.3 C. The relative humidity averaged 50.9% per year. The average monthly wind speed was 1.2 m / s. The maximum monthly wind speed averages 11.9 m / s. As a result, the monthly precipitation averaged 36.6 mm per year.

RESULTS AND DISCUSSION

The results of the study show that the seedlings of Calendula officinalis L., Chamomillarecutita L. and Echinacea purpurea (L.) Moench, grown in the soil and climatic conditions of Tashkent regiongrows and developswell as medicinal and ornamental plants in all regions of Uzbekistan.

According to the 2020 indicators, three species of medicinal plants were fed twice during the praxis period: the first was fed in late May and the second in mid-June, and the yield (raw material) indicators were determined.

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Yield indicators of raw medicinal calendule flowers. The diagonal method was used to determine the yield in medicinal plants where the topsoil or flower was the raw material. The yield of medicinal plants was collected on the basis of 4 variants of 3 returns 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 1kg / ha.

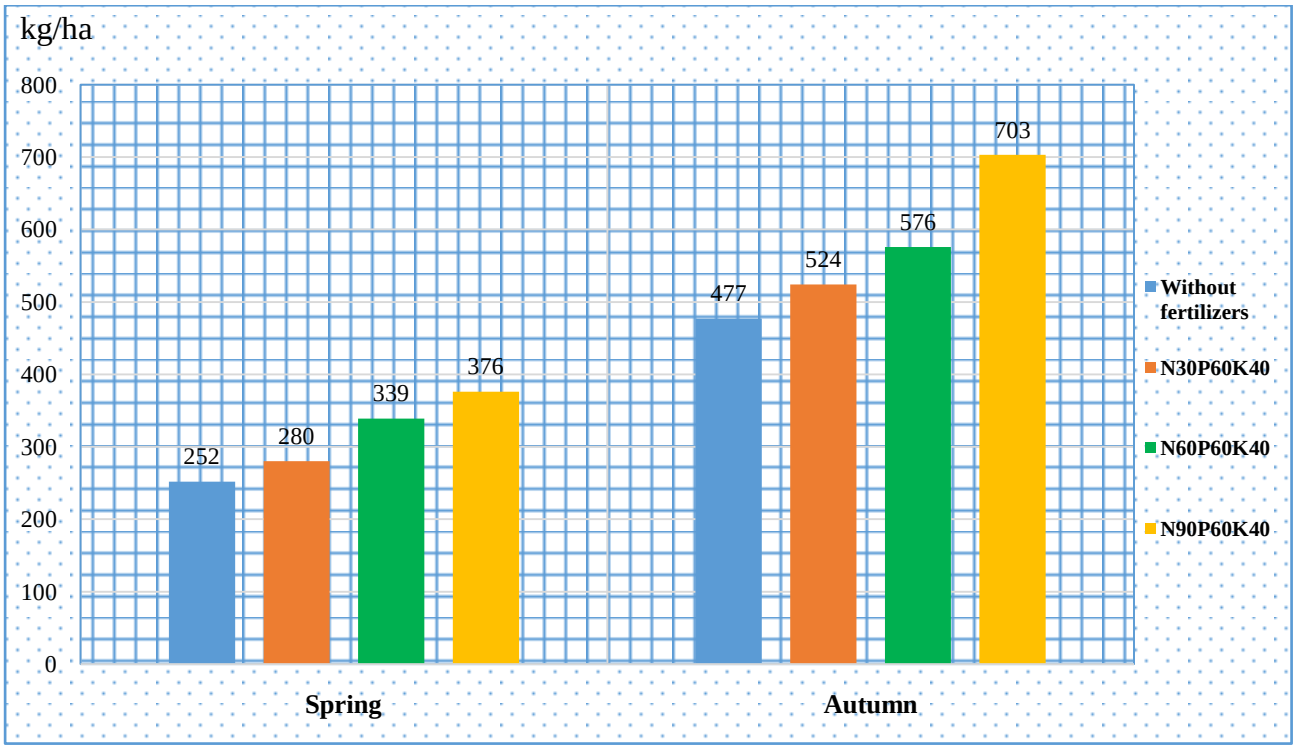

Figure 1. Yield of medicinal calendula flowers and seeds, c/ha

The data show that in the control variant of medicinal calendule planted in the spring, the dry mass of flowers was 252 kg / ha per hectare.
According to the results of the study, in the fourth option, when applied with different norms of mineral fertilizers, the dry mass of flowers was 376 kg / ha.
When planted in the fall, the dry mass of flowers in the control (without fertilizer) variant was 477 kg / ha.

