

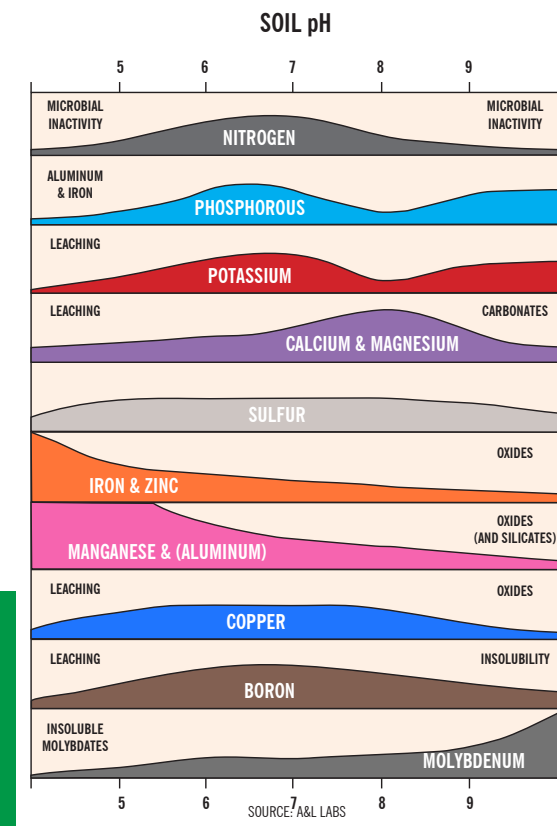
# Forgotten plant nutrients; don't be left behind!

All plants, whether it be corn, soybeans, wheat, cotton, cranberries, or canola, require nutrients for proper growth and development. About 90-95% of plant dry matter is composed of carbon, hydrogen, and/or oxygen. The remaining 5-10% is obtained from the soil and/or from fertilizer supplied by the farmer. We all understand the importance of Primary Nutrients (nitrogen, phosphorus, potassium) in achieving production goals that are set each year. However, we often forget the importance of Secondary Nutrients (calcium, magnesium, sulfur) and Micronutrients (boron, copper, iron, manganese, molybdenum, zinc) in the overall process of plant growth and development. Although these nutrients are required in much smaller quantities, they are essential for completion of many physiological cycles and processes within the plant. In many cases, plants cannot fully utilize primary nutrients without adequate supplies of secondary and/or micronutrients supplied at the appropriate time. Below is a listing of functions these nutrients provide within the plant.

Most of the Secondary and Micronutrients can be provided to plants in a chelated form with the exception of sulfur, boron, and molybdenum. Chelation allows nutrients to remain available to the plant even if environmental conditions are less than optimal. There are many forms of chelates that can be used, ranging from EDTA, citric acid, amino acids, and organic acids just to name a few. In general, EDTA chelates are by far the most stable and are the only form that can be safely added to true, clear NPK solutions (i.e. NACHURS orthophosphates). NACHURS Micronutrients (9% Zn, 6% Mn, 4.5% Fe, 3% Ca, 2.5% Mg, 7.5% Cu, 10% Boron) offer a wide range of uses under a vast array of growing environments. Ask for NACHURS Micronutrients today from your local NACHURS dealer so YOU don't get left behind!

Nutrient	Function in the plant
<b>Nitrogen (N)</b>	<ul style="list-style-type: none"> <li>Converts to amino acids, the building blocks for proteins</li> <li>Produces necessary enzymes and structural parts of the plant</li> <li>Becomes part of the stored proteins in the grain</li> <li>Works with chlorophyll to utilize the sunlight as an energy source</li> <li>Needed for rapid growth and full development</li> </ul>
<b>Phosphorus (P)</b>	<ul style="list-style-type: none"> <li>Needs to be available during early development for max yield potential</li> <li>Needed for strong root development</li> <li>Encourages early plant growth for longer growing seasons</li> <li>Provides required energy for nutrient transport</li> <li>Plays a vital role in photosynthesis</li> <li>Essential in providing the genetics for all plant growth and development</li> </ul>
<b>Potassium (K)</b>	<ul style="list-style-type: none"> <li>Plays a vital role in photosynthesis</li> <li>Regulates water use with stomatal activity</li> <li>Keeps transportation systems functioning normally</li> <li>Required for protein synthesis and starch synthesis</li> <li>Enhances quality by improving disease resistance and stress management</li> </ul>
<b>Sulfur (S)</b>	<ul style="list-style-type: none"> <li>Mirrors phosphorus requirements in plants</li> <li>Primary constituent of many amino acids</li> <li>Aids in activation of enzymes and vitamins</li> <li>Needed for chlorophyll formation</li> <li>Used in nitrogen stabilization</li> <li>Nodulation in legume crops</li> </ul>

