IPNI Plant Nutrition TODAY
Better Crops, Better Environment...through Science

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WHERE DOES SULFUR COME FROM?

Sulfur is widely distributed in nature and is essential for the health of both plants and animals. It often accumulates in areas with volcanic activity, and large geologic deposits of elemental S are scattered across the world. In the 20th century, the process of melting S to extract it from underground deposits was developed, making S more accessible for agricultural and industrial purposes.

Modern Sulfur Supplies: Fossil hydrocarbons contain S since it was present in the organic matter that formed the hydrocarbons. This S is now recovered as a by-product from materials such as oil, methane, tar sands, and coal. Elemental S is currently extracted wherever oil or gas is processed and refined. Sulfur is traded globally in a solid or in a molten form.

Sulfur is an important product in many industrial processes, especially as sulfuric acid. The production of phosphate fertilizer is the single largest use of S. The global supply and price of S is closely linked with the phosphate fertilizer market.

Soil Sulfur: The majority of S in soil is present as organic compounds found in crop residues and soil organic matter (up to 98% of the total S). There are a variety of complex S-containing compounds in organic matter, but plant roots are not able to use these compounds for nutrition until they are first converted into soluble sulfate by microbial action.

Sulfur in the soil is continually transformed between organic and inorganic compounds by microbes. Mineralization occurs when sulfate is released as a by-product of microbial activity. Immobilization results when sulfate is incorporated into microbial cells during their growth.

Sulfur mineralization from soil organic matter is often too slow to meet the nutritional demands of high-yielding crops. This nutrient deficit must be overcome by adding mineral or organic fertilizers.

Only a small fraction of the total S in soil is found as inorganic compounds. Sulfate is the most abundant form of inorganic S in agricultural soils. Sulfate is generally soluble and moves with soil water. It is only weakly retained (adsorbed) by a variety of clays and soil minerals, especially in low-pH conditions.

Fate of Sulfur

- Plant uptake and removal during harvest. Annual crops typically remove between 10 to 30 lb S/A.
- Sulfate leaching from the root zone with rainfall or irrigation water can be a major pathway of loss. Annual losses are often in the range of 5 to 50 lb S/A.
- In anaerobic soil conditions, sulfate is chemically reduced by bacteria to a variety of compounds that are largely unavailable for plant uptake.
- There are no government limits on sulfate in drinking water, but the US EPA suggests a limit of 250 mg/L (ppm) due to taste and odor concerns.

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Abbreviations: S = sulfur; EPA = Environmental Protection Agency.