



Secondary Nutrients: Role in Crop Production

(*Sonal Sharma¹, Anju Choudhary² and Neha Khardia¹)

¹Rajasthan College of Agriculture, MPUAT, Udaipur – 313001, Rajasthan

²Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj

*Corresponding Author's email: sonasharma2731198@gmail.com

Secondary nutrients are important elements that are required by plants in moderate amounts for optimal growth and development. These nutrients are essential for several physiological processes that take place within the plant, including photosynthesis, respiration, and protein synthesis. Secondary nutrients are also crucial for maintaining the physical and chemical properties of the soil, which ultimately affects the plant's ability to absorb and utilize nutrients. Calcium, magnesium, and sulphur are the three primary secondary nutrients that are required by plants. Calcium is important for maintaining the structural integrity of plant cells, as well as for cell division and elongation. Magnesium is a component of chlorophyll, which is essential for photosynthesis, and is also involved in the production of ATP, the energy currency of cells. Sulphur is necessary for the synthesis of amino acids, which are the building blocks of proteins, and is also involved in the formation of certain vitamins and enzymes. In addition to their importance for plant growth and development, secondary nutrients also play a critical role in soil health. Calcium, for example, can help to neutralize soil acidity and improve soil structure, while magnesium and sulphur are important for maintaining soil fertility and nutrient availability. Secondary nutrients are involved in a range of plant processes, including cell division, photosynthesis, and the formation of plant tissue. Deficiencies of these nutrients can have a significant impact on crop growth and yield, leading to stunted growth, poor quality produce, and increased susceptibility to disease and pests. It is important to understand the impact of secondary macronutrients on crop production and how they can be managed to ensure optimal plant growth and yield. This includes identifying the symptoms of nutrient deficiency, determining the appropriate application rate and timing, and selecting appropriate fertilizers and soil amendments to meet plant nutrient requirements. By understanding the importance of these nutrients and their role in plant physiology and soil chemistry, farmers and gardeners can make informed decisions about nutrient management and help to promote sustainable agriculture.

Role of Calcium in Crop Production

Calcium (Ca) is a secondary macronutrient that plays a crucial role in crop production. Here are some of the ways in which calcium impacts crop growth and development:

1. Structural support: Calcium is a key component of plant cell walls, providing structural support and helping to maintain plant shape and rigidity.
2. Enzyme activation: Calcium is involved in activating a range of plant enzymes, including those involved in hormone synthesis, cell division, and protein synthesis.
3. Nutrient uptake: Calcium helps regulate the uptake of other plant nutrients, including nitrogen and potassium.
4. Disease resistance: Calcium plays a role in plant defence mechanisms, helping to protect plants against disease and pests.

5. Fruit quality: Calcium is particularly important for fruit crops, where it helps to promote firmness, shelf life, and resistance to bruising.

Deficiency Symptoms of Calcium

Calcium is immobile in plant hence deficiency symptoms appear on the younger structures.

- Calcium deficient leaves become cup-shaped and crinkled and the terminal buds deteriorate with some break-down of petioles.
- Blossom end rot in tomato.
- Bitter pit in apple.
- Tip hooking in cauliflower
- Blackheart in celery
- Cavity spots in carrot
- Water core of apple
- Leaf tip burn in cabbage and lettuce

Role of Magnesium in Crop Production

Magnesium is an essential macronutrient for plants, playing a crucial role in various physiological processes that contribute to crop growth and development.

Here are some key roles of magnesium in crop growth:

1. Chlorophyll synthesis: Magnesium is a key component of chlorophyll, the green pigment in plants responsible for photosynthesis. Without sufficient magnesium, plants cannot produce chlorophyll, leading to stunted growth and yellowing of leaves.
2. Enzyme activation: Magnesium is involved in the activation of numerous enzymes that are necessary for various metabolic processes in plants, including protein synthesis, carbohydrate metabolism, and DNA synthesis.
3. Energy production: Magnesium is involved in the production of adenosine triphosphate (ATP), which is the primary energy source for plants. This energy is used for growth and development, nutrient uptake, and stress responses.
4. Nutrient uptake: Magnesium plays a role in the uptake and utilization of other nutrients, including nitrogen and phosphorus.

Deficiency Symptoms of Magnesium

- Mg deficiency symptoms manifest themselves in terms of interveinal chlorosis and streaked or patchy effects on older leaves.
- In many species, shortage of Mg^{2+} results in interveinal chlorosis of the leaf, in which only veins remain green.
- Grass tetany is an Mg-deficiency related nutritional disorder common in cattle grazing on Mg-deficient pastures well fertilized with potassium.
- Sand drawn in tobacco.

Role of Sulphur in Crop Production

Sulphur is an essential macronutrient for plant growth and plays several important roles in crop production:

1. Protein Synthesis: Sulphur is a critical component of amino acids, which are the building blocks of proteins. Plants require proteins to carry out a variety of physiological processes, such as growth and development.
2. Chlorophyll Formation: Sulphur is also involved in the synthesis of chlorophyll, the green pigment in plants responsible for photosynthesis. Chlorophyll helps plants convert light energy into chemical energy, which is then used for growth and development.

3. Resistance to Stress: Sulphur plays a role in the production of compounds that help plants resist stress from biotic and abiotic factors. For example, it helps plants produce sulphur-containing compounds that can deter pests and diseases.
4. Nutrient Uptake: Sulphur is important for the uptake of other nutrients, such as nitrogen and phosphorus. It helps plants absorb and use these nutrients more efficiently.

Deficiency Symptoms of Sulphur

- Crop plants having N: S ratios more than 16:1 also can be suspected to be deficient in S.
- Sulphur deficiencies first appear on the younger growths as S is immobile in the plants.
- Brassicas are most susceptible for S-deficiency, the lamina is restricted, leaves show cupping owing to the curling of the leaf margins and arresting of the growing points.
- Tea yellow disease in tea.

Conclusion

In conclusion, secondary nutrients such as calcium, magnesium, and sulphur are important for healthy crop production. They play crucial roles in plant growth and development, including cell wall development, chlorophyll synthesis, enzyme activation, energy production, stress response, and nutrient uptake. In addition, these nutrients help maintain soil fertility, pH balance, and nutrient availability, which are all important factors for healthy crop growth. While primary nutrients like nitrogen, phosphorus, and potassium are often the focus of fertilizer applications, the importance of secondary nutrients should not be overlooked. Soil management practices should include monitoring and managing secondary nutrient levels to ensure that crops have access to sufficient amounts of these essential nutrients. This will help farmers achieve better yields, improve crop quality, and reduce the risk of nutrient deficiencies or toxicities.