

nourish

Garden *for* Health

Soil Management & Fertilization



Jan 15 <i>welcome!</i>	Soil Management
Feb 5	Composting
Feb 26	Fruits
Mar 11	Propagation
Apr 1	Container Gardens
Apr 22	Vegetable Gardening



Schedule

Sign up for our upcoming classes!



Meet Your Garden and Kitchen Guides!



“He heard nothing but the swish of the scythes, and saw before him Tit’s upright figure mowing away, the crescent-shaped curve of the cut grass, the grass and flower heads slowly and rhythmically falling before the blade of his scythe, and ahead of him the end of the row, where would **come the rest.**”

Leo Tolstoy, *Anna Karenina*

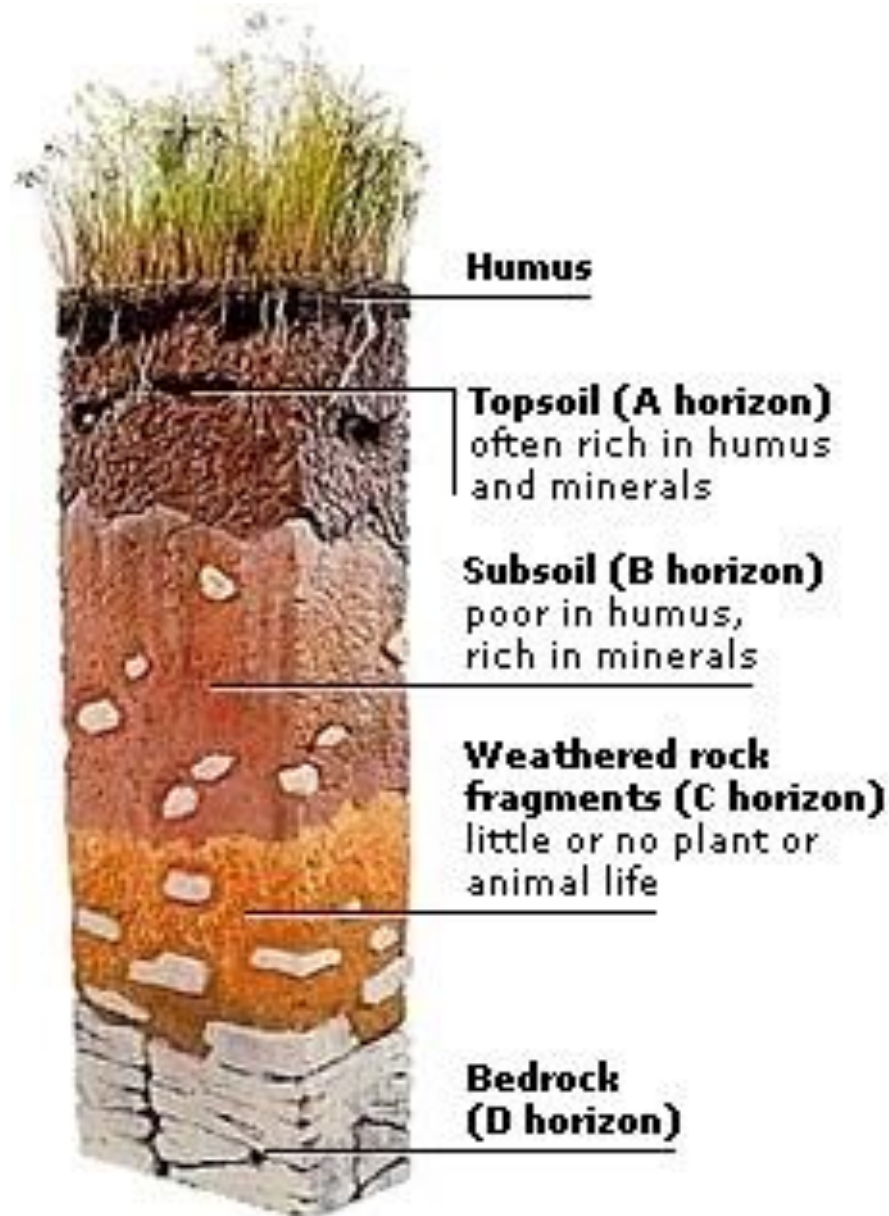
Soil & Soil Layers

Soil is a dynamic medium

- » Humus (decaying flora & fauna)
- » Minerals
- » Living organisms (fungi, bacteria, insects)
- » Rock particles

