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Biogeochemistry of Plants Allium Karataviense Regel, Fritillaria Sewerzowii Regel in Mountain Brown Soils of Uzbekistan

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Abstract

In the article, the amount of elements and biogeochemical properties of the surface layer of mountain brown soils formed at various levels and in the organs (root, leaf, bulb) of medicinal black onion (Allium karataviense Regel), Severtsov's onion (Fritillaria sewerzowii Regel) were studied. It has been proven that Sb, and Cs are less than lithospheric clay, and Sc, Cr, and Co, on the contrary, are more than lithospheric clay. A high accumulation of cyclic and scattered trace elements was observed in the root of black onion (Allium karataviense Regel). In mountain brown soils, the order of Anzur onion root and onion bulb absorption decreases in the form of Co>Sc>Cs>Sb>Cr. This indicator was Co>Cs>Sb>Sc>Cr in small numbers on the leaf. It was found that Z/1 - O/2 Sb-1.13-1.54, Cs-7.42-7.04 mg/kg in cross-sections of mountain brown soils is less than lithospheric soil. Microelements such as Sc, Cr, and Co, on the contrary, it was observed that the abundance of lithospheric clay is Cr-61.3-67.2, Co-15.0-15.6, Sc-11.4-12.8 mg/kg. The amounts of microelements in the organs of Allium karataviense Regel and Fritillaria sewerzowii Regel plants are Cr 2.31-9.9 mg/kg, Co-0.073-0.057 mg/kg, Sb-0.0090-0.089 mg/kg, Sc-0.035 -0.40 mg/kg, Cs-0.024-0.24 mg/kg. These elements are also included in the plow layers of mountain brown soils: Cr-61.3-67.2 mg/kg, Co-15.0-15.6 mg/kg, Sb-1.3-1.54 mg/kg, Sc-11.4-11.8 mg/kg, Cs-7.42-7.4 found to be in mg/kg amounts.

Keywords: mountain brown; allium karataviense regel; fritillaria sewerzowii regel; trace elements; bioabsorption coefficient; correlation.

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1 Introduction

Today, one of the main factors in increasing the productivity of agricultural products and improving their quality in Uzbekistan is the improvement of soil fertility, properties, and the level of timely supply of nutrients. Today, for the productivity of crops to be high and of high quality, it is necessary not only to provide them with mineral fertilizers, in particular, NPK but also to provide them with other macro and microelements, as well as to study the biogeochemical changes taking place.

After tomato and cabbage, onion is the world's leading vegetable crop, and it plays an important role in the economy of many countries. Onion (Allium cepa L.) is 4,444 million in the world. 85,795 mln. they are planted per hectare. tons of products are obtained and the average yield is 19.31 t/ha. According to the onion harvest, China has 22,345 million tons, and India has 19,299 million tons. t., USA 3.159 mln. t., Iran 2.382 mln. tons occupy the leading positions among the countries, and at the same time, onion is one of the main crops in the vegetable production of these countries.

Many earth elements of the periodic system, which are present in the soil, can be found in different amounts in vegetables and bulbous plants. In this regard, many scientists have conducted research on the chemical element composition of onions, the agrotechnology of its cultivation, and medicinal properties. M. B. Alekseeva in Russia, R. U. Eshonkulova in Tajikistan, D. K. Adotey in Africa [2], Juan Carlos Diaz-Perezl in the USA [5], M. N. Yousuf in Bangladesh [16], Jongtae in South Korea Lee et al. [11] many researchers can be cited. They studied the chemical composition of onion heads, the effect of macro and micro-fertilizers on the growth, development, and productivity of onion plants, the dependence of chemical elements in the soil on the quality and taste of onion heads, the water regime and similar properties and characteristics [2, 5, 11, 16].

N, P, K, S, Ca, Mg, Na, Zn, Mn, Fe, and many other elements, including heavy metals, in vegetables and other crops were determined quantitatively and qualitatively [6, 8, 12, 14]. There is a lot of data on how the amount of nutrients changes depending on the soil properties, especially the chemical composition. When it increases, the amount of the crop also increases. In particular, the amount of chemical elements found in vegetable crops, and the accumulation of various toxic substances in the plant as a result of excessive use of mineral fertilizers [7]. In the cultivation of onion crops, the use of Zn organic fertilizers is of great importance to increase productivity [3]. In addition, carbon (C), hydrogen (H), oxygen (O), nitrogen (N), and sulfur (S) nutrients were used to obtain high yields from onion crops in soils formed in different geographical climatic conditions [15]. The size of the bulb is an important factor in determining the plant's high productivity. The importance of temperature directly in the growth and development of vegetable crops is important [9]. To obtain ecologically clean quality products from crops, first of all, it is important to analyze their general components, i.e., the composition of protein, fat, ash, and essential oils [1]. Irrigation water is of great importance in the cultivation of onion crops., Cu, Fe, Cr, Zn, and Ni chemical elements were determined [4]. In addition, up to 42 macro- and microelements were determined in Allium cepa L. var. proliferum Regel plant species adapted to the soil and climatic conditions of North China.

