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Effect of Sulphur Fertilizer in Plant

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SUMMARY

Sulphur is a crucial element for plant growth and development, with higher requirements in oilseeds, pulses, forages, tuber crops, and cereals. Soil availability can cause deficiency symptoms, such as withering leaves, curling dead leaves, and thinner stems. Sulphur is involved in chlorophyll formation and promotes photosynthesis, allowing plants to produce starch, sugars, oils, fats, vitamins, and other compounds. It is present in organic and inorganic forms and can be influenced by natural and anthropogenic factors. Sulphur improves crop quality and soil fertility, making it essential for increasing yield and crop quality.

INTRODUCTION

Sulphur is one of the seventeen essential elements required for optimum crop growth and reports indicated that more than 30 % soils of Gujarat and India deficient in available sulphur. Irrespective of crops, sulphur is now rightly called the fourth major plant nutrient next to N, P and K. In general, sulphur requirement is slightly less than phosphorus. Sulphur is absorbed by the plant as the sulphate ions (SO_4^{2-}). Sulphur is an important element in living organisms where it processes a plethora of functions. Sulphur is a chemical element with symbol S and atomic number 16. It is abundant, multivalent, and non-metallic. Sulphur atom form cyclic octatonic molecules with a chemical formula S_8. Element Sulphur is a bright yellow crystalline solid at room temperature.

In general sulphur requirement is higher in oilseeds followed by pulses, forages, tuber crops and cereals. Sulphur not only improve pulses production but also improve the quality of crops. Sulphur has a profound influence on synthesis for pulses and is a part of amino acid such as cysteine, cystine and methionine. Sulphur plays an important role in the formation of proteins, vitamins and enzymes. In the recent years the importance of sulphur in pulse nutrition has been well recognized because of the widespread occurrence of its deficiency in the soil. Pulses crops play an important role in Indian agriculture and India is the largest producer, consumer and processor of pulses in the world.

Deficiency

It varies with plant species, cultivars and physiological age. But 0.2% S in plant has been considered as a critical limit of deficiency. In soil available S is generally low to plant can give some deficiency symptoms of sulphur like younger leaves wither and die off, dead leaves curl, twist and reflexed, intensive more tillering than normal, basal parts of plants remain green or dark green, and stems thinner than normal condition also found in cysteine, amino acids that make up proteins, and activates certain enzyme systems.

Role of sulphur in plant

- Involved in the formation of chlorophyll and promotes nodule formation that permits photosynthesis through which plants produce starch, sugars, oils, fats, vitamins and other compounds.
- Protein production. Sulphur is a constituent of three S-containing amino acids (cysteine, cystine and methionine), which are the building blocks of protein. About 90% of plant Sulphur is present in these amino acids.
- Synthesis of oils. This is why adequate sulphur is so crucial for oilseeds or cotton.
- Activation of enzymes, co-enzymes and vitamins, which aid in biochemical reactions in the plant.
- Increases crop yields and improves produce quality, both of which determine the market price a farmer would get for his produce.

- With reference to crop quality, Sulphur improves protein and oil percentage in seeds, cereal quality for milling and baking, marketability of dry coconut kernel (copra), quality of tobacco, nutritive value of forages, Responsible for pungency and flavour (onion, garlic, mustard etc.).
- It is associated with special metabolisms in plant and the structural characteristics of protoplasm.
- Responsible for pungency and flavour (onion, garlic, mustard etc.).
- It is responsible for protein synthesis; it is an important content for pluses crop. It increases root growth and stimulate seed formation

Form of sulphur in soil

In the soil sulphur present in two form

(1) Organic: Ester sulphate and carbon bound sulphur compound

(2) Inorganic form: water soluble sulphate (SO_4^{2-}) of sodium (Na), K, Mg, Ca., Absorbed sulphate on the surface of clay mineral and aluminium and iron oxides, Insoluble sulphate of calcium, Barium Iron and Aluminium. Sulphide or reduced form of sulphur.

