SOIL TESTING NUTRIENT FERTILITY CHART

NUTRIENT	SUMMARY	OPTIMUM RANGE	SOURCES OF FERTILITY	SUSCEPTIBLE PLANTS
Organic Matter	Improves soil structure, water retention, and nutrient availability. Acts as a reservoir of nutrients.	The higher, the better	Compost, Biochar, Worm Castings, Peat Moss, Cover Crops, Animal Manure, Coco Coir, Seed Meals, Mulches, Kitchen Scraps, Organic Fertilizers	All plants
Cation Exchange Ratio (CEC)	Bright, Measures the soil's ability to hold and exchange cations (nutrients). Higher CEC indicates better nutrient availability.	• Sandy Soils: Minimum CEC: 5 meq/100g; Optimal Range: 5-15 meq/100g • Loamy Soils: Minimum CEC: 10 meq/100g; Optimal Range: 10-25 meq/100g • Clay Soils: Minimum CEC: 15 meq/100g; Optimal Range: 20-40 meq/100g	• Organic Matter Biochar: Providing more surfaces for cations to adhere to, improving nutrient retention. • Humic and Fulvic Acids: Increases the soil's organic matter content and improving its structure. • Glacial Rock Dust: Composed of a mixture of ground-up rocks, glacial rock dust is rich in a variety of minerals. • Greensand: Rich in potassium and iron. It has a slow-release effect on nutrients. • Azomite: Natural source of trace minerals and elements. • Gypsum: Contributes calcium and sulfur, which can help improve CEC in certain soil types. • Dolomitic Limestone: Provides calcium and magnesium. • Soft Rock Phosphate: Rich in phosphorus and calcium to improve fertility and soil structure.	All Plants
pH Level	Affects nutrient availability and microbial activity. Most plants prefer a pH between 6.0 and 7.5.	6.0 - 7.5	**To Lower pH:** • Sulfur: Oxidized by soil bacteria to form sulfuric acid, which lowers the soil pH. Iron Sulfate: Provides iron and also helps to acidify soil. • Sphagnum Peat Moss: Acidic and can be mixed into the soil to help lower pH.Acidifying Fertilizers: Contain ammonium nitrate, ammonium sulfate, or urea can lower soil pH as the ammonium is converted to nitrate. **To Raise pH:** • Lime: A common soil amendment that raises soil pH by neutralizing acidity. • Dolomitic Lime: Contains calcium carbonate and magnesium carbonate, used to raise pH and add magnesium. • Bone Meal: Adds phosphorus and calcium, and can slightly raise soil pH. • Oyster Shell: Slowly raises pH by adding calcium carbonate.	Refer to final page of this document
Nitrogen (N)	Essential for plant growth and development. Crucial for photosynthesis and protein synthesis., indirect to direct	20-50 ppm	• Blood Meal: A fast-acting source of nitrogen derived from dried animal blood. • Fish Emulsion: A liquid fertilizer made from fish waste, providing a quick nitrogen boost. • Alfalfa Meal: An organic amendment that slowly releases nitrogen as it breaks down. Soybean Meal: A plant-based amendment that is high in nitrogen. • Feather Meal: A slow-release nitrogen source made from processed poultry feathers. Cover Crops: See related information on cover crop seed.	Leafy greens (lettuce, spinach), Brassicas (cabbage, broccoli)