Nutrient	Function in the plant
<b>Calcium (Ca)</b>	<ul style="list-style-type: none"> <li>Necessary for the proper functioning of growing points</li> <li>Forms compounds which strengthen cell walls</li> <li>Aids in cell division and elongation</li> <li>Neutralizes organic acids</li> <li>Regulates protein synthesis and slows the aging process</li> </ul>
<b>Magnesium (Mg)</b>	<ul style="list-style-type: none"> <li>Only mineral component of the chlorophyll molecule</li> <li>Aids in formation of sugars and starches</li> <li>Plays important part in phosphorus translocation</li> <li>Aids in proper functioning of plant enzymes</li> </ul>
<b>Boron (B)</b>	<ul style="list-style-type: none"> <li>Required for cell division</li> <li>Plays important part in calcium translocation</li> <li>Protein synthesis and hormone formation</li> <li>Carbohydrate metabolism</li> <li>Pollen viability</li> <li>Flower formation and fruit set</li> </ul>
<b>Copper (Cu)</b>	<ul style="list-style-type: none"> <li>Required for chlorophyll production</li> <li>Aids in photosynthesis and enzyme formation</li> <li>Involved in oxidation-reduction reactions</li> <li>Regulates water movement in cells</li> <li>Needed for seed production</li> </ul>
<b>Iron (Fe)</b>	<ul style="list-style-type: none"> <li>Necessary for the formation of chlorophyll</li> <li>Involved in oxidation process that releases energy from starches</li> <li>Protein formation</li> <li>Aids conversion of nitrate to ammonia in cells</li> <li>Plant respiration</li> </ul>
<b>Manganese (Mn)</b>	<ul style="list-style-type: none"> <li>Essential for chlorophyll production and photosynthesis</li> <li>Aids in carbohydrate metabolism</li> <li>Oxidation-reduction reactions</li> <li>Enzyme activation</li> <li>Combines with iron, copper, and zinc in hormone balance</li> </ul>
<b>Molybdenum (Mo)</b>	<ul style="list-style-type: none"> <li>Co-factor in nitrate reductase enzyme</li> <li>Essential for rhizobia in nitrogen fixation process</li> <li>Aids in nitrate utilization</li> <li>Involved in phosphate and iron metabolism</li> </ul>
<b>Zinc (Zn)</b>	<ul style="list-style-type: none"> <li>Necessary in chlorophyll formation</li> <li>Involved in enzyme activation and production</li> <li>Required in hormone (auxin) and nucleic acid synthesis</li> <li>Aids in uptake and water use efficiency</li> </ul>



## NUTRIENT DEFICIENCIES

Nutrient Functions In The Plant And Deficiency Symptoms

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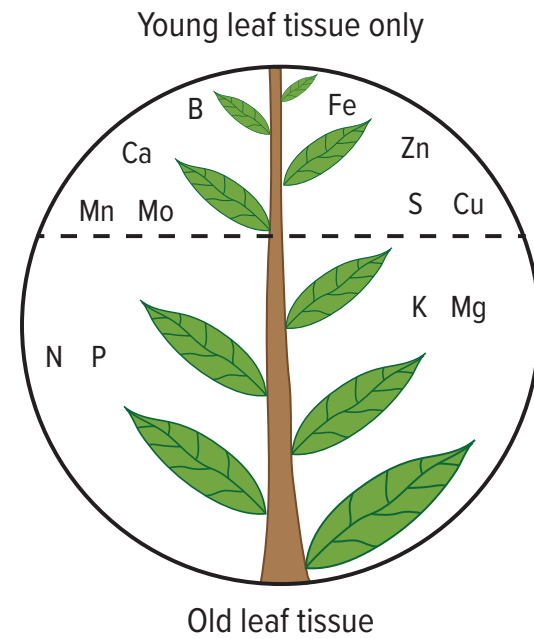
# Nutrient Deficiency Symptoms

All twenty one nutrients required by the plant, including macronutrients, micronutrients, and secondary nutrients, must be in balance in order for the plant to maintain its utmost health to defend against unfavorable environmental conditions. A proper soil and tissue sampling program is key tool in managing plant nutrition.