In Uzbekistan, much scientific research has been conducted on the onion crop. However, their research is limited to the agrotechnology of onion cultivation, mineral fertilizer application norms, and water regime [13]. Research on the onions' elemental composition and biogeochemical properties in irrigated brown soils has hardly been conducted. However, it was noted that the chemical composition and quality of onions and medicinal plants depend on the soil's composition and amount of elements.

In particular, the chemical properties of soils formed in the climatic conditions of mountain regions have been studied since ancient times. Many scientists have researched the evolution of mountain soils, their distribution in geographical zones, the distribution of plant life at a specific level, and other properties.

Following the fertility and nutritional value of the soil, it is one of the current issues to carry out scientific research on the research of medicinal properties, geochemical and biogeochemical properties, and properties of representatives of the onion family growing in the soils of this region, the migration and accumulation of elements, the coefficient of biological absorption, and the study of medicinal properties.

Much scientific research has been conducted on Allium plant species, but research on the chemical element composition and biogeochemical properties of Allium karataviense Regel plant, distributed in mountain regions, has hardly been conducted under conditions of mountain brown soils. However, it was noted that the chemical composition and quality of the organs of medicinal Allium karataviense Regel, Severtsov's onion (Fritillaria sewerzowii Regel) plants depend on the soil's composition and amount of elements.

2 Materials and Methods

The research areas were mountain brown soils formed in the Chodaksoi mountain region, Pop district, Namangan region, and black mountain onion (Allium karataviense Regel), Severtsov's onion (Fritillaria sewerzowii Regel.) plants, and mountain brown soils, 1500-2600 meters above sea level includes.

Morphogenetic, physico-chemical, and neutron-activation methods were chosen as the main methods of soil research, as well as standard methodologies and methods generally accepted in soil science today were widely used. Elemental analysis of soil and plant was carried out by neutron activation method. In this case, the samples are 5*1013 neutrons/cm2 sec in the atomic reactor irradiated with a neutron beam, their quantities were determined based on the half-life periods of chemical elements.

3 Results and Discussion

The studied mountain brown soils have a unique morphological structure and chemical composition. Brown in color, characterized by the fact that the color of the soil cross-section in the lower genetic layer changes from much lighter brown to light gray than in the upper layer. It was observed that the amount of humus varies by 1.4-7% according to the genetic layers [13].

Mountain brown soils formed in mountain regions differ from plain soils in terms of their morphological, chemical, and physical properties. It is a product of modern soil formation processes [13].

It is known that in the processes of soil formation, the nutrient micro elements found in their composition and their combined amounts are not distributed at the same level. The amounts of cyclic (Cr, Co, Sb), and dispersed (Sc, Cs) elements in soils were analyzed. According to the analysis of the surface layers of the studied mountain brown soils, the amount of cyclic and scattered trace elements is presented in Table (1) below.

It was found that Z/1-O/2 Sb-1.13-1.54, Cs-7.42-7.04 mg/kg in cross-sections of mountain brown soils is less than lithospheric soil. Microelements such as Sc, Cr, and Co, on the other hand, differ from lithosphere Clark with Cr-61.3-67.2, Co-15.0-15.6, Sc-11.4-12.8 mg/kg. This is directly related to the distribution of these microelements at various levels, the vegetation cover and thickness in the mountain region, and the climatic conditions, and it plays the main role in transforming the organic world and the mother rock into the soil.

It can be observed that most of the microelements are distributed in large quantities in the driving layer of mountain brown soils compared to the lithosphere and soil Clark. It can be seen that the amount of cyclic, scattered microelements in the soil constantly changes with the increase in the level of natural cultivation of brown mountain soils and the increase of plant cover.

Most chemical analysis shows [10] that the elemental composition of a plant growing under certain soil conditions changes depending on the amount of chemical elements in this soil. Also, the plant absorbs and accumulates chemical elements differently in its different phases and organs. This can also be seen from the data in Table (2) below.

