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Editorial

Management of Essential Elements for Plant Nutrition and Soil Fertility

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ABOUT THE STUDY

Soil fertility and plant nutrition is an applied science that integrates knowledge from all fields of soil and plant sciences in order to deliver nutrients to plants in an effective and efficient manner. Not only in efficient nutrient usage required to enhance agricultural productivity, but it is also necessary to maintain air, soil, and water quality, as well as the natural resources used to provide fertilizers for agricultural production. This page gives an overview of important nutrients, their significance in plant growth, soil behavior, and crop production system management.

Soil fertility and plant nutrition refers to the control of vital components for plant growth, usually with the goal of achieving specific management objectives. Although soil fertility is important in natural systems, the focus of this article is on plant production for human consumption (e.g., food, feed, fiber, energy, and landscape esthetics). If an element is required for plant metabolism and the conclusion of the plant's life cycle, it is deemed vital. Typically, 17 elements, separated into macro- and micronutrients, are regarded to meet these criteria. This classification is based on their relative abundance in plant tissue, not on their importance to plant growth. Macronutrients are found in plant tissue in amounts greater than 0.2 percent, while micronutrients are found in concentrations less than 0.01 percent (dry weight basis). Carbon (C), hydrogen (H), and oxygen (O) are obtained from carbon dioxide (CO_2) and water (H_2O), further which are converted into carbohydrates during photosynthesis and are hence found in the highest amounts in plant tissue. They are not considered mineral elements, however, and are virtually always present in sufficient quantities for direct utilization in entire plant metabolism.

Primary macronutrients, such as nitrogen (N), potassium (K), and phosphorus (P), and secondary macronutrients, such as calcium (Ca), magnesium (Mg), and sulphur (S), are the essential mineral macronutrients (S). Copper (Cu), manganese (Mn), iron (Fe), boron (B), nickel (Ni), molybdenum (Mo), chlorine (Cl), and zinc are the eight micronutrients (Zn). Other mineral elements may be necessary for some plants or advantageous to crop quality or growth, but they are not required for metabolic activities or the conclusion of the plant's life cycle; these elements are commonly referred to as "beneficial elements." Cobalt (Co), sodium (Na), silicon (Si), selenium (Se), and vanadium (V) are all beneficial elements (V). Silicon is found in many plant tissues in amounts comparable to some macronutrients and has beneficial characteristics, although it is not typically regarded necessary to metabolic activities or the life cycle of any plants outside the Equisetaceae family.

Plants absorb a variety of additional elements to varied degrees, but they are not regarded essential as indicated above. Plants can be poisonous to both necessary and non-essential components if they accumulate in high enough amounts to interfere with metabolic operations. As a result, soil fertility and plant nutrition as a subject involves the management of these important components in the soil to ensure that they are present in enough or sufficient proportions for the completion of plant metabolic processes and reproductive activities. In order for soil fertility to be optimal, required components must not only be present in sufficient quantities, but also in a form and position that allows for plant uptake and hence optimum plant nutrition.

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