MIGRATION OF MICROELEMENTS IN SOILS OF FERGHANA VALLEY AND ADVANTAGES OF USING THEM

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Abstract. *The role of microelements in physiological, biological and chemical processes in plants is extremely high. The soil is a source of microelements for plants, animals and people. Microelements include vitamins, enzymes, and hormones. The lack or excess of microelements in the soil leads to a decrease in crop yields, deterioration in the quality of agricultural products, metabolic disorders and, in some cases, causes endemic diseases of plants, animals and people. Migration of microelements in living organisms is carried out in the system soil → plant → animal → human. Mineral fertilizers are used to provide plants with microelements, they are called microfertilizers because they contain trace elements. Obtaining high-quality agricultural products, the elimination of endemic diseases of animals and humans is achieved by defining areas with insufficient, optimal or excessive content of trace elements in the soil. Microfertilizers are a powerful tool that can regulate the composition of trace elements in the soil.*

Keywords: *microelement, endemic disease, microfertilizer, migration, accumulation, concentration, toxicosis, photosynthesis, enzyme, soil, plant, living organism.*

INTRODUCTION

Today, mineral fertilizers with N, P, K are used as mineral fertilizers in the territory of our republic, including Ferghana Valley. Even they are taken out from the soil with agricultural products in larger quantities than are used as mineral fertilizers every year. In particular, micronutrients are not regularly added to the soil together with the main fertilizers, which leads to the loss of balance between the micronutrients leaving the soil and the micronutrients being added to the soil.

It is difficult to say that the amount of trace elements in the soil, the process of their movement, the biological activity of plants, geochemical barriers, their role in managing soil properties, geochemical flows and other soil geochemical indicators have been sufficiently studied not only in Ferghana Valley, but also throughout Uzbekistan and other countries.

Solving the problem of lack of microelements in soils is an urgent task today. The role of micronutrients in improving the quantity and quality of food products, including the prevention of production problems related to the medical aspects of humans and animals, is invaluable.

LITERATURE REVIEW

Soil, plants and living organisms contain most of the elements in Mendeleev's periodic system of elements. However, the measurement of their amount is very wide range n "10^{-3}- n "10^{-5} and even n n " 10^{-9}- n "10^{-10} %. Academician V.I. Vernadsky noted about it in the 30s of the 20th century. V.I. Vernadsky said that it is necessary to take into account their most important properties and characteristics in the earth's crust when classifying elements. In this, it is meant to take into account such parameters as their ability to move, the formation of minerals, and their radioactivity.

A number of scientists [1, 2], [3-5], [6, 7], [8-11], R.L.Mitchell, A.L.Page, [12], [13], J.F.Hodson, [14], [15], [16], [17], [18], [19], [20] have discussed in their works. They noted that microelements are present not only in parent rocks, but also in water, plants, and living organisms, and these microelements migrate and accumulate, but if they are lacking, they have a negative effect on plants.

[21], in their work, divided the elements into constitutive, irreplaceable, little-studied, and unstudied. B, F, Mn, Fe, Co, Ni, Cu, Zn, Br, Mo, I are described as irreplaceable trace elements.

[22], for the first time/ created a single database on the composition of important and rare elements based on the materials of a long-term comprehensive study of the composition of microelements in the forest-steppe and desert soils of the Central Chernozem zone. Formation of Mn, Cr, V, Cu, Ni, Zn, Co, Ti, Be, Ga, Ba, Sr, Mo, B, I and Mn, Cu, Zn, Co, Mo, B trace elements in the soil profile, spatial and intra-profile differentiation and concept have been developed. The distribution of microelements in the main soil-forming rocks of the region according to their genetic characteristics, granulometric and chemical-mineralogical composition have been determined.

RESEARCH METHODOLOGY

During the research, the field studies were conducted based on the “Methodology of conducting field experiments” of the former Uzbek Cotton Growing Research Institute, and analyzes were conducted based on “Guidelines for the chemical analysis of soils” by E.V. Arinushkina. Systematic geochemical approaches of A.I. Perelman (1975) and M.A. Glazovskaya (1976) were used. The mathematical-statistical analyses of the results obtained were calculated by the dispersion method using the manual "Methods of field experience" by B.A.Dospekhov and Microsoft Excel.