Topsoil is most productive soil

- » Anchors plants
- » Essential nutrients for plant development
- » Traps water and air



Topsoil Texture

Texture based on particle size

» clay → silt → sand → gravel, rocks

In Texas, most topsoil is loamy

» Equal proportion of clay, silt, and sand

Sandy loams = “lighter” soil

» Easier to work

» Requires more water and less fertile

Clayey loams = “heavier” soil

» Need less water

» Fertile and productive





Soil Moisture

Soil texture, environmental conditions, and plant “thirst” affect soil moisture.

Check

- » Tactile: Use your hands!
- » Visualize: Soil shrinks away from container edges

Water

- » Long, deep water to thoroughly soak roots
- » Good drainage essential

Topsoil pH

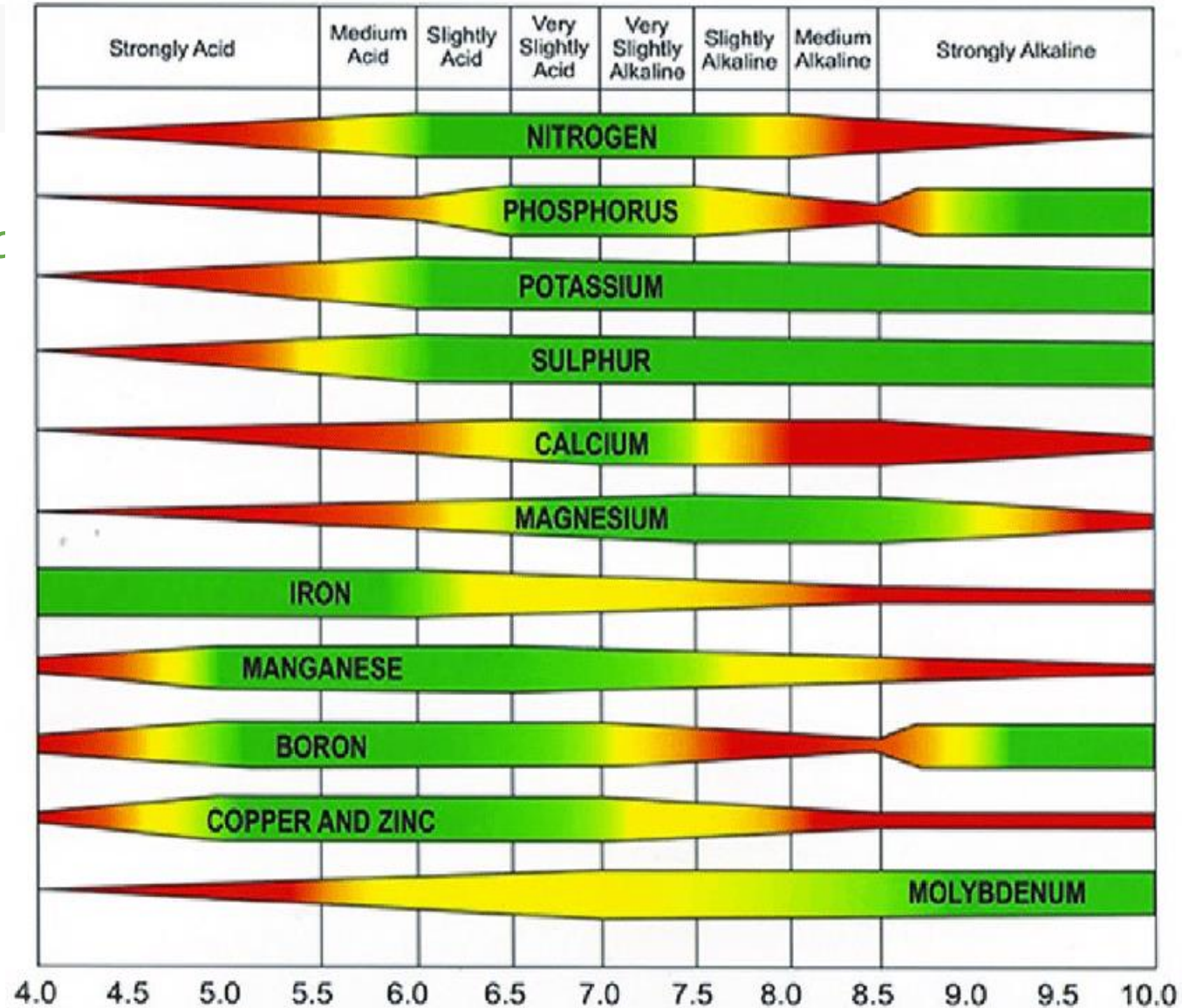
Optimum pH = 6.0 - 6.8 *slightly acidic*