In the fourth variant, when fed with mineral fertilizers $N_{90}P_{60}K_{40}$ norms, the dry mass of flowers was 703 kg / ha per hectare.
At the same time, the average yield increased the dry mass of flowers by 1.4 times, or 147%, compared to control (Figure 1).

When the yield of raw medicinal calendule flowers was observed in autumn, higher results were obtained than in spring.

Yield indicators of raw materials of medicinal chamomile flowers. Research carried out after germination and flowering of medicinal chamomile grasses planted in the spring and autumn, the amount of mineral fertilizers was fed in pure form $N_{30}P_{60}K_{40}$, $N_{60}P_{60}K_{40}$, $N_{90}P_{60}K_{40}$, (in the control option, the field is taken without fertilizer).

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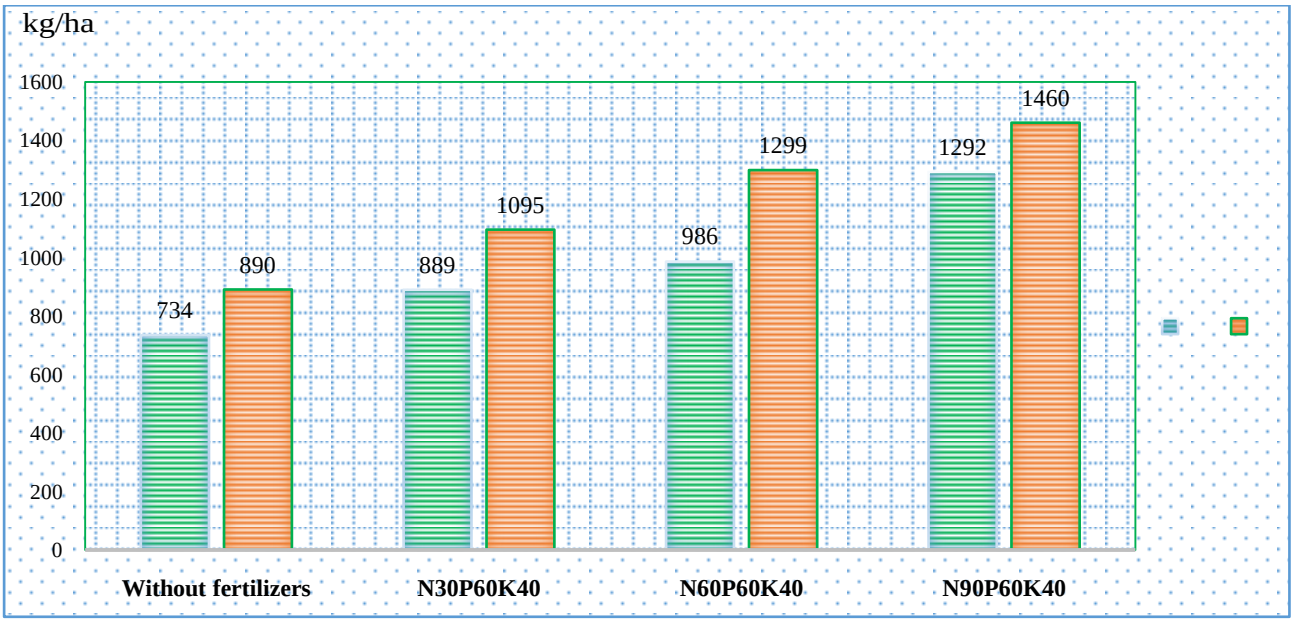

Figure 2. Yield of medicinal chamomile flowers and seeds, c/ha

In general, the average yield of medicinal chamomile grown in the spring was 975 kg / ha per hectare, and in the autumn - 1186 kg / ha.
The raw yield of medicinal chamomile flowers, when observed in autumn, gave better results than in spring.

Yields of medicinal chamomile planted in the spring were determined. In this case, the dry mass of flowers in the fertilizer-free control variant is 734 kg / ha; $N_{30}P_{60}K_{40}$ variant 889 kg / ha; 986 kg / ha in $N_{60}P_{60}K_{40}$ variant; the $N_{90}P_{60}K_{40}$ variant consisted of 1292 kg / ha (Figure 2.).