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Potassium (K)	Regulates water uptake, enzyme activation, and photosynthesis. Improves drought resistance and disease tolerance.	150-250 ppm	• Potassium Sulfate: A highly soluble form of potassium that also provides sulfur; good for all soil types. • Potassium Chloride: Also known as muriate of potash; a common and inexpensive potassium source, though it adds chloride. • Greensand: A mineral amendment that slowly releases potassium and other trace minerals over time. • Kelp Meal: A natural source of potassium that also adds trace minerals and organic matter.	Fruit-bearing vegetables (tomatoes, peppers), root vegetables
Magnesium (Mg)	Central component of chlorophyll. Necessary for photosynthesis and enzyme activation.	50-120 ppm	• Epsom Salt: Dissolves in water and apply as a soil drench or foliar spray. Provides a quick boost of magnesium and sulfur. • Dolomitic Lime: Contains both calcium carbonate and magnesium carbonate. Helps raise soil pH while adding magnesium. • Greensand: Contains glauconite, which provides potassium and magnesium. Slow-release amendment that also improves soil structure. • Langbeinite: A naturally occurring mineral that provides potassium, magnesium, and sulfur.	Leafy greens (lettuce, spinach), fruit-bearing vegetables
Phosphorus (P)	Important for energy transfer and root development. Enhances flowering and fruiting.	30-60 ppm	• Bone Meal: A slow-release organic fertilizer made from ground animal bones, rich in phosphorus. • Rock Phosphate: A natural mineral powder that releases phosphorus slowly over time. • Fish Bone Meal: Similar to bone meal but made from fish bones, providing phosphorus and other nutrients. • Guano: High in phosphorus, especially the type sourced from fruit-eating bats.	Root vegetables (carrots, potatoes), legumes (beans, peas)
Magnesium (Mg)	Central component of chlorophyll. Necessary for photosynthesis and enzyme activation.	50-120 ppm	• Epsom Salt: Dissolves in water and apply as a soil drench or foliar spray. Provides a quick boost of magnesium and sulfur. • Dolomitic Lime: Contains both calcium carbonate and magnesium carbonate. Helps raise soil pH while adding magnesium. • Greensand: Contains glauconite, which provides potassium and magnesium. Slow-release amendment that also improves soil structure.	Leafy greens (lettuce, spinach), fruit-bearing vegetables
Calcium (Ca)	Important for cell wall structure and stability. Enhances root development and nutrient uptake.	1000-2000 ppm	• Lime: This is one of the most common amendments used to raise soil calcium levels. It also helps to raise soil pH, making it less acidic. • Gypsum: This amendment adds calcium without affecting soil pH, making it suitable for soils that already have a neutral or slightly alkaline pH. • Bone Meal: This organic amendment is high in calcium and phosphorus, making it a good choice for improving calcium levels and overall soil fertility. • Dolomitic Lime: This is a type of lime that contains both calcium carbonate and magnesium carbonate, providing both calcium and magnesium to the soil. • Oyster Shell Flour: This is a fine powder made from ground oyster shells, rich in calcium carbonate and used as a slow-release calcium amendment.	Tomatoes, peppers, leafy greens (lettuce, spinach)
Sodium (Na)	In small amounts, it can help with osmotic balance in plants, but excess can cause toxicity and soil degradation.	<50 ppm	• Gypsum: Replaces sodium ions with calcium ions, improving soil structure and drainage. • Organic Matter: Adding compost or other organic materials improves soil structure and promotes leaching of sodium. • Sulfur (Elemental): Help lower soil pH and displace sodium when converted to sulfuric acid by soil microbes. • Acid-forming Fertilizers: Ammonium sulfate or other acid-forming fertilizers can help displace sodium ions.	Most plants are sensitive to high sodium; not usually deficient