Horticulture Lingo

- » Acidic soil = "sour"
- » Alkali soil = "sweet"

Keep within plant ideal range

- » Essential nutrients biochemically available
- » Greater microorganism diversity and activity





DIY Soil Testing

Dig a hole 1-2 feet deep

- » Easy to do after recent rain

Identify soil layers

- » Topsoil: usually darker because more humus
- » Subsoil: lighter, accumulation of clay

Ask yourself

- » How deep is the organic debris (e.g. leaves)
- » How deep is the layer of topsoil?
- » What is the texture of the topsoil?
- » Where does the subsoil begin?
- » What is the texture of the subsoil?



DIY Soil Test: Hand-Texturing Method

Plant Nutrition

Nourishing your plants

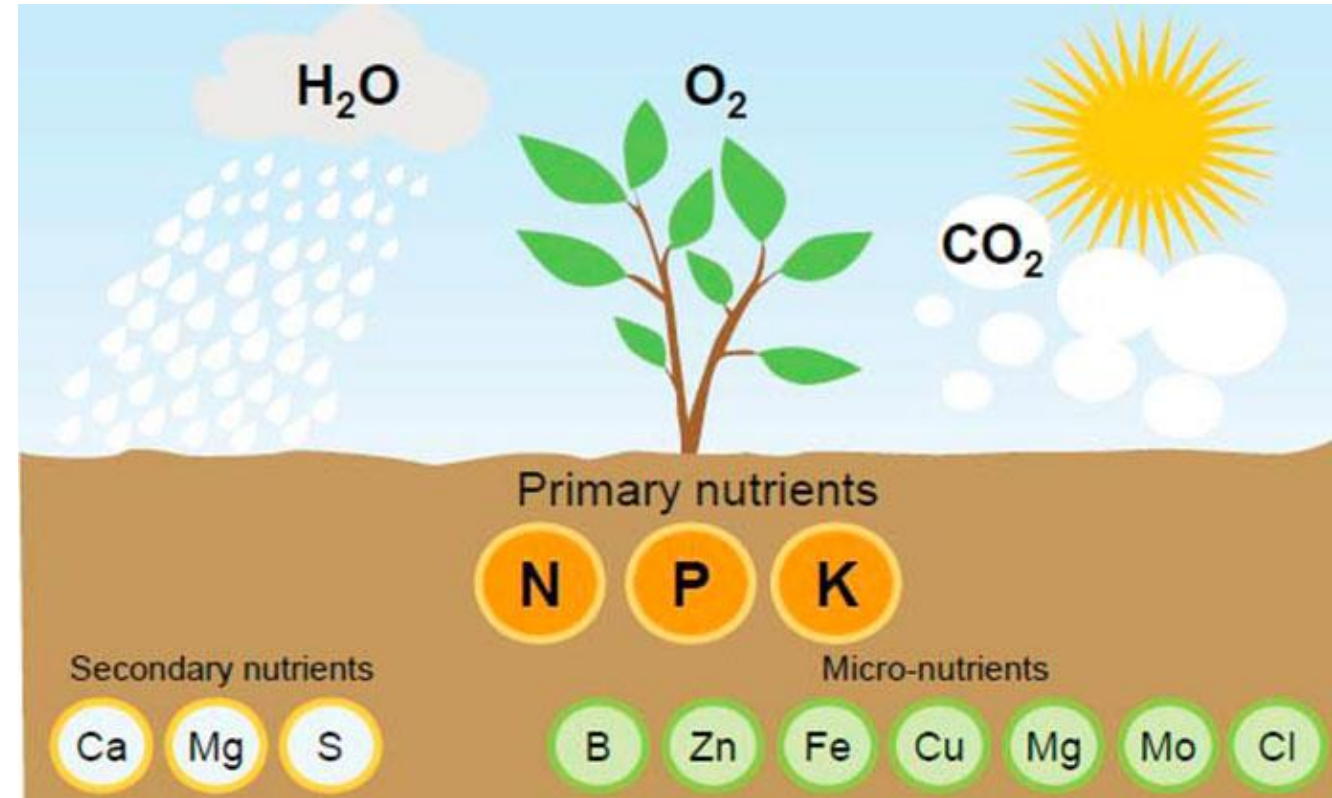
16 Essential Nutrients

General Nutrients

- » Carbon (C) → organic material in soil
- » Oxygen (O) → air in soil or CO₂
- » Hydrogen (H) → water in soil

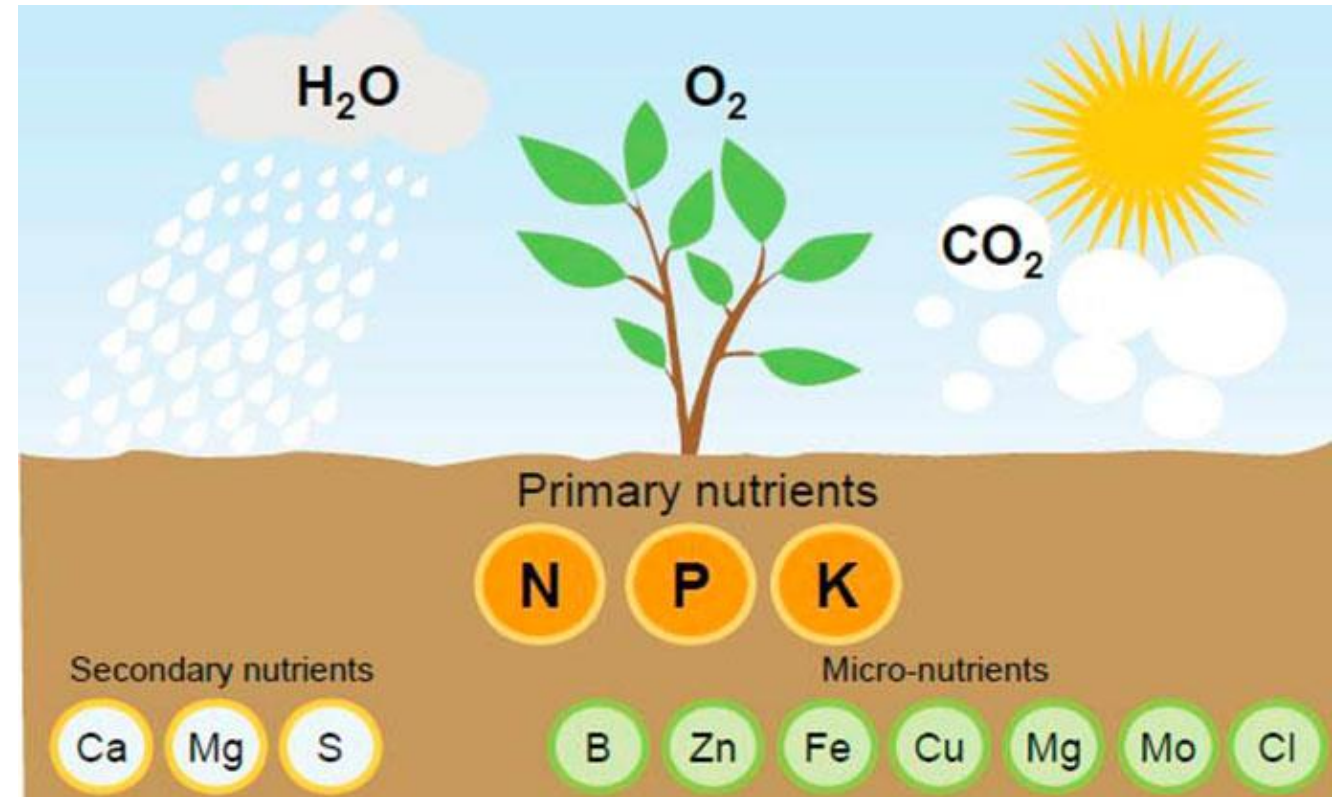
Primary Nutrients

- » Nitrogen (N) → shoot and green growth
- » Phosphorus (P) → root growth, flowers
- » Potassium (K) → root growth, tubers, bulbs



