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# ZINC SULFATE - ITS ROLE IN PLANT LIFE CHARACTERISTICS OF ZINC SULFATE

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**Abstract:** Zinc is an essential trace element for all living organisms, and its physiological role in plants is to activate many enzymatic reactions - it is considered a cofactor for more than 300 enzymes. Zinc increases the resistance of crops to heat, drought and cold.

**Key words:** chlorophyll, enzyme, reproductive, carbohydrate, phosphate, oxyl, metabolism, ribosome, phosphorus.

Zinc sulfate is widely used in agriculture due to its beneficial properties for the fertile layer. This product is a preparation containing sulfur obtained by the reaction of zinc with sulfuric acid. The substance is glycerin, soluble in water, but not in alcohol. Its formula is $ZnSO_4$. Water solubility depends on the temperature of the latter: at -7°C, 27.6% of the total composition is mixed; 39°C temperature. It helps to dissolve 41.4% of its total volume, as well as the formation of $ZnSO_4$ crystalline hydrate crystals; When brought to 100°C, the agent dissolves only 44 percent; After dissolving zinc sulfate to 70%, monohydrate is formed and it becomes anhydrous at 238°C. The preparation may contain nitrates, chlorides, iron, manganese, arsenic, calcium, copper, and lead compounds.

The percentage of additional general indicators is 0.05-2% (depending on the production) rN value varies from 4.4 to 6.

**Physical characteristics**. This substance has a powdery or crystalline appearance. It quickly disappears when exposed to air. Density 3.54 g / $cm^3$. When zinc is heated, sulfate separates into other compounds: at a temperature of 600-800 °C, it separates into sulfur oxide, and at 930 °C, zinc is released.

**Movement on the ground**. After entering the soil, it is divided into cations absorbed by the root system and anions. Absorption of the substance in acidic and alkaline environments is different: this indicator weakens when the rN value is less than 7, as a result, zinc is alkalized from the soil with high acidity. The higher the pH, the more organic matter consumption is required for the balance of useful elements in the soil. Ions are bound by zinc complexes. Material may accumulate on the ground. Sulfur in the compound can be washed away during irrigation or rain. After entering the soil, it is divided into cations absorbed
by the root system and anions.

**Effects of zinc sulfate on crops.** The use of this drug in the cultivation of vegetable gardens has many positive aspects. There is a significant increase in productivity. Zinc sulfate has the following effects on plants:

1. It is more nutritious in corn;
2. Phosphorus content increases in oat, wheat, and rye grains;
3. Lettuce collects chlorophyll and ascorbic acid better;
4. Alfalfa grows leaves faster;
5. In the case of tomatoes, the amount of vitamin C in the fruit increases and the amount of sugar increases;

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6. With the introduction of flax and beets, more planting increases productivity;
7. Fruits and berries taste better

**Physiological role of microelement.** Zinc (Zn) is a trace element important for all living organisms and its physiological role for plants is to activate many enzymatic reactions - it is a cofactor for more than 300 enzymes. Zinc participates in the formation of chlorophyll, is part of 40 enzymes, affects reproductive processes, affects the metabolism of carbohydrates, phosphates and proteins, the formation of auxins, the formation of DNA, ribosomes. Taking part in maintaining the integrity of biological membranes, it is responsible for the resistance of plants to pathogens. Zinc increases heat, drought and cold resistance of crops, stabilizes their respiration, and also helps to utilize phosphorus.

**Signs of micronutrient deficiency.** Zinc deficiency is the most common micronutrient in crops worldwide. Taking into account that approximately one-third of the world's population suffers from a lack of this element in the diet, it is very important to create conditions for zinc deficiency in plant-based food products. With a lack of zinc in the soil, the color of the leaves of the plant turns yellow-green, then they are covered with brown spots and disappear. Young leaves slow down in growth, they are formed in a small size, their deformation occurs: they have an asymmetric shape, often have wavy edges. In addition, the symptoms of zinc deficiency are determined by external signs such as the delay of apical growth (reduction of interplant height), low height of plants, chlorosis of leaves between the veins, the appearance of small brown spots on the upper leaves and their curling.

Agricultural crops such as corn, rice, flax, potatoes, buckwheat, beets and alfalfa are sensitive to zinc deficiency. Compared to them, grains are not so dependent on this trace element. However, given that nearly half of the world's grain fields are deficient in zinc, grains may be deficient in this mineral. In turn, this leads to a loss of productivity.

