

# Essential Potato Plant Nutrients

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**P**otatoes require sixteen essential nutrients to produce an economically viable crop. Most of these nutrients are available from the soil.

When soil-available quantities are not adequate for production goals, fertilizers are applied to compensate for these deficiencies. Fertilizer can also be applied to supply nutrients that are not available in the soil.

## Nutrient Mobility

Within the soil solution,  $\text{NO}_3^-$ ,  $\text{SO}_4^{2-}$ ,  $\text{H}_3\text{BO}_3$ ,  $\text{Cl}^-$ , and  $\text{MoO}_4^{2-}$  are mobile and move relatively freely with the soil solution. The other nutrients are immobile in the soil, do not move freely, and may be unavailable for plant uptake.

Within the plant,  $\text{NO}_3^-$ ,  $\text{H}_2\text{PO}_4^-$ ,  $\text{K}^+$ ,  $\text{Mg}^{+2}$ ,  $\text{Cl}^-$ , and  $\text{SO}_4^{2-}$  are mobile and are relocated within the plant. The other nutrients are immobile in the plant and are not relocated.

## Nutrient Function in Potato Plants

### Nitrogen

Nitrogen is a component of amino acids, proteins, enzymes, nucleic acids, and chlorophyll, among other compounds in plants. Nitrogen is necessary for photosynthesis, respiration, and cell division.

### Phosphorus

Phosphorus is a component in nucleic acids, membranes, and ATP and ADP, which are used in energy transfer. Phosphorus is necessary for reproduction, respiration, and energy transfer.

### Potassium

Potassium is present as an ion (a charged particle) and is critical in opening and closing stomata, which allow carbon dioxide into the plant and oxygen out, and help regulate water flow within the plant. Potassium also plays a key role as a cofactor in enzyme reactions.

### Calcium

Calcium is vital in structural integrity of cell walls. Calcium is also needed for proper meristematic development.

### Magnesium

Magnesium is needed for the chlorophyll molecule, which is essential for photosynthesis and respiration.

### Boron

Boron is involved in cell elongation, cell walls, and movement of sugars from the leaves to the roots.

### Chlorine

Chlorine maintains ionic balance in the plant, helps with membrane transport, and is essential in photosynthesis.

### Copper

Copper is important for some chemical reactions and electron transport.

### Iron

Iron is important for some chemical reactions, electron transport, and chlorophyll synthesis.

## Manganese

Manganese is essential in respiration and photosynthesis.

## Molybdenum

Molybdenum is needed for nitrogen-related enzymes.

## Sulfur

Sulfur is essential for some amino acids and helps with protein structure.

## Zinc

Zinc is needed for some enzymes and for growth.

Nutrient Element	Plant-Available Forms	Common Forms in Soils
Nitrogen (N)	$\text{NO}_3^-$ , $\text{NH}_4^+$	Organic, $\text{NH}_4$ , $\text{NO}_3$
Phosphorus (P)	$\text{H}_2\text{PO}_4^-$ , $\text{HPO}_4^{2-}$	Organic, mineral
Potassium (K)	$\text{K}^+$	Mineral, exchangeable
Calcium (Ca)	$\text{Ca}^{2+}$	Mineral, exchangeable
Magnesium (Mg)	$\text{Mg}^{2+}$	Mineral, exchangeable
Boron (B)	$\text{H}_3\text{BO}_3$	Mineral, organic
Chlorine (Cl)	$\text{Cl}^-$	Mineral, soluble
Copper (Cu)	$\text{Cu}^{2+}$	Mineral
Iron (Fe)	$\text{Fe}^{2+}$	Mineral, exchangeable
Manganese (Mn)	$\text{Mn}^{2+}$	Mineral, exchangeable
Molybdenum (Mo)	$\text{MoO}_4^{2-}$	Mineral
Sulfur (S)	$\text{SO}_4^{2-}$	Organic, mineral
Zinc (Zn)	$\text{Zn}^{2+}$	Mineral, exchangeable
Carbon (C)	$\text{CO}_2$	Carbon Dioxide
Hydrogen (H)	$\text{H}_2\text{O}$ and others	Water, $\text{H}_3\text{O}^+$
Oxygen (O)	$\text{O}_2$ , $\text{H}_2\text{O}$	Oxygen, $\text{H}_2\text{O}$

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