Secondary Nutrients

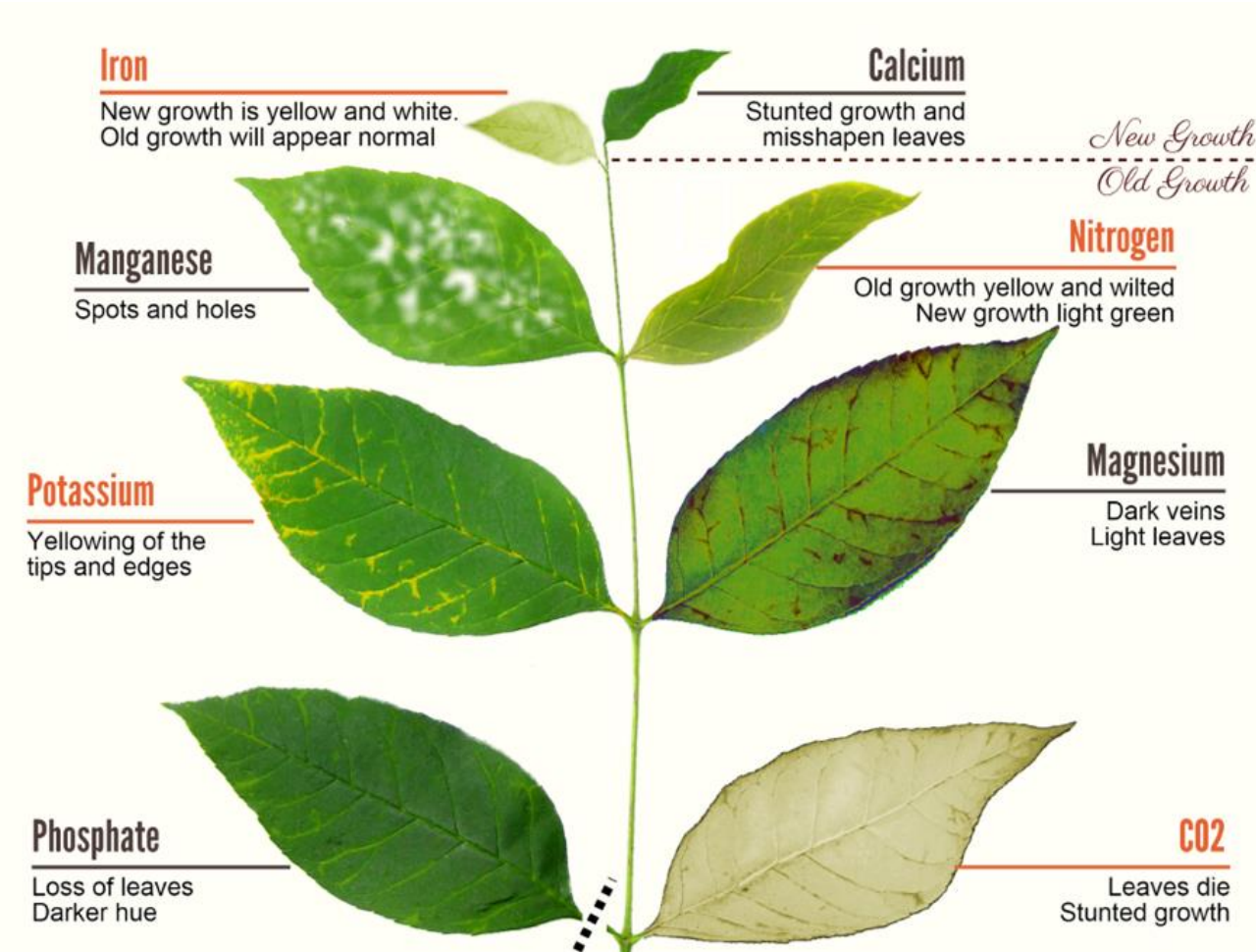
- » Calcium (Ca) → meristem and throughout
 - Deficiency: blossom end rot and tip burn
 - Solution: apply lime or gypsum
- » Magnesium (Mg) → chlorophyll
 - Deficiency: interveinal chlorosis
 - Solution: apply epsom salt, lime
- » Sulfur (S) → plant proteins & chlorophyll
 - Deficiency: uniform chlorosis
 - Solution: apply compost, manure, gypsum