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Sulfur (SO_4-S)	Vital for protein synthesis and enzyme function. Improves root growth and resistance to diseases.	20-40 ppm	• Gypsum (Calcium Sulfate): Gypsum is a widely used soil amendment that adds sulfur and calcium to the soil. • Elemental Sulfur: This is a concentrated form of sulfur that, when applied to soil, gets converted to sulfate by soil bacteria, thereby increasing the sulfur content. • Epsom Salt (Magnesium Sulfate): Epsom salt provides both magnesium and sulfur, making it a good choice for soils deficient in these elements.	Allium family (garlic, onions), Brassicas (cabbage, broccoli)
Zinc (Zn)	Essential for enzyme activation, protein synthesis, and growth regulation.	1-5 ppm	• Zinc Sulfate: A widely used inorganic zinc fertilizer that is highly effective in increasing soil zinc levels. It can be applied as a soil amendment or foliar spray. • Zinc Oxide: An inorganic compound that can be used as a soil amendment. It is less soluble than zinc sulfate but can still be effective. • Bone Meal: An organic source of phosphorus that can also contain trace amounts of zinc. • Greensand: A natural mineral containing glauconite, which can provide trace minerals including zinc.	Corn, beans, citrus fruits
Manganese (Mn)	Crucial for photosynthesis, respiration, and nitrogen assimilation.	5-20 ppm	• Manganese Sulfate: Trace element can be added during pre-planting or planting times.Cascade Remineralizing • Soil Boost: Contains multiple trace minerals.	Cereals (wheat, barley), beans, potatoes
Iron (Fe)	Necessary for chlorophyll synthesis and enzyme function. Deficiency can cause chlorosis (yellowing of leaves).	2-10 ppm	• Iron Sulfate (Ferrous Sulfate): This is one of the most common iron supplements for soil. It quickly increases iron availability but may need frequent applications. • Blood Meal: This organic fertilizer is rich in nitrogen and also provides iron. It releases nutrients slowly as it breaks down in the soil.	Leafy greens (spinach, kale), beans, tomatoes
Copper (Cu)	Important for photosynthesis, respiration, and lignin synthesis. Helps with seed production and disease resistance.	0.5-2.0 ppm	Cascade Remineralizing Soil Boost: Contains multiple trace minerals	Grains (wheat, barley), beans, potatoes
Boron (B)	Essential for cell wall formation, membrane integrity, and reproductive development.	0.5-2.0 ppm	Fertibor: Slow release fertilizer with a risk of toxicity to plants if over-applied	Root vegetables (carrots, beets), Brassicas (cabbage, broccoli)

COVER CROP

COVER CROP	NUTRIENTS ADDED	COMMON PLANTING SEASON	ADDITIONAL BENEFITS
Legumes (e.g., clover, alfalfa, peas)	Nitrogen (N), Magnesium (Mg), Calcium (Ca)	Spring or Summer	Fix atmospheric nitrogen into the soil through symbiotic relationships with nitrogen-fixing bacteria. Adds organic matter and improves soil structure.
Austrian Winter Peas	Nitrogen (N), Calcium (Ca), Magnesium (Mg)	Fall	Adds nitrogen to the soil, provides ground cover, and can be used as forage for livestock.
Buckwheat	Phosphorus (P), Potassium (K), Calcium (Ca), Manganese (Mn)	Spring or Summer	Scavenges and makes phosphorus more available. Rapid growth suppresses weeds.
Crimson Clover	Nitrogen (N), Phosphorus (P), Calcium (Ca), Sulfur (SO_4-S)	Summer or Fall	Provides a good ground cover, adds organic matter, and attracts beneficial insects.
Hairy Vetch	Nitrogen (N), Potassium (K), Calcium (Ca), Zinc (Zn), Manganese (Mn)	Summer or Fall	Excellent nitrogen fixer, adds organic matter, and improves soil structure.
Mustard	Sulfur (SO_4-S)	Spring or Summer	Biofumigant properties that help control soil-borne pests and diseases.
Oats	Nitrogen (N), Potassium (K), Magnesium (Mg), Calcium (Ca)	Spring or Summer	Improves soil structure and organic matter. Effective in suppressing weeds.
Radish (e.g., daikon radish)	Nitrogen (N), Phosphorus (P), Calcium (Ca), Magnesium (Mg), Boron (B)	Summer or Fall	Breaks up compacted soil layers (bio-tillage) and scavenges deep nutrients.
Rye	Nitrogen (N), Potassium (K), Sulfur (SO_4-S), Zinc (Zn)	Summer or Fall	Excellent for preventing soil erosion, adding organic matter, and improving soil structure.
Sorghum-Sudan Grass	Nitrogen (N), Potassium (K), Sulfur (SO_4-S), Zinc (Zn)	Spring or Summer	Produces large amounts of biomass, improves soil structure, and suppresses weeds and nematodes.

