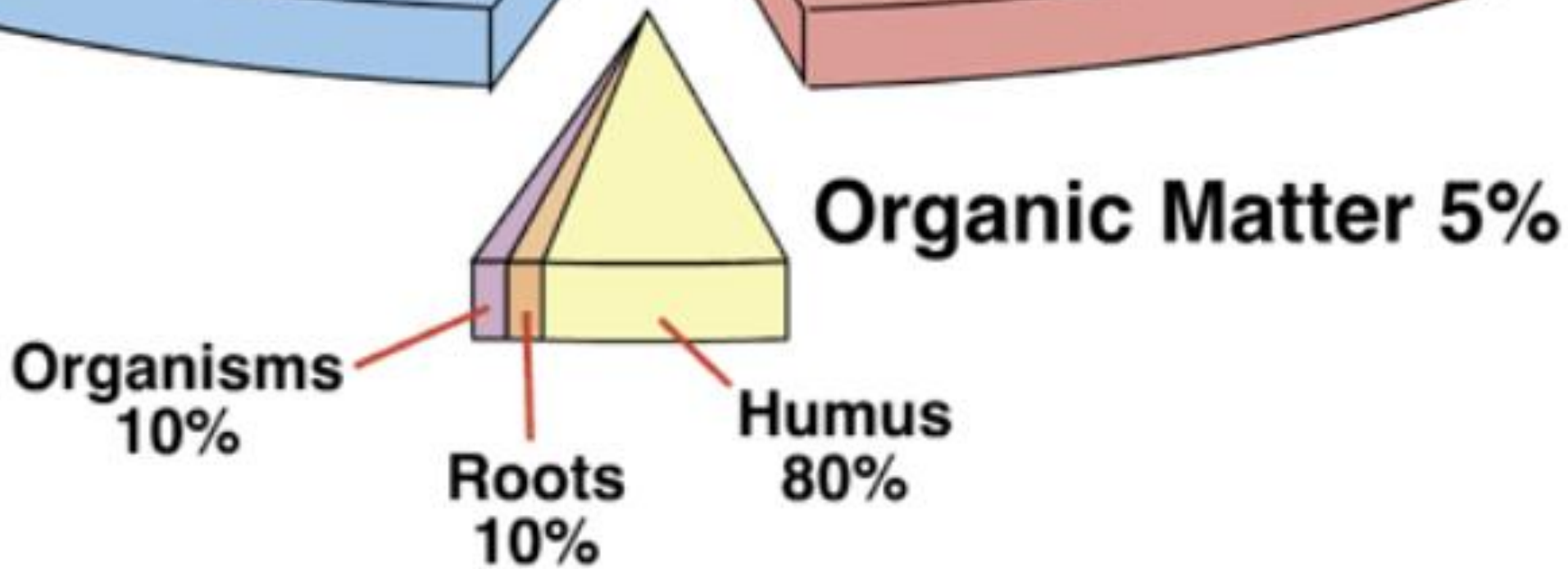
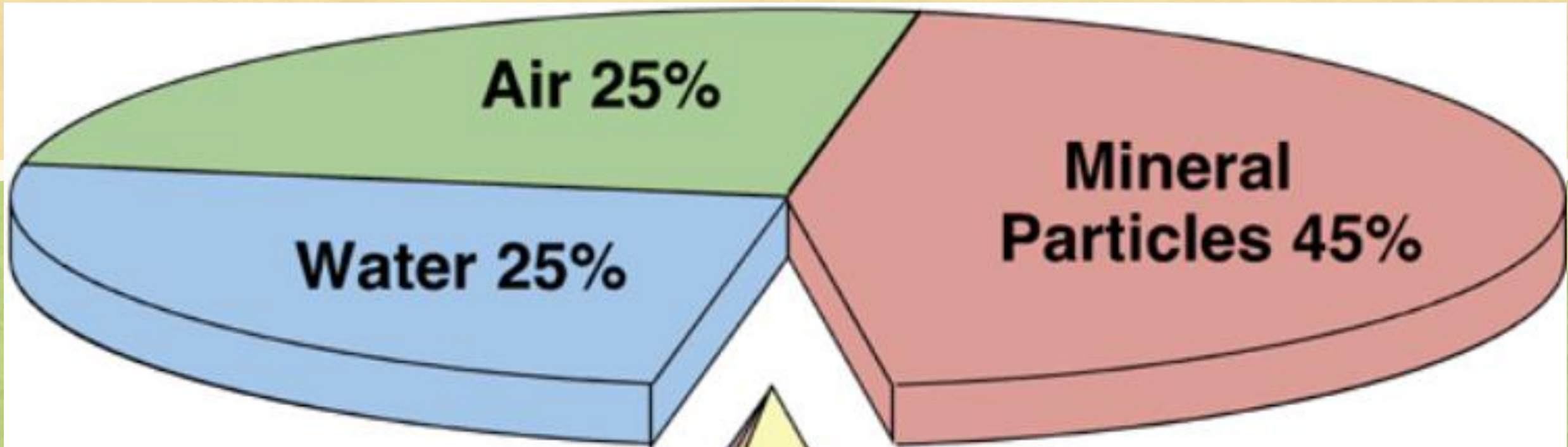