ANALYSIS AND RESULTS

Almost all elements in D.I.Mendeleev's periodic system of chemical elements are found in soil, plants and living organisms. The main source of trace elements in the soil is parent rocks. The biological functions of microelements are different. Toxic elements are sometimes present in the soil, in small amounts. They can include mercury, lead, cadmium. Nevertheless, it should be noted that an abundance of microelements can have a toxic effect on the soil and living organisms, and a very small concentration of toxic elements may not have a harmful effect on the flora and fauna. Because of this, we think it would be appropriate to call them elements in toxic concentration instead of toxic elements.

For example, Boron (B) is an irreplaceable element for the life and activity of plants and animals. Boron microelement improves their activity even if it is not included in the composition of enzymes, its amount exceeding the norm increases the rate of metabolism. At the same time, boron and its compounds are toxic. Phosphorus is released in large quantities during boron poisoning.

The total amount of boron in the soil is around $2 \cdot 10^{-3}$-$1.6 \cdot 10^{-3}$%, its mobile amounts are equal to $1.9 \cdot 10^{-5}$-$1.1 \cdot 10^{-4}$%. According to the data, boron is abundant in sedimentary rocks. There are many minerals in the soil, such as tourmaline, datolite, bura, asharite, and in the form of boric acid.

B^{+3} does not show metallic properties, it is one of the most essential trace elements among non-metals. The combination of this element with oxygen is widespread. Calcium and magnesium borates are insoluble in water, the feature of accumulation in vapor barriers also applies to this element, and it moves in the form of BO_3^{-3}.

Ca is the main barrier to borates in arid climatic regions and deserts. Therefore, although the total amount of B in this region is high, there is a significant need for it in the growth and development of plants.

Boron accumulates in the evaporative barrier during evaporation of saline waters. In this regard, saline soils occupy a special place. $2.76 \cdot 10^{-2}$ - $3.01 \cdot 10^{-2}$ % is present in the upper layers of salines, and it is almost 2-3 times less in irrigated soils.

The amount of molybdenum (Mo) element in the soil is also low, around 3·10-4%. In soils rich in organic matter, it is reduced to $Mo^{+6} \rightarrow Mo^{+2}$, as a result, it becomes a weakly mobile group. Mo^{+6} is relatively mobile in neutral and weakly alkaline soils and is easy for plants to acquire. It is interesting to note that an excess of Mn leads to a deficiency of molybdenum and vice versa [23].

Mo has a good effect on cauliflower, sugar beet, cotton and leguminous plants, excess of Mo causes molybdenum toxicosis in animals. Toxicosis occurs due to the abundance of MoO_4^{2-} in alkaline, calcareous soils. In healthy plants, Mo is about 3-4 mg/kg, in diseased species it is about 33-38 mg/kg.

Mo element also accumulates in salts, like B, and can exist in both anion and cation states. Accumulation of Mo in the soil resembles B, Zn, Cu in alkaline and neutral environments. As the level of soil cultivation increases, the amount of Mo decreases. The largest amount of Mo accumulation corresponds to the layers in contact with ground waters. The mobile amount of this element in irrigated meadow saz soils distributed in Fergana Valley is 0.03-0.31 mg/kg. It constitutes 0.06-0.07 mg/kg in arable layers and is 0.22-0.31 mg/kg in 170-180 cm layers.

The amount of manganese (Mn) in soils is $8.5 \cdot 10^{-2}$%. The mobile amount of this element is 1-10% of its total amount. A weak alkaline reaction produces $Mn(OH)_2$, so it is almost not absorbed by the plant. Deficiency symptoms appear in plants due to the conversion of Mn $\rightarrow MnO_2$ in weakly alkaline and neutral environments.

Mn is part of a number of enzymes, in case of its deficiency, "necrosis" appears in the leaves of plants, and then they die, and gray spots appear in grain plants. This phenomenon can also be observed in Fergana Valley. Chlorosis occurs in fruit trees.