**Conditions caused by zinc deficiency.** The conditions under which zinc deficiency occurs in plants include: a general low amount of the element (or its compounds) in the soil; very large or small (peat soils) amount of organic matter in the soil; strong alkalization of soils, as well as calcareous and calcareous soils; low soil temperature; their swamp; soils with high phosphorus content are sandy or saline soils.

Zinc deficiency is often observed in neutral and slightly alkaline calcareous soils. In acidic soils, zinc is more mobile and available to plants, so it is not advisable to add zinc-containing fertilizers. Root uptake of zinc is highly dependent on phosphates. Their high amount makes it difficult for the element to enter plants through the root.

In addition, zinc can form chelated compounds with organic matter in the soil, so it is impossible to enrich the soil with a large amount of manure for a long time. This can cause zinc deficiency in plants. In addition, the introduction of organic matter significantly increases the yield, which also leads to a significant removal of its elements from the soil.

The average amount of zinc in the soil is 50 mg/kg. It can be from 10 mg/kg to 570 mg/kg, but in the soil solution this indicator does not exceed 270 mg/kg. The concentration of trace elements in plants is 1-80 mg/kg of dry weight. For example, an apple contains 1.2 mg zinc, and a lettuce leaf contains up to 73 mg/kg. Cultivated crops contain zinc from 0.06 to 2.25 kg/ha, in cereal crops from 0.06 to 0.3 kg/ha.

**Types of zinc fertilizers and their use.** Three types of chemical compounds are used as zinc fertilizers: inorganic, synthetic chelates and organic complexes. The use of synthetic

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chelates is the most effective, but for many crops the form of fertilization does not play a major role. Therefore, inorganic salts are used in such cases, which are more economically beneficial. Zinc oxide, zinc carbonate, zinc sulfate (solubility in water up to 98%), zinc nitrate and zinc chloride are common among inorganic zinc compounds. In modern practice, the most promising method is to incorporate zinc into complex NR and NPK fertilizer granules. This technology allows micronutrients to be distributed uniformly in the soil. To increase the amount of zinc in the soil, pig manure and poultry manure are also used, which contain a sufficient amount of this element.

**Treatment of seeds before sowing.** Soaking seeds in a solution containing zinc improves their germination, further growth and development of plants, and also increases productivity. Recommended for growing crops on soils with moderate zinc deficiency. For soils that are low in this element, processing such seeds will not give the desired result. Zinc sulfate (0.2-2.0 kg/t) or zinc polymicro-fertilizers (up to 4 kg/t) are often used for processing before planting.

**Application of zinc fertilizers in the soil.** If the amount of zinc in the soil does not exceed 3 mg/kg (for mineral soils) or 10 mg/kg (for peat soils), it is advisable to use fertilizers containing zinc. Fertilizers should be applied to the soil to increase the availability of the microelement, because zinc is inactive in the soil. The solubility of fertilizers in water should be at least 40-50%. A one-time application of 20-30 kg/ha of zinc sulfate in the soil allows to meet the needs of plants in micronutrients for 4-5 years. But the amount of fertilizer and the frequency of their application mainly depends on the type of soil. For example, calcareous soils require high application rates and short application periods.

The method of spot application of zinc-containing fertilizers directly to the root zone is very effective, and there are also broad-banded or re-applied methods. In this case, 1-2 kg/ha of zinc is applied per year for annual crops, and this indicator is 0.5-2.2 kg/ha for synthetic chelates.

**Extra root nutrition of plants.** After adding zinc to the soil, it has a significant effect on the yield of crops. However, foliar feeding is used to quickly eliminate the symptoms of deficiency of this element. For this, a 0.05 - 0.1% solution of zinc sulfate is used. If the root system of the plant is located in the deep layers of the soil, and taking into account the low mobility of zinc in the plant, the leaves should be supplemented with additional nutrients. In this case, after spraying the plant with a solution of zinc sulfate, the supply of zinc to the plant is improved. It is recommended to repeat such fertilization during the growth of plants. In this case, a solution of zinc sulfate is added during the growth of the plant, thereby improving the supply of zinc to the plant.

In conclusion, it can be said that, The leaves of vegetable crops are fed using chelated compounds and zinc sulfate. The practical use of zinc chelates has proven to be three to five times superior to inorganic salts. If there are specific signs of zinc deficiency, it is required to add at least one third of the seasonal intake of this element to the crop. We do not neglect the elements of plants for their more harmonious development, we study and increase the yield.

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