Daphne Richards
County Extension Agent—Horticulture
Texas A&M AgriLife Extension Service

Understanding Plant Nutrition

Grown Green Landscape Professionals Training
March 3, 2017



Essential Elements/Nutrients

There are **17** plant essential elements

3 are elements acquired from air and water:

C, H, O

Carbon

Hydrogen

Oxygen

Comprise **~95%** of fresh weight of plants

H₂O, CO₂, O₂

rainfall, irrigation, photosynthesis, respiration

Essential Elements/Nutrients

14 are nutrients acquired from minerals and/or the breakdown of organic matter

Split into *macro* and *micro* nutrients, according to amounts required for normal plant growth and development

Essential Elements/Nutrients

Macronutrients:

Amounts range from 0.2 to 10% of dry weight of healthy plants (2,000 to 100,000 ppm)

N	Nitrogen	P	Phosphorus
K	Potassium	S	Sulfur
Ca	Calcium	Mg	Magnesium

Essential Elements/Nutrients

Micronutrients:

Amounts range from 0.0001 to 0.03% of dry weight of healthy plants (1 to 300 ppm)

Mn Manganese

Fe Iron

Cu Copper

B Boron

Zn Zinc

Mo Molybdenum

Cl Chlorine

Ni Nickel

Essential Elements/Nutrients

Nutrient deficiencies:

Various negative symptoms are caused when essential nutrients not available in high enough concentration

Stunting, chlorosis, necrosis, tip-burn, marginal desiccation, deformed growth

Essential Elements/Nutrients

Nutrient toxicities:

Caused when essential nutrients are present in extremely high concentrations

Stunting, chlorosis, necrosis, tip-burn, marginal desiccation, deformed growth

Essential Elements/Nutrients

Nutrients are either *mobile* or *immobile* within the plant

Plant can either move/redistribute them from one area to another, or it can't

Essential Elements/Nutrients

Mobile nutrients: may be moved from one area of the plant to another if availability becomes growth limiting

Move from “less important” to “more important” areas

old leaves to new leaves

leaves to flowers/apical meristems, etc.

Essential Elements/Nutrients

Mobile nutrients:

Deficiencies of mobile nutrients will manifest symptoms in older/lower leaves first

Plant moves mobile nutrients from older tissues to newer tissues.

N

P

K

Mg

Cl

Zn

Mo

Essential Elements/Nutrients

Immobile nutrients:

Deficiencies of mobile nutrients will manifest symptoms in newer leaves first

Plant unable to move nutrients from older tissues to newer tissues.

Calcium (Ca), sulfur (S), iron (Fe), boron (B) and copper (Cu) are immobile.