NUTRIENT	COVER CROPS	ADDITIONAL BENEFITS
Nitrogen (N)	Legumes (e.g., clover, alfalfa, peas), Oats, Radish (e.g., daikon radish), Rye, Sorghum-Sudan Grass, Crimson Clover, Hairy Vetch, Austrian Winter Peas	Fix atmospheric nitrogen into the soil through symbiotic relationships with nitrogen-fixing bacteria. Adds organic matter and improves soil structure.
Phosphorus (P)	Buckwheat, Radish (e.g., daikon radish), Crimson Clover	Scavenges and makes phosphorus more available. Rapid growth suppresses weeds.
Potassium (K)	Buckwheat, Oats, Rye, Sorghum-Sudan Grass, Sunflowers, Hairy Vetch	Regulates water uptake, enzyme activation, and photosynthesis. Improves drought resistance and disease tolerance.
Magnesium (Mg)	Legumes (e.g., alfalfa, clover), Sunflowers, Radish (e.g., daikon radish), Oats, Austrian Winter Peas	Central component of chlorophyll. Necessary for photosynthesis and enzyme activation.
Calcium (Ca)	Legumes (e.g., alfalfa, clover), Buckwheat, Sunflowers, Radish (e.g., daikon radish), Oats, Crimson Clover, Hairy Vetch, Austrian Winter Peas	Important for cell wall structure and stability. Enhances root development and nutrient uptake.
Sulfur (SO4-S)	Mustard, Rye, Sorghum-Sudan Grass, Crimson Clover	Vital for protein synthesis and enzyme function. Improves root growth and resistance to diseases.
Zinc (Zn)	Rye, Sorghum-Sudan Grass, Hairy Vetch	Essential for enzyme activation, protein synthesis, and growth regulation.
Manganese (Mn)	Buckwheat, Hairy Vetch	Crucial for photosynthesis, respiration, and nitrogen assimilation.
Iron (Fe)	No specific cover crop is known for adding iron directly; maintaining soil pH and organic matter can help improve iron availability.	Necessary for chlorophyll synthesis and enzyme function. Deficiency can cause chlorosis (yellowing of leaves).
Boron (B)	Radish (e.g., daikon radish)	Essential for cell wall formation, membrane integrity, and reproductive

PH LEVEL EXCEPTIONS

PLANT	PREFERRED PH RANGE
Plants Preferring pH Below 6.0:	
Blueberries (Vaccinium spp.)	4.5 to 5.5
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Azaleas (Rhododendron spp.)	4.5 to 6.0
Rhododendrons (Rhododendron spp.)	4.5 to 6.0
Camellias (Camellia spp.)	4.5 to 6.0
Gardenias (Gardenia jasminoides)	5.0 to 6.5
Cranberries (Vaccinium macrocarpon)	4.0 to 5.5
Potatoes (Solanum tuberosum)	4.8 to 5.5
Raspberries (Rubus idaeus)	5.5 to 6.5
Sweet Potatoes (Ipomoea batatas)	5.5 to 6.5
Parsley (Petroselinum crispum)	5.0 to 7.0
Strawberries (Fragaria x ananassa)	5.5 to 6.5
Lupines (Lupinus spp.)	4.5 to 6.0
Hydrangeas (Hydrangea macrophylla)	5.0 to 5.5 for blue flowers6.0 to 6.5 for pink flowers

PLANT	PREFERRED PH RANGE
Plants Preferring pH Above 6.5-7.0	
Lavender (Lavandula spp.)	7.0 to 8.0
Asparagus (Asparagus officinalis)	6.5 to 8.0
Cabbage (Brassica oleracea)	6.0 to 8.0
Oregano (Origanum vulgare)	6.0 to 8.0
Beets (Beta vulgaris)	6.0 to 8.0
Cilantro (Coriandrum sativum)	6.5 to 8.0
Sage (Salvia officinalis)	6.0 to 8.5
Almond Trees (Prunus dulcis)	7.0 to 8.5
Artichoke (Cynara scolymus)	6.5 to 8.0