It was found that the application of mineral fertilizers with different rates increased the dry mass of flowers by 1.7 times compared to the control option of chamomile plant in the experimental area.
When planted in the autumn, these yields were 1.6 times higher than the control, or 164%.

Yield of echinacea seedlings. The data from the studies show that the yield of land-surface raw material per $1m^2$ during the praxis period of the red echinacea plant was determined. At the same time, the weight of dry mass of land-surface raw material in the control (fertilizer-free) variant was 8930 kg / ha.

In the second option, as a result of the application of different rates of mineral fertilizers, these figures are 12510 kg / ha of dry mass of land-surface raw materials; in the third variant 14380 kg / ha; in the fourth option, it was found to be higher than 16840 kg / ha.

The effect on the yield and biomass of seedlings when fed with different rates of mineral fertilizers in the growth and development of red echinacea seedlings was studied. At the same time, it was found that the average yield of seedlings increased the dry mass by 1.8 times compared to the control of land-surface raw materials (Figure 3).

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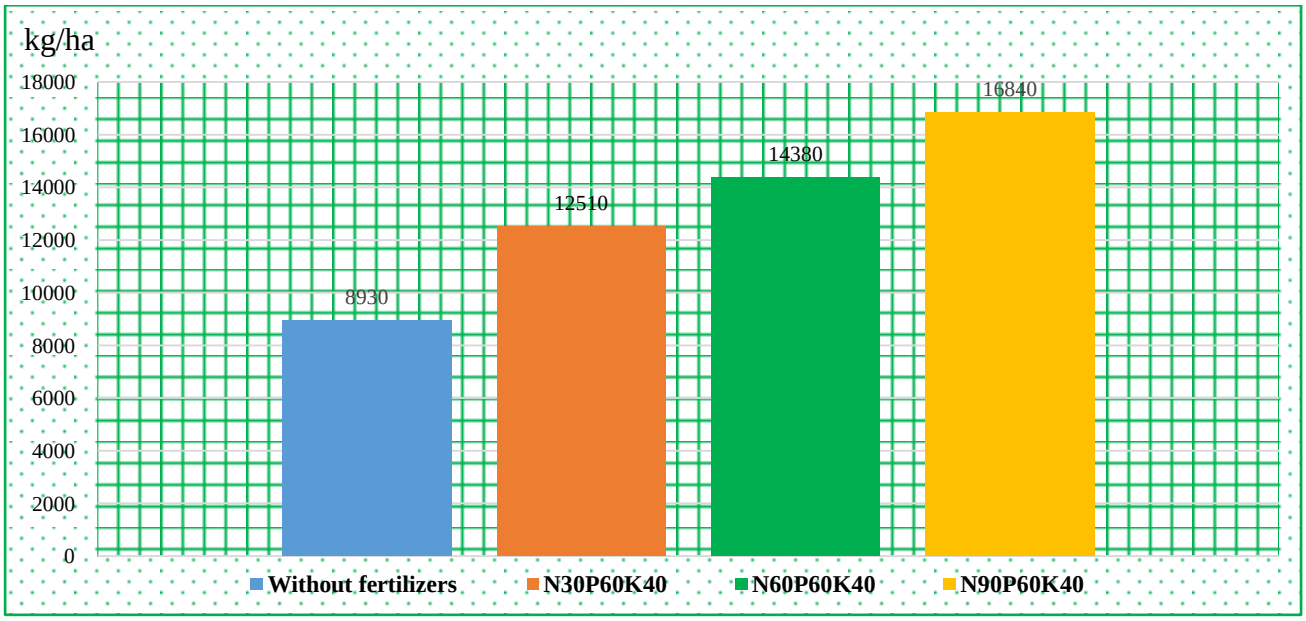

Figure 3. Yield ofsurface raw materials of echinacea officinalis red

CONCLUSION

The results of the study show that in the soil and climatic conditions of Tashkent region, when fed with different norms of mineral fertilizers, medicinal calendule, chamomile and red echinacea seedlings are highly effective in raw materials and biomass. At the same time, high yields were observed when fed with mineral fertilizers $N_{90}P_{60}K_{40}$rates.

Mineral fertilizers used for intensive cultivation of medicinal calendule, chamomile and red echinacea seedlings were observed when the plant was planted in spring and autumn as follows: calendule plant was 150% of the dry mass of raw material compared to control; 176% of the chamomile plant; and red echinacea by 188%.

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