Essential Elements/Nutrients

Nutrient deficiencies and toxicities are rare in landscapes, if native/adapted species are used

More common in production agriculture and greenhouse production, hydroponics, etc.

fruits, vegetables, grains

And common in non-native, non-adapted species

Azaleas, Camellias, maples, etc.

Fertilizers

Soil Amendments

Fertilizers are Salts

Soluble vs Granular vs Polymer Coated

Organic vs. Man-made

Chelated

Compost Tea/Foliar Feeding

Common issues

Too much N

lack of flowers

excessive vegetative growth

frost susceptibility

increased insect pressure

desiccation

Common issues

Low P

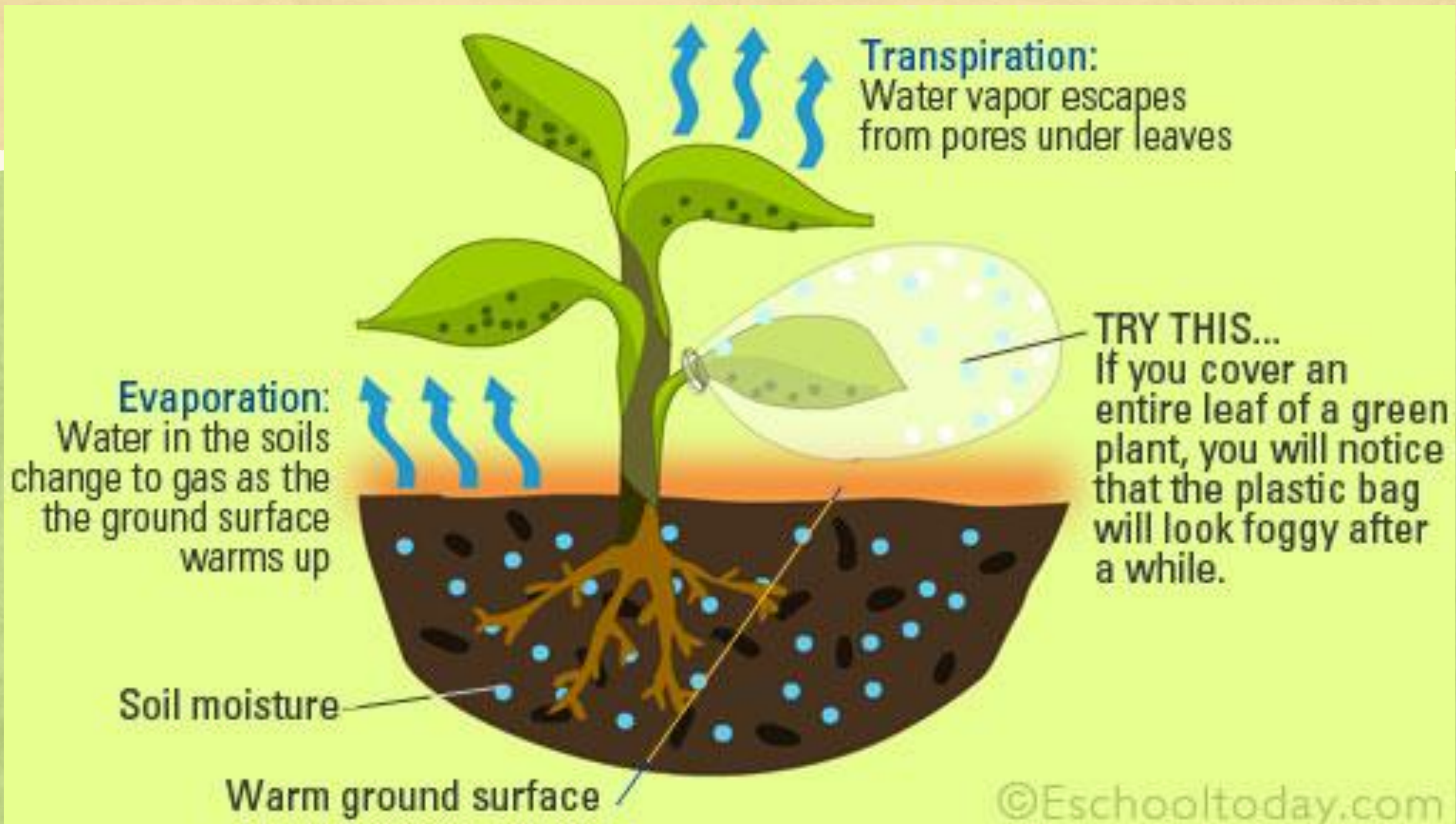
lack of flowering

Low Fe

interveinal chlorosis

common in lawns

common in acid-loving plants



Transpiration:
Water vapor escapes from pores under leaves

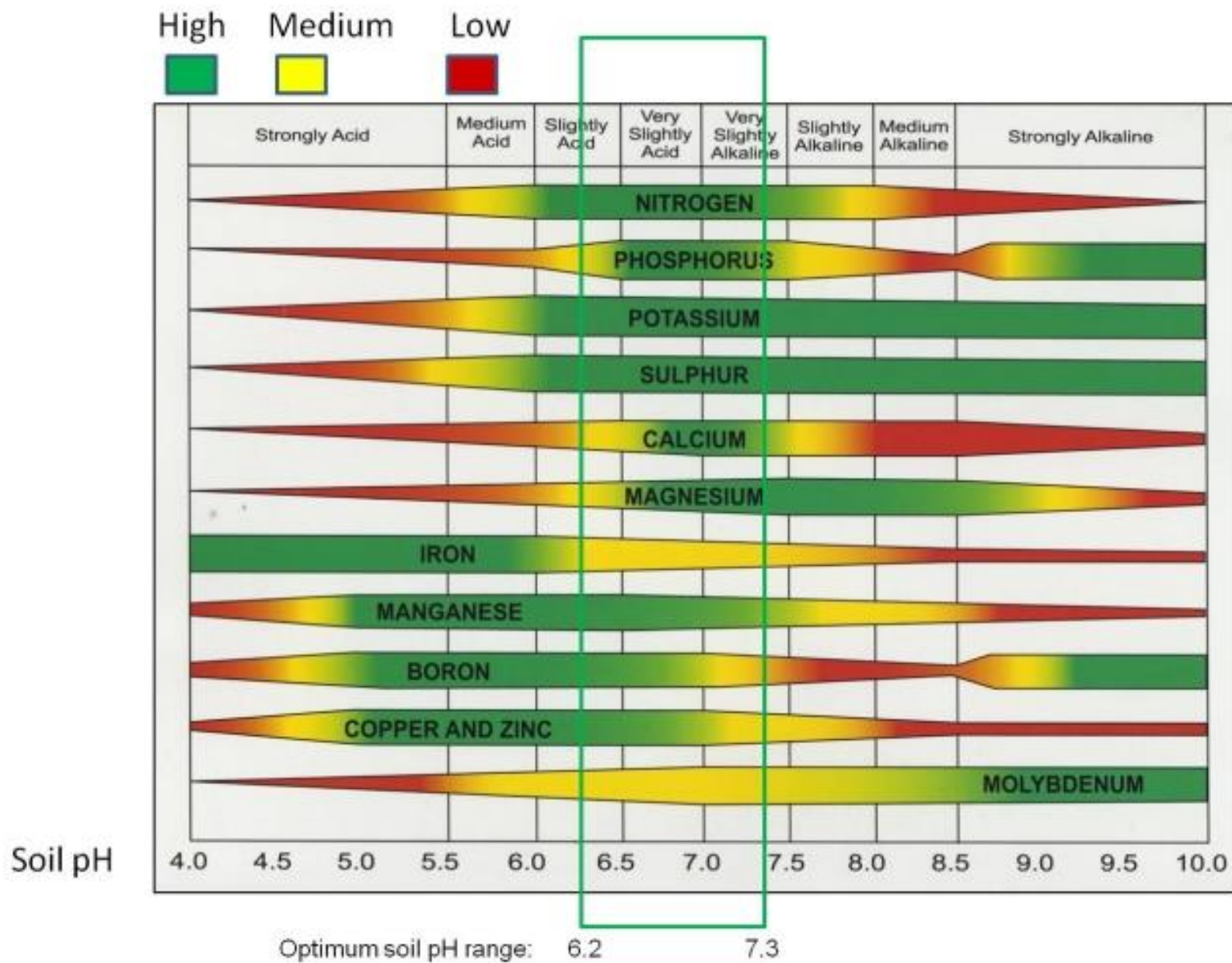
Evaporation:
Water in the soils change to gas as the the ground surface warms up

