

Nitrogen in the Environment: Essential Plant Nutrients

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Carbon, oxygen and hydrogen are among the most basic elements necessary for plant growth. Plants obtain these elements from water and carbon dioxide in the air and soil. Plants also require additional "mineral elements" that they obtain from the soil for proper growth and development. These mineral elements, together with carbon, hydrogen and oxygen, are referred to as essential plant elements or nutrients. They are essential because they are important to plant functions. Plants would not be able to grow, develop and reproduce without them. Although all are not necessarily essential to all plants, all are essential to some.

Sixteen essential elements for most plants

Element	Symbol	Comments
Carbon Oxygen Hydrogen	C O H	Carbon, oxygen, and hydrogen are obtained by plants from carbon dioxide and water found in the air and soil. They are called mineral elements
Nitrogen Phosphorus Potassium	N P K	These three nutrients are needed in greater amounts by plants. They are called the major or macronutrients
Calcium Magnesium Sulfur	Ca Mg S	These three nutrients are needed by plants in lesser amounts than macronutrients. They are called secondary nutrients

Boron	B	These nutrients are needed in smaller amounts by plants. They are called the minor or micronutrients
Iron	Fe	
Manganese	Mn	
Copper	Cu	
Zinc	Zn	
Molybdenum	Mo	
Chlorine	Cl	

Impact on water quality

Where production of crops are concerned, levels of most essential elements in the soil are generally sufficient and do not need the addition of an outside source of fertilizer. Calcium, and to a lesser extent magnesium, can be found in high levels in many soils and in the bedrock beneath soils. With respect to water quality, calcium and magnesium can cause water to be "hard." Some essential elements, such as phosphorus and potassium, are often not found in sufficient levels for crop production and must be supplied from fertilizers or manure. Although phosphorus and potassium can impact surface water quality, these two elements do not normally impact groundwater quality. Other naturally occurring elements in the soil, such as sulfur, can result in a rather unpleasant odor in water, while iron can cause water to be discolored and leave deposits in pipes.

Nitrogen is perhaps the one element of most concern as it relates to water quality. Although nitrogen can be found in many forms in the soil, it is the nitrate form that primarily affects water quality. The presence of nitrate in the soil is desirable because it is the form of nitrogen that plants need to grow, develop and produce seed. Nitrate normally exists in soils and is produced from bacterial decay of plant residues and organic matter. However, for most crops nitrate is simply not found, or naturally produced from the decay of organic matter, in sufficient quantities in the soil to meet basic crop needs and must be supplied through fertilizers or manure.

Nitrate is also a form of nitrogen that is highly mobile and easily moves with water. The results of a heavy rain can move nitrates downward in the soil, below the root zone of plants. Whether nitrates continue to move downward, and into groundwater, depends on underlying soil and/or bedrock conditions, as well as depth to groundwater. If depth to groundwater is shallow and the underlying soil is sandy, the potential for nitrates to enter groundwater is relatively high. However, if depth to groundwater is deep and the underlying soil is heavy clay, groundwater contamination from nitrates is not likely.

Once nitrates get into the groundwater, the greatest concerns are for infants less than one year old and for young or pregnant animals. High levels of nitrates can be toxic to newborns, causing **anoxia**, or internal suffocation. Seek alternative water sources if nitrate levels exceed the health standard of 10 ppm nitrate-N.

Do **not** boil water to eliminate nitrates. It increases nitrate levels rather than decreasing them. The most common symptom of nitrate poisoning in babies is a bluish color to the skin, particularly around the baby's eyes and mouth. These symptoms of nitrate toxicity are commonly referred to as the "blue-baby" syndrome.

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