Micronutrients

Needed in smaller amounts relative to general and macronutrients, yet very important to plant vitality

- » Boron (B) → promote root growth / sugar formation
- » Zinc (Zn) → cell differentiation, RNA synthesis
- » Iron (Fe) → photosynthesis and respiration
- » Copper (Cu) → enzymes for photosynthesis
- » Manganese (Mn) → photosynthesis
- » Molybdenum (Mo) → assimilate N
- » Chlorine (Cl) → osmotic pressure and water content of plants



Nitrogen Deficiency

Problem

- » Deficiency of nitrogen in soil
- » Common in Houston, high humidity / wet environments
- » Nitrogen leaching

Signs

- » Old growth is yellow and pale
- » Small new growth

Solution

- » Apply organic or inorganic fertilizer



Magnesium Deficiency

Problem

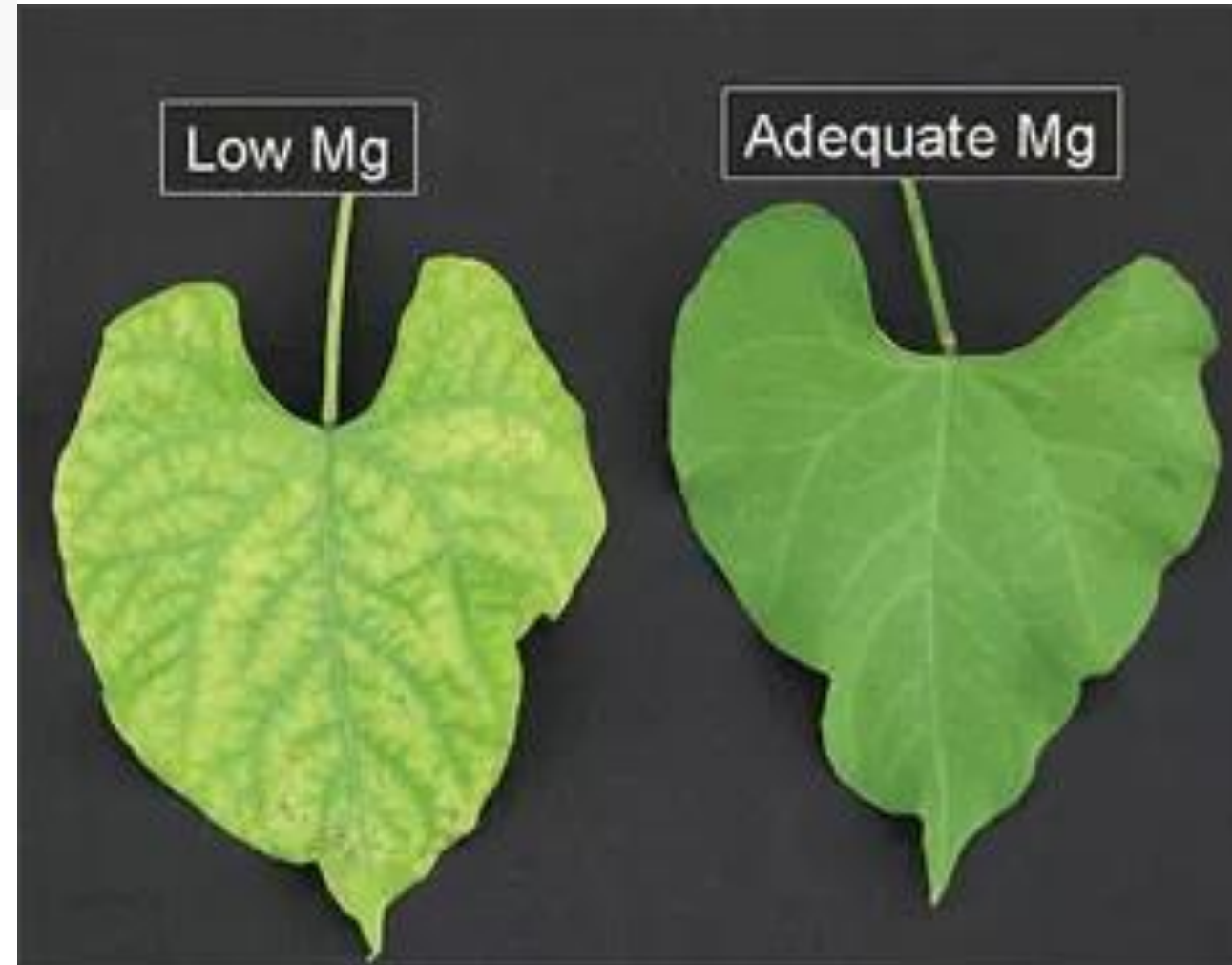
- » Deficiency of magnesium in soil
- » Common in Houston, sandy soils, or purchased sandy loam topsoils