TRY THIS...
If you cover an entire leaf of a green plant, you will notice that the plastic bag will look foggy after a while.

Soil moisture

Warm ground surface

How soil pH affects availability of plant nutrients

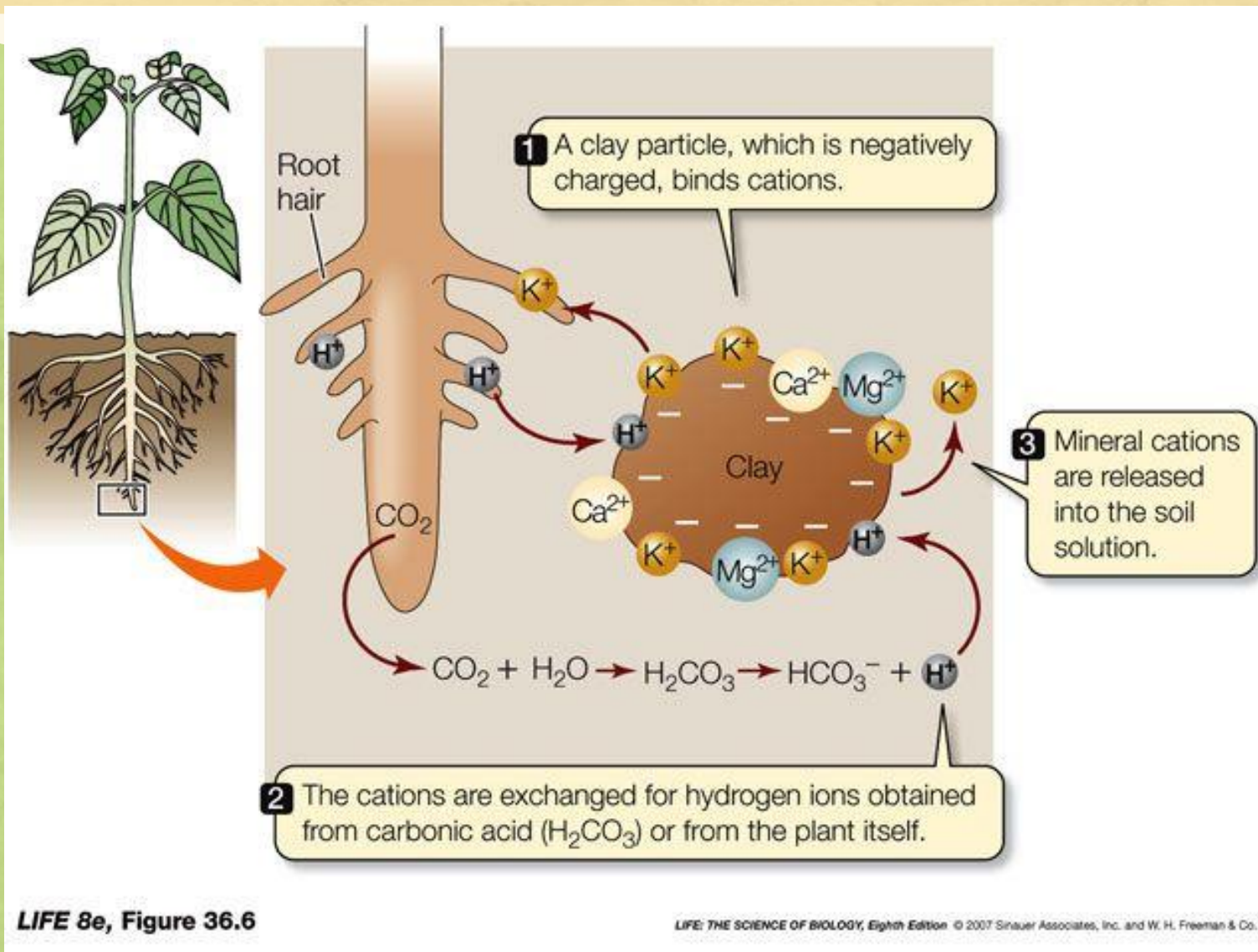


Essential Elements/Nutrients

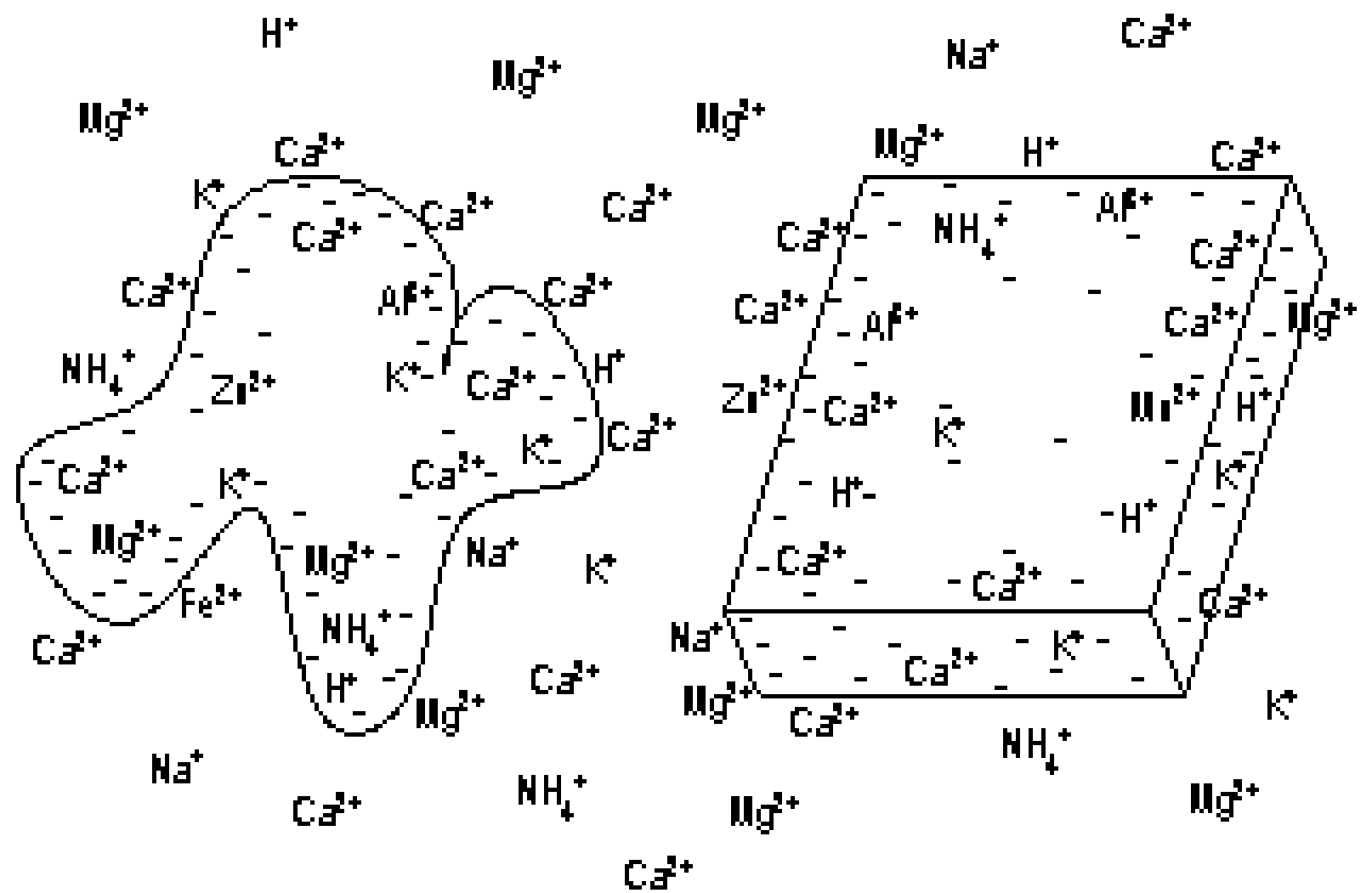
Form taken up by plants

N	NO_3^-	P	H_2PO_4^-
	NH_4^+		HPO_4^{--}
K	K^+	Ca	Ca^{++}
Mg	Mg^{++}	S	SO_4^{--}
Cl	Cl^-	Fe	Fe^{++}
			Fe^{+++}

