PHYSIOLOGICAL BASIS OF THE USE OF MICROELEMENTS IN AGRICULTURAL CROPS

X.R.Adizova, A.E.Kholliev, U.T.Norboeva
Bukhara State University, Bukhara, Uzbekistan

Micronutrients are chemical elements that are necessary for the normal functioning of plants and animals and are used in small amounts by plants and animals in relation to the main components of nutrition. However, the biological role of micronutrients is great. All plants without exception need micronutrients to create enzyme systems - biocatalysts, including essential iron, manganese, zinc, barium, molybdenum, cobalt, and others. Micronutrients are called "elements of life" as if the life of plants and animals would be impossible without these elements. The lack of certain elements in the soil does not lead to plant death but is the cause of the decline. As a result of the speed and consistency of the processes responsible for the development of the organism, plants do not realize their potential and do not always produce high-quality products [1-4].

Micronutrients cannot be replaced by other substances and their deficiency must be replenished taking into account that they are present in the soil. Plants can use micronutrients only in a water-soluble form (a portable form of the micronutrient). After complex biochemical processes involving humic acids in the soil, the plant in many cases, these processes are very slow and continues with too much irrigation of the soil. As a result, a significant portion of the portable forms of micronutrients is washed away. All micronutrients of life are part of barium or other enzymes. Boron is not an enzyme, but it diffuses in the substrate and participates in the movement of sugars across membranes due to the formation of a carbohydrateborate complex.

Boron is not an enzyme and is involved in the movement and distribution of sucrose. The number of micronutrients plays a key role in increasing the yield quality and quantity of elements as follows:

1. In the presence of the required amount of trace elements, plants have the ability to synthesize all enzymes that allow intensive use of energy, water, and nutrition (N, P, K) and, accordingly, high yields.
2. Micronutrients and enzymes based on them enhance tissue regenerative activity and prevent plant diseases.
3. Micronutrients are one of the few substances that increase plant immunity. Their deficiency creates a state of physiological depression and the general susceptibility of plants to disease.

Most trace elements are active catalysts that accelerate several biochemical reactions. Micronutrients, which have their own amazing properties, have a strong effect on vital processes. In some cases, only the micronutrient content can restore the normal development of plants or restore hemoglobin in the event of anemia. However, it is wrong to reduce the role of the elements only to their catalytic effect. Micronutrients have a major effect on and affect bio colloids [5-7].

Hence, manganese regulates the ratio of two-trivalent iron in the cell. The iron-manganese ratio should be greater than two. Copper protects chlorophyll from decomposition and increases the amount of nitrogen, and phosphorus is about doubled. However, the role of microelements is not only their catalytic effect, but microelements have a great influence on bio colloids and have a positive effect on the direction of biochemical processes. Hence, manganese regulates the ratio of two to three valent iron in the cell. The iron-manganese ratio should be greater than two. Copper protects chlorophyll from decomposition and increases the nitrogen dose, and phosphorus is about doubled. Boron and manganese enhance photosynthesis in plants after a decrease in temperature. Sudden changes in the ratio of nitrogen, phosphorus, potassium can lead to plant diseases. The analysis of the results of the study of the effectiveness of the use of micronutrients in agriculture by local and foreign experts leads to the following:

1. A moderate intake of micronutrients is acceptable, especially for phosphorus and zinc, nitrate-nitrogen, and molybdenum.
2. Plants need essential micronutrients throughout the growing season, some micronutrients are not reused in plants. They do not pass from the old organs to the young. At present, micronutrients in the biologically active form are not equal in leaf nutrition, which is especially distinguished by the ratio of macro and micronutrients.
3. Irrespective of the soil composition, the amount of biologically active micronutrients applied does not affect the total content of micronutrients in the soil but has a beneficial effect on the condition of plants. Micronutrients increase the physiological activity status of plants and their resistance to parasitic diseases, and in general, it has a positive effect on increasing the quantity and quality of the crop. Among all the heavy metals in plants, iron plays a leading role, indicating that it is present in more significant amounts in plant tissues than other metals. Thus, the amount of iron in the leaves reaches one hundred percent, then the concentration of manganese, zinc is expressed, and the copper content does not exceed one-thousandth of a percent [8-11].

Organic compounds containing iron are essential for biochemical processes during respiration and photosynthesis. This is due to their very high level of catalytic properties. Inorganic iron compounds can accelerate many biochemical reactions, and the catalytic properties of iron in combination with organic substances are multiplied. The catalytic effect of iron is related to its ability to alter oxidation levels. The role of manganese in plant metabolism is similar to that of magnesium and iron. Manganese activates many enzymes, especially during phosphorylation. Because manganese activates enzymes in plants, its deficiency affects many metabolic processes, in particular the synthesis of carbohydrates and proteins [12-15].

Symptoms of manganese deficiency in plants are often observed in some peat and other soils with calcareous, highly classified, as well as pH values above 6.5. Manganese deficiency is primarily felt in young leaves with a light green color or discoloration (chlorosis). In relation to zinc, all cultivated plants are divided into 3 groups:

– very sensitive (corn, flax, grapes);
– moderately sensitive (soy, beans, legumes, peas, sugar beets, sunflowers, onions, potatoes, cabbage, cucumbers, fruits);
– Slightly sensitive (oats, wheat, barley, rye, carrots, rice, alfalfa).