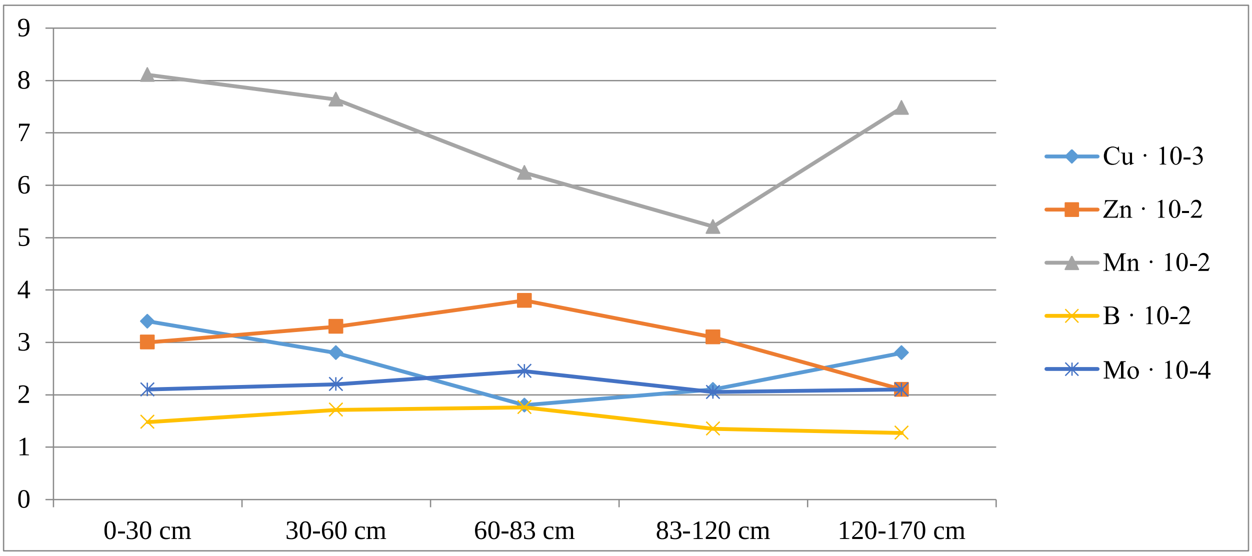
The total amount of copper (Cu) in the soil is $2 \cdot 10^{-3}$%, and only 1% of this amount is in a mobile state. Cu is considered a very necessary element for the activity of plant life and is part of the polyphenol oxidase enzyme. The amount of Cu is related to photosynthesis through chloroplasts. Deficiency of Cu in organisms causes enzootic ataxia, and its excess causes diseases such as anemia and hepatitis.

The amounts of Cu, Zn, Mn, B, Mo are not uniformly distributed in the irrigated and non-irrigated reserve soils of the Ferghana Valley, and are distributed according to certain laws concerned to their characteristics and soil properties (1-4 graphs).

It is known that Cu is distributed in nature in the form of free Cu^0 and Cu^+, Cu^{+2}, mostly in the form of Cu^{+2}, this characteristic of which determines the oxidation and reduction process in the soil among other such elements. Accumulates in oxidizing, evaporative barriers. In our researched soils, it is plowed and 120-170 (180) cm. corresponds to the layers. Concentration of Cu is caused by its depositors.

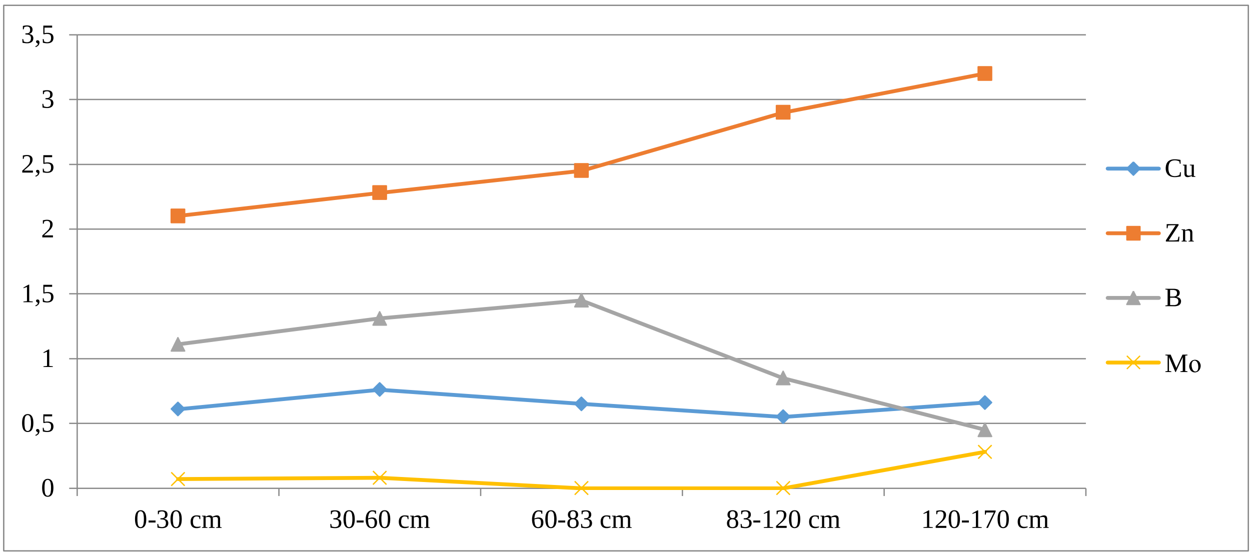
Graph 1.