Cation Exchange Capacity

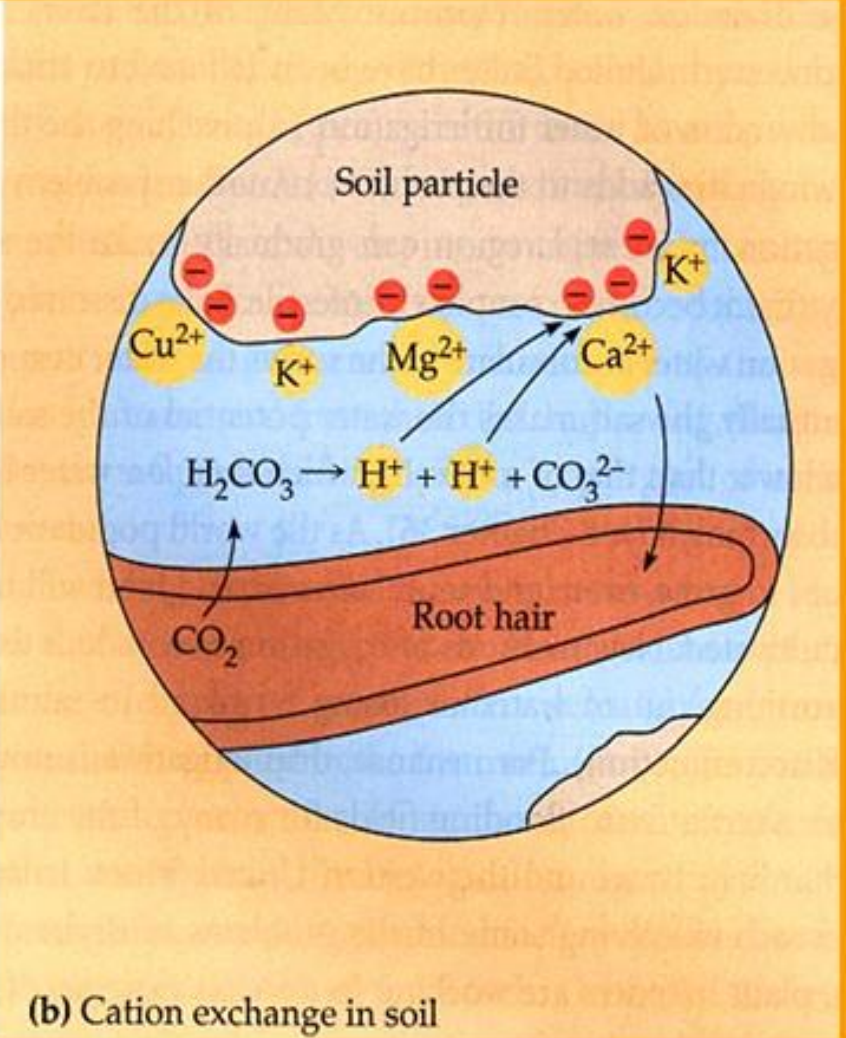