Signs

- » Interveinal chlorosis in **older** leaves first
- » Premature leaf drop in severe cases

Solution

- » Add epsom salt
- » Add dolomitic lime



High Soil Salinity

Problem

- » High concentration of sodium in soil
- » Burns plant roots, prevents nutrient uptake
- » Common in Houston, poor irrigation / drainage

Signs

- » Brown or dead edges of leaf margins (apex first)

Solution

- » Improve irrigation
- » Avoid overuse of **inorganic** fertilizer
- » Add sulfur to soil



Prepare Your Soil

Use your existing soil unless you have little to no soil

1. Remove existing vegetation
2. Turn surface soil
3. Promote good drainage
4. Prepare the seed or plant bed
5. Add soil amendments



Soil Preparation: Double Digging

Deeply prepare soil by making subsoil accessible and useful to plant roots

How

- » Topsoil removed and subsoil loosened
- » Amendments added to subsoil

When

- » Done every 2 or 3 years
- » As needed



Replenish Soil = Fertilize

Fertilizer Ratio

- » Percentage weight of N - P - K
- » Nourish holistic garden uses 6 - 2 - 4

Fertilizer Forms

- » Liquid
- » Powder or granular (pellets)

Organic vs Inorganic

- » Organic: moderate concentration, slow release, contains all nutrients
- » Inorganic: higher concentration, cheaper, faster release



Applying Fertilizer

Replenish depleted nutrients to prevent or correct nutrient deficiencies

Methods

- » Split application
- » **Broadcast application**
- » Band application
- » **Side dress application**
- » **Mulch application**
- » Top dressing

Always wear gloves when handling chemicals!



Today's Activities

Garden



- » Taste test crops
- » Practice soil fertilizing techniques
- » Harvest winter greens and herbs
- » Collect plant material for compost


Kitchen




- » Clean our harvest
- » Cooking demonstration
- » Take home extras and herbs

Thank You!

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 [sph.uth.edu/research/centers/dell/
nourish-program/](https://sph.uth.edu/research/centers/dell/nourish-program/)



Extra Reading: “Essential Nutrients for Plant Growth” by Uchida, R.



Calcium deficient corn leaves fail to unfold.













Calcium deficient bean leaves have chlorotic and necrotic spots.

Deficiency symptoms

- Ca is not mobile and is not translocated in the plant, so symptoms first appear on the younger leaves and leaf tips. The growing tips of roots and leaves turn brown and die.
- Ca deficiency is not often observed in plants because secondary effects of high acidity resulting from soil calcium deficiency usually limit growth, precluding expressions of Ca deficiency symptoms.
- Without adequate Ca, which in the form of calcium pectate is needed to form rigid cell walls, newly emerging leaves may stick together at the margins, which causes tearing as the leaves expand and unfurl. This may also cause the stem structure to be weakened.
- In some crops, younger leaves may be cupped and crinkled, with the terminal bud deteriorating.
- Buds and blossoms fall prematurely in some crops.

Ca

Extra: Monocots vs Dicots

Monocots				
 <p>One cotyledon</p>	 <p>Veins usually parallel</p>	 <p>Vascular bundles usually complexly arranged</p>	 <p>Fibrous root system</p>	 <p>Floral parts usually in multiples of three</p>
Embryos	Leaf venation	Stems	Roots	Flowers
Dicots				
 <p>Two cotyledons</p>	 <p>Veins usually netlike</p>	 <p>Vascular bundles usually arranged in ring</p>	 <p>Taproot usually present</p>	 <p>Floral parts usually in multiples of four or five</p>

Extra: Nutrient Bioavailability Related to pH