Amount of microelements in irrigated meadow saz soils of Fergana Valley (gross, %).



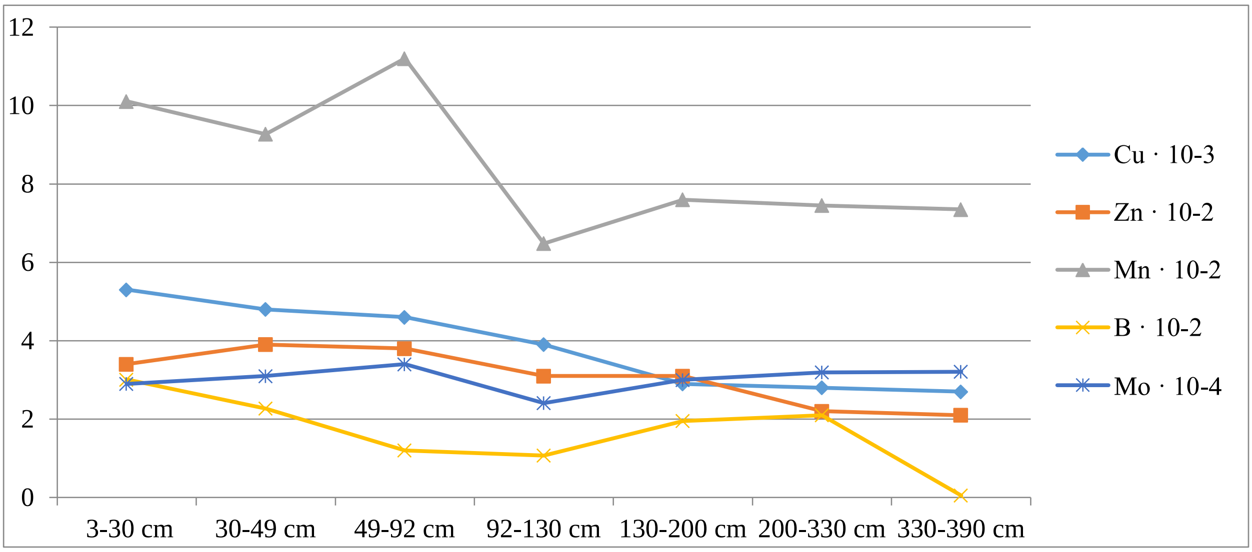
Graph 2.

Amount of microelements in irrigated meadow saz soils of Fergana Valley (mobile, mg/kg).



