

Effect of Zinc Application on Maize Growth and Yield in Saline Soil

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Introduction

Zinc is an essential micronutrient for plants and is involved in many metabolic processes. It plays a critical role in plant growth and development, including seedling vigor, leaf expansion, and stem elongation. Zinc is also involved in the synthesis of chlorophyll and in the regulation of carbohydrate metabolism. Maize is an important crop that is grown worldwide, and it is particularly important for food security in developing countries. However, maize is also sensitive to soil salinity, which can negatively impact its growth and yield. In saline soils, the availability of zinc may be reduced due to the presence of excess sodium ions, which can compete with zinc for uptake by the plant roots. Several studies have investigated the effect of zinc on maize plants grown in saline soils. One study found that the application of zinc to maize plants grown in saline soil increased their biomass, leaf area, and root length, compared to plants that did not receive zinc. Another study found that the application of zinc increased the concentration of zinc in the leaves and roots of maize plants, and also increased the activity of antioxidant enzymes, which can protect the plant against oxidative stress caused by salt stress. It is important to note that the optimum level of zinc application may vary depending on the specific soil and environmental conditions, and excessive zinc application can be toxic to plants. Therefore, it is important to carefully manage the application of zinc to maize plants in saline soils to achieve the desired benefits without causing harm to the plant.

Beneficial Effect of Zinc for Maize Plant?

- Zinc is an essential micronutrient required by plants for their normal growth and development. In saline soils, the availability of zinc to plants can be limited, which can adversely affect plant growth and yield.
- In maize plants, zinc plays a crucial role in several physiological processes, including

photosynthesis, protein synthesis, and carbohydrate metabolism. Zinc also helps in the synthesis of growth hormones and enhances the plant's ability to resist stress, including salt stress.

- Application of zinc fertilizers can improve the growth and yield of maize plants in saline soils.
- Zinc helps to increase the plant's chlorophyll content, which enhances photosynthesis and improves the plant's ability to tolerate salt stress.
- Zinc also improves root development, which can help plants to absorb water and nutrients more efficiently, even in saline soils.
- Zinc can also play a beneficial role in mitigating the negative effects of salinity on plant growth.
- Zinc can be highly beneficial for maize plants in saline soils, as it improves plant growth, enhances stress tolerance, and increases yield. However, it's important to note that the appropriate amount of zinc application should be based on soil and crop requirements, and excess zinc can be toxic to plants.

How Zinc Is Helpful For Maize Plant In Saline Soil?

The beneficial effects of zinc on maize plants grown in saline soils are likely due to its ability to enhance the plant's tolerance to salt stress. Zinc can help maintain the osmotic balance of cells and tissues, which can help to prevent the accumulation of toxic ions, such as sodium, that can be harmful to plant growth and development. Zinc can also enhance the activity of enzymes involved in antioxidant defense, which can protect the plant against oxidative stress caused by salt stress.

Harmful Effect of Zinc on Maize Plant Saline Soil:

- **Phytotoxicity:** Excessive zinc application can lead to zinc toxicity, which can cause phytotoxicity in maize plants. Zinc toxicity can result in stunted growth, chlorosis, and necrosis, which can reduce plant growth and yield.
- **Imbalance of other micronutrients:** Over-application of zinc can lead to an imbalance of other micronutrients, which can negatively affect plant growth and yield. For example, excessive zinc can reduce the availability of iron and copper to plants, which are also essential micronutrients required for plant growth.
- **Environmental pollution:** Zinc can be highly persistent in the soil, and over-

application of zinc can lead to soil contamination and environmental pollution. Zinc can leach into groundwater, which can contaminate water sources and pose a risk to human health and the environment.

- **Economic cost:** The excessive application of zinc can increase the cost of production, which can affect the economic viability of maize production. This is particularly important for small-scale farmers who may not have the resources to afford excessive fertilizer application.

In summary, while zinc is essential for the growth and development of maize plants in saline soil, excessive application can have negative effects on plant growth, yield, and the environment. Therefore, it's important to apply the appropriate amount of zinc fertilizer based on soil and crop requirements to maximize the benefits of zinc while minimizing its negative effects.

Conclusion:

The application of zinc to maize plants grown in saline soil can help to improve their tolerance to salt stress and increase their growth and yield. Zinc can enhance the plant's ability to maintain cellular water balance, protect against oxidative stress, and regulate metabolic processes. Further research is needed to determine the optimal level of zinc application and to evaluate the long-term effects of zinc on maize growth and yield in saline soils.