The amounts of microelements in the organs of Allium karataviense Regel and Fritillaria sewerzowii Regel plants are Cr 2.31-9.9 mg/kg, Co-0.073-0.057 mg/kg, Sb-0.0090-0.089 mg/kg, Sc-0.035 -0.40 mg/kg, Cs-0.024-0.24 mg/kg. These elements are also included in the plow layers of mountain brown soils: Cr-61.3-67.2 mg/kg, Co-15.0-15.6 mg/kg, Sb-1.3-1.54 mg/kg, Sc-11.4-11.8 mg/kg, Cs-7.42-7.4 distributed in mg/kg amounts.

From the data in the table above, it can be seen that Sc and Cr accumulate more in the roots of Allium karataviense Regel and Fritillaria sewerzowii Regel growing naturally in the conditions of brown mountain soil than in other organs, and this situation is maintained in relatively low levels of microelement Cs. In Allium karataviense Regel, Cr, Co, and Sc are absorbed in the root and this indicator does not exceed the permissible limit.

High amounts of Cr, Sc, Co, Sb, and Cs characterize the bulbs of Severtsov and Karatog onions grown in both soil sections. In the plant leaf, it is observed that the amount of studied microelements is almost close to each other.

In studying the process of biogenic migration of cyclic and dispersed elements in the studied plants, first of all, the coefficient of biological absorption by Severtsov and black onions was studied. The formula recommended by A.I. Perelman was used Table (3) below.

The indicator of biological absorption coefficient in the studied plant organs proved that the amount of microelements changes depending on their physiological and biochemical functions in mountain brown soils formed at different levels.

4 Conclusion

An organic relationship was established between the composition of elements found in the bulbs, leaves, and roots of the organs of the studied medicinal plants and the composition of microelements in the mountain brown soils. A strong relationship, i.e. closeness, was found in the coefficient of biological refraction between mountain brown soils, black onion (Allium karataviense Regel), and severtsov onion (Fritillaria sewerzowii Regel), and cyclic and dispersed elements in both plant organs.

Table 1. Changes in cyclic and scattered elements in mountain brown soils, μg/g (n=7)

Section number	Depth, sm	Cr	Co	Sb	Sc	Cs
Z/1	0-26	61.3	15.0	1.13	11.4	7.42
O/2	0-27	67.2	15.6	1.54	12.8	7.04
Lithosphere Clark		10.0	3.7	18.0	0.5	83
Soil Clark		7.0	5.0	8.0	0.24	200

Table 2. Changes in the amount of trace elements in the organs of Karatog onion (Allium karataviense Regel), Severtsov onion (Fritillaria sewerzowii Regel), mg/kg (n=7)

Depth, cm and plant name	Organs of the plant	Cr	Co	Sb	Sc	Cs
Z/1 Allium karataviense Regel.	Onion head	2,31	0,073	0,0090	0,035	0,024
	Leaf	6,55	0,42	0,061	0,29	0,24
	Root	34,7	1,81	0,18	1,05	0,71
	Average	14,52	0,77	0,083	0,46	0,32
O/2 Fritillaria sewerzowii Regel.	Onion head	9,9	0,57	0,089	0,40	0,24
	Leaf	1,36	0,13	0,021	0,079	0,055
	Root	39,5	1,91	0,14	1,1	0,81
	Average	16,9	0,87	0,083	0,86	0,37

Table 3. Variation of the bioabsorption coefficient (Ax) of Allium karataviense Regel and Fritillaria sewerzowii Regel plants (n=7)

Element	Black onion (Allium karataviense Regel.) cross section/Z/1				Severtsov onion (Fritillaria sewerzowii Regel.) cross section/O/2			
	onion head	leaf	root	average	onion head	leaf	root	average
Cr	0,20	0,11	0,57	0,29	0,15	0,020	0,59	0,253
Co	0,005	0,028	0,12	0,05	0,011	0,008	0,12	0,046
Sb	0,008	0,053	0,16	0,07	0,058	0,014	0,09	0,054
Sc	0,003	0,025	0,092	0,04	0,03	0,006	0,08	0,116
Cs	0,003	0,032	0,096	0,04	0,034	0,008	0,12	0,054

The average of trace elements Cr-0.29-0.25, Sc-0.04-0.12, Co-0.05, Cs-0.04-0.05, as well as Sb-0.07-0.05 and lower absorption was observed. It was found that the studied plants absorb the cyclic and diffuse elements present in mountain brown soils in a similar amount. This process is related to the selective absorption capacity of the studied plants, that is physiological properties.

Monitoring the amount of trace elements in the studied mountain soils, their migration, and other biogeochemical properties makes it possible to control the chemical composition of medicinal plant organs growing in natural conditions. This, in turn, makes it easier to increase the yield and quality of crops and to evaluate the ecological value of agricultural products.

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