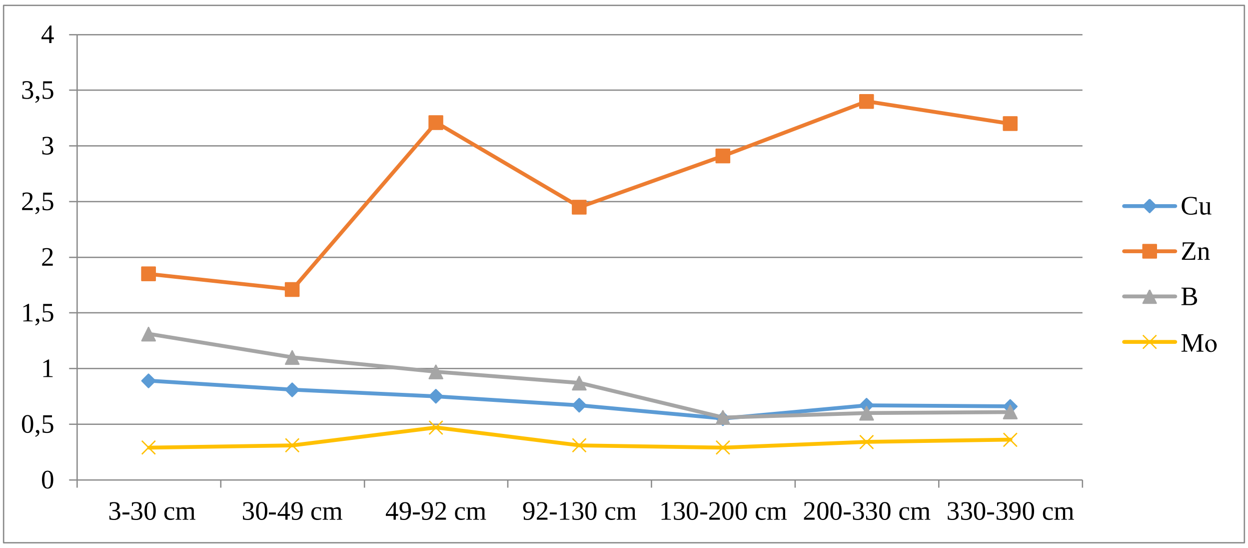
Graph 3.

Amount of microelements in saline soils of Fergana Valley (gross, %).



Graph 4.

Amount of microelements in saline soils of Fergana Valley (mobile, mg/kg).



Cu^{+2} is easily sorbed by humus and colloids, limiting its mobility. There are 198 minerals of Cu, the most common of which are carbonate, sulfate, silicate and phosphate compounds. In weak alkaline barriers, copper secondary minerals are precipitated.

The first of the most concentrated layers of this element is the plowed layer of irrigated moderately saline meadow sedge soils, accumulated by humus and partially accumulated by the action of carbonates, sulfates. is coming. The second layer is the seepage water contact zone, where the accumulated Cu is due to oxidation and reduction processes and colloids in the gley layer.

If we determine the amount of copper depending on the degree of cultivation of the soil, then the highest amount is salt marshes ($2.7 \cdot 10^{-3}$-$5.3 \cdot 10^{-3}$), and in the next places, newly assimilated, newly watered are harvested and old irrigated soils, i.e. their indicators are $1.8 \cdot 10^{-3}$-$3.4 \cdot 10^{-3}$, $1.8 \cdot 10^{-3}$-$3.2 \cdot 10^{-3}$, $1.45 \cdot 10^{-3}$-$2.50 \cdot 10^{-3}$%.

As the level of cultivation of the soil increases, the reduction of Cu in it depends on the development of agriculture and the amount of harvested crops, moreover, although Cu is a trace element, it is almost not added to the ground. The relative abundance of Cu in salines depends on the corrosion and amount of primary and secondary minerals that make up this soil, as well as the presence of very little ground water.

Another microelement is Zinc (Zn) and the average amount of this element in the soil is $5 \cdot 10^{-3}$%, only 1% is in mobile states, and the average amount in plants is about $3 \cdot 10^{-4}$%. Zinc is part of a number of enzymes, and many plants require this element, including cotton, corn, apples, grapes, and others.

The clarity of the zinc is $8.3 \cdot 10^{-3}$%. Zinc contains 66 minerals, and it is difficult for plants to assimilate it in soils with a weak alkaline environment. Such soils include carbonate, that is, the soils we have studied. Because of this, most plants growing in carbonate soils are always in need of zinc.

Zn is weakly mobile in neutral and weakly alkaline ground waters of the desert region. Although its mobility is relatively weak in salines, it accumulates in a small amount, i.e. around $2.1 \cdot 10^{-2}$-$3.9 \cdot 10^{-2}$%, in irrigated soils, the amount of Zn decreases from this indicator as the level of cultivation increases [24].

The microelements listed above are widely used in agriculture, including cotton growing. One of the ways to effectively use these elements is to study their gross and mobile amounts in the soil and their migration chain.

CONCLUSIONS

Due to the fact that the old irrigated soils distributed in Fergana valley belong to the province where copper and molybdenum are lacking, they need these micronutrients. However, in each case, it is advisable to determine their quantity and use only the lacking part, taking into account the types of crops. It should be noted that the province is highly supplied and saturated with Mn and B and normally with Zn.

The effective use of microfertilizers for obtaining high and quality crops from agricultural crops is of great importance for the society in the making of products rich in elements, nutritious and high-quality.

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