Zinc deficiency for plants is often observed in sandy natural soils [16 - 19].

The amount of zinc in saline soils is very low. Its deficiency moderately affects the development of vegetative organs. Symptoms of zinc deficiency are observed in various fruit crops (apple, cherry, Japanese plum, walnut, apricot, lemon, grape). Citrus crops suffer especially from zinc deficiency. The physiological role of zinc in plants is very diverse. This has a major impact on redox processes. Zinc deficiency leads to disruption of the hydrocarbon conversion process. With a lack of zinc in the leaves and roots of tomatoes, citrus and other crops, phenolic compounds accumulated and a decrease in starch content was observed [18 - 21].

Zinc is a part of various enzymes: carbonathanhydraza, triose phosphate dehydrogenase, peroxidase, oxidase, polyphenol oxidase and others. High doses of phosphorus and nitrogen have been found to exacerbate symptoms of zinc deficiency in plants, and zinc fertilizers are particularly necessary when high doses of phosphorus are used [9].

The value of zinc for plant growth is closely related to its participation in nitrogen metabolism. Zinc deficiency leads to a significant accumulation of soluble nitrogenous compounds - amines and amino acids, which leads to changes in protein synthesis. Zinc plays an important role in oxidation-reduction processes, in the plant organism it is a component of enzymes, directly involved in the synthesis of chlorophyll, affects carbohydrate metabolism in plants and promotes the synthesis of vitamins [13-16].

With zinc deficiency, chlorotic spots are formed on the leaves of plants. There is very necessary for the development of the meristem. Characteristic symptoms of boron deficiency are growth points, loss of buds and roots, disorders in the formation and development of reproductive organs, and others.

Boron deficiency often leads to the death of growing young tissue. Under the influence of boron, the synthesis and movement of carbohydrates, especially sucrose, is improved from the leaves to the fruit organs and roots. It is known that monocotyledonous plants are twice as demanding. Improves growth movement, accelerates the movement of substances and ascorbic acid from the leaves to the fruit organs. When it is removed from the nutrient, the dust cells do not grow well or even germinate. In such cases, barium promotes good germination of dust, eliminates ovarian shedding and enhances the development of reproductive organs [19-23].

Boron plays an important role in cell division and protein synthesis and is an integral part of the cell wall. Bar performs a very important function. Its deficiency in carbohydrate metabolism in the nutrient medium leads to the accumulation of sugar in plant leaves. This phenomenon is observed when the bor is most sensitive. Barley in fertilizing crops also helps to better use calcium in physiological processes and is actively involved in plant metabolism. Therefore, plants with barium deficiency are usually unable to use calcium, even if the latter is present in sufficient quantities in the soil. It has been found that the volume of boron absorption and accumulation in plants increases with the increase of potassium in the soil [21-24].

Deficiency of boron in the nutrient medium leads to disruption of the anatomical structure of plants, for example, poor development of xylem, fragmentation of the primary parenchymal phloem and degeneration of the cambium. The root system is poorly developed because the bar plays an important role in its development. Boron deficiency not only leads to a decline in agricultural production, but also to a deterioration in quality. It should be noted that barley plants are very necessary during the growing season. Removal of boron from the nutrient medium at any stage of plant growth leads to its disease. External signs of boron deficiency vary depending on the plant species, but several common symptoms specific to most higher plants can be cited [22 - 26].

At the same time, the growth of the root and stem stops, then chlorosis of the apical growth point occurs, and then with a strong lack of barium, its complete drying is observed. Crops have different sensitivities in copper deficiency. The following plants immediately show a decrease in copper: wheat, barley, oats, flax, corn, carrots, beets, onions, spinach, alfalfa, and white cabbage. Plants such as potatoes, tomatoes, red clover, beans, and soybeans are characterized by moderate sensitivity, leading to an increase in copper deficiency in plants as a result of the use of large amounts of nitrogen fertilizers [27-30].

Sometimes copper deficiency leads to zinc deficiency, while sandy soils lead to magnesium deficiency. The introduction of high doses of nitrogen fertilizers increases the need for copper in plants and helps to aggravate the symptoms of copper deficiency. Although several macro-and micronutrients are abundant, they affect the rate of oxidation-reduction processes, the effect of copper in them is unique and it cannot be replaced by other elements. Under the influence of copper, both peroxidase activity and the activity of synthetic centres decrease, leading to the accumulation of soluble carbohydrates, the formation of amino acids and other decomposition products of complex organic substances.

Copper is an integral part of a number of the most important oxidizing enzymes - polyphenol oxidase, ascorbinatoxidase, lactase, dehydrogenase and others. All of these enzymes carry out oxidation reactions by transferring electrons from the substrate to molecular oxygen. In connection with this function, the valence of copper varies from the valence of the oxidation-reduction reactions to the monovalent state and back. Copper plays an important role in photosynthesis processes. Under the influence of copper, both peroxidase activity and the synthesis of proteins, carbohydrates and fats increase.

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