Factor affecting sulphur availability

The availability of sulphur in soil can be influenced by various factors, both natural and anthropogenic. Sulphur is an essential nutrient for plants, and its availability in soil is crucial for plant growth and development. Here are some factors that can affect the availability of sulphur in soil:

- Sulphur Content in Parent Material: The sulphur content in the rocks and minerals that make up the parent material of the soil can influence the initial sulphur content of the soil. Soils derived from sulphur-rich parent material tend to have higher sulphur availability.
- Organic Matter Content: Organic matter in the soil can act as a source of sulphur as it decomposes. Organic matter, such as crop residues, animal manure, and plant roots, contains sulphur, and the breakdown of these materials releases sulphur into the soil, making it available to plants.
- Microbial Activity: Sulphur in organic matter and soil minerals can be converted into plant-available forms by soil microorganisms. Microbes play a critical role in the mineralization of organic sulphur compounds into soluble forms that plants can uptake.
- pH of the Soil: Soil pH can affect sulphur availability. Sulphur tends to be more available in slightly acidic to neutral soils (pH 6-7). In highly acidic or highly alkaline soils, sulphur availability can be reduced because it can become tied up in chemical reactions or become less soluble.
- Sulphur Fertilization: Application of sulphur-containing fertilizers can directly increase sulphur availability in the soil. Common sulphur-containing fertilizers include ammonium sulphate and gypsum (calcium sulphate). These can provide an immediate source of sulphur for plants.
- Soil Texture: Soil texture, including the percentage of clay, silt, and sand, can affect sulphur availability. Sandy soils tend to have lower sulphur retention capacity and may require more frequent sulphur additions, while clayey soils may retain sulphur better.
- Drainage and Water Management: Proper drainage and water management can impact sulphur availability in the soil. Poor drainage can lead to waterlogging, which can reduce the oxygen levels in the soil and affect microbial activity, potentially reducing sulphur mineralization.
- Weathering and Erosion: Weathering of rocks and minerals over time can release sulphur into the soil. Conversely, erosion can lead to the loss of sulphur-rich topsoil, reducing sulphur availability.
- Pollution and Industrial Activities: Industrial emissions and pollution can introduce sulphur compounds into the environment. In some cases, this can lead to excessive sulphur accumulation in soil, which may have negative effects on plant health.
- Crop Type and Rotation: Different plant species have varying sulphur requirements. Crop selection and rotation practices can influence sulphur availability in soil, as some crops may deplete soil sulphur levels more rapidly than others.

It's important to consider these factors when managing soil fertility and nutrient availability for agricultural or horticultural purposes. Soil testing and nutrient management practices can help ensure that sulphur levels are adequate for optimal plant growth while minimizing environmental impacts.

So_2 toxicity in plants

- Major sources sulphur dioxide are coal-burning operations, especially those providing electric power and space heating.
- Sulphur dioxide emissions can also result from the burning petroleum and the smelting of sulfur containing ores.
- Sulphur dioxide enters the leaves mainly through stomata and the resultant injury is classified as either acute or chronic.
- Acute injury is caused by absorption of high concentrations of SO_2 in a relatively short time.
- The symptoms appear as 2-slided lesions that usually occur between the veins and occasionally along the margins of the leaves.
- The colour of the necrotic area vary from a light tan or near white to an orange-red or brown depending on the time of year, the plant species affected
- The symptoms appear as a yellowing or chlorosis of leaf and occasionally as bronzing on the under surface of the leaves.
- Some crops are generally considered susceptible to SO_2 like Alfalfa, barley, buckwheat, pumpkin, reddish, rhubarb, spinach, tobacco, etc.

CONCLUSION

It can be concluded that the soil application of appropriate dose of sulphur in different corps should be 10 to 40 percent on application of 30-50 kg Sulphur/ha along with recommended dose of fertilizer for boosting production. It also helps in to improve quality and soil fertility over control. Therefore, Sulphur cannot be neglected any more in the interest of increasing yield, quality of crops and soil fertility.

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