MACRONUTRIENTS	SECONDARY NUTRIENTS	MICRONUTRIENTS	
Nitrogen	Calcium	Boron	Manganese
Phosphorus	Magnesium	Zinc	Copper
Potassium	Sulfur	Molybdenum	Iron

Micronutrient deficiencies are likely when one of the following conditions apply:

- Removal of large amounts by high yielding crops
- Leaching from sandy soils
- Naturally high pH soils
- Over-limed soils resulting in a high pH
- Land leveling
- Additions of high rates of phosphorus
- Soil compaction
- Cool, wet growing conditions
- Tie-up by the soil
- Use of sensitive crop varieties



SOURCE: INTERNATIONAL PLANT NUTRITION INSTITUTE (IPNI)

Nutrient	Position on plant	Chlorosis?	Leaf margin necrosis?	Color and leaf shape	Diagram	NACHURS® Product
Nitrogen (N)	All leaves	Yes	No	Yellowing of leaves and leaf veins		<b>NACHURS SRN®</b> <b>NACHURS N-Rage Max®</b> <b>NACHURS Finish Line®</b> <b>NACHURS imPulse®</b> <b>NACHURS First Down®</b> <b>NACHURS Green-Flag®</b>
Phosphorus (P)	Older leaves	No	No	Purplish patches		<b>NACHURS imPulse®</b> <b>NACHURS First Down®</b> <b>NACHURS Triple Option®</b> <b>NACHURS Aqua-Tech® 7-20-4*</b> <b>NACHURS Balance®</b> <b>NACHURS Green-Flag®</b> <b>NACHURS Rhyzo-Link® PE</b>  * For overhead irrigation
Potassium (K)	Older leaves	Yes	Yes	Yellow patches		<b>NACHURS K-fuel®</b> <b>NACHURS K-flex®</b> <b>NACHURS K-fuse</b> <b>NACHURS Triple Option®</b> <b>NACHURS Finish Line®</b> <b>NACHURS First Down®</b> <b>NACHURS Aqua-Tech® 2-0-20</b> <b>NACHURS Balance®</b>

Nutrient	Position on plant	Chlorosis?	Leaf margin necrosis?	Color and leaf shape	Diagram	NACHURS® Product
Magnesium (Mg)	Older leaves	Yes	No	Yellow patches		<b>NACHURS® 2.5% Mg EDTA</b>
Calcium (Ca)	Young leaves	Yes	No	Deformed leaves		<b>NACHURS® 3% Ca EDTA</b>
Sulfur (S)	Young leaves	Yes	No	Yellow leaves		<b>NACHURS K-flex®</b> <b>NACHURS K-flex® MAX</b> <b>NACHURS K-fuse</b> <b>NACHURS Aqua-Tech® 2-0-20</b> <b>NACHURS Triple Option®</b>
Manganese (Mn) Iron (Fe)	Young leaves	Yes	No	Interveinal chlorosis		<b>NACHURS® 6% Mn EDTA</b> <b>NACHURS® 4.5% Fe EDTA</b> <b>NACHURS Finish Line®</b> <b>NACHURS Sideswipe®</b> <b>NACHURS Face Off®</b>
Boron (B) Copper (Cu) Molybdenum (Mo) Zinc (Zn)	Young leaves	--	--	Deformed leaves		<b>NACHURS® 10% B</b> <b>NACHURS® 7.5% Cu EDTA</b> <b>NACHURS® 9% Zn EDTA</b> <b>NACHURS Finish Line®</b> <b>NACHURS Balance®</b> <b>NACHURS Sideswipe®</b> <b>NACHURS Face Off®</b>