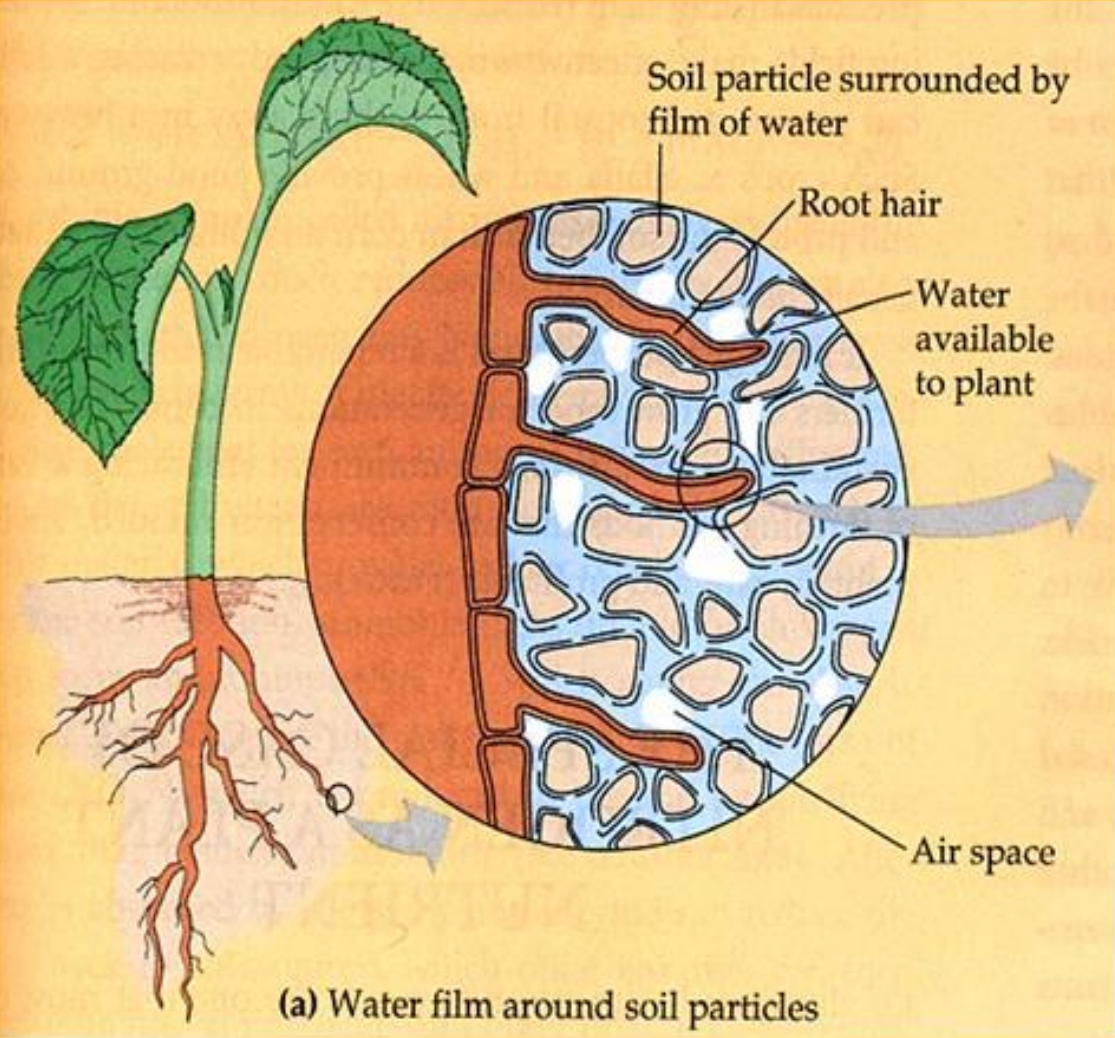


LIFE 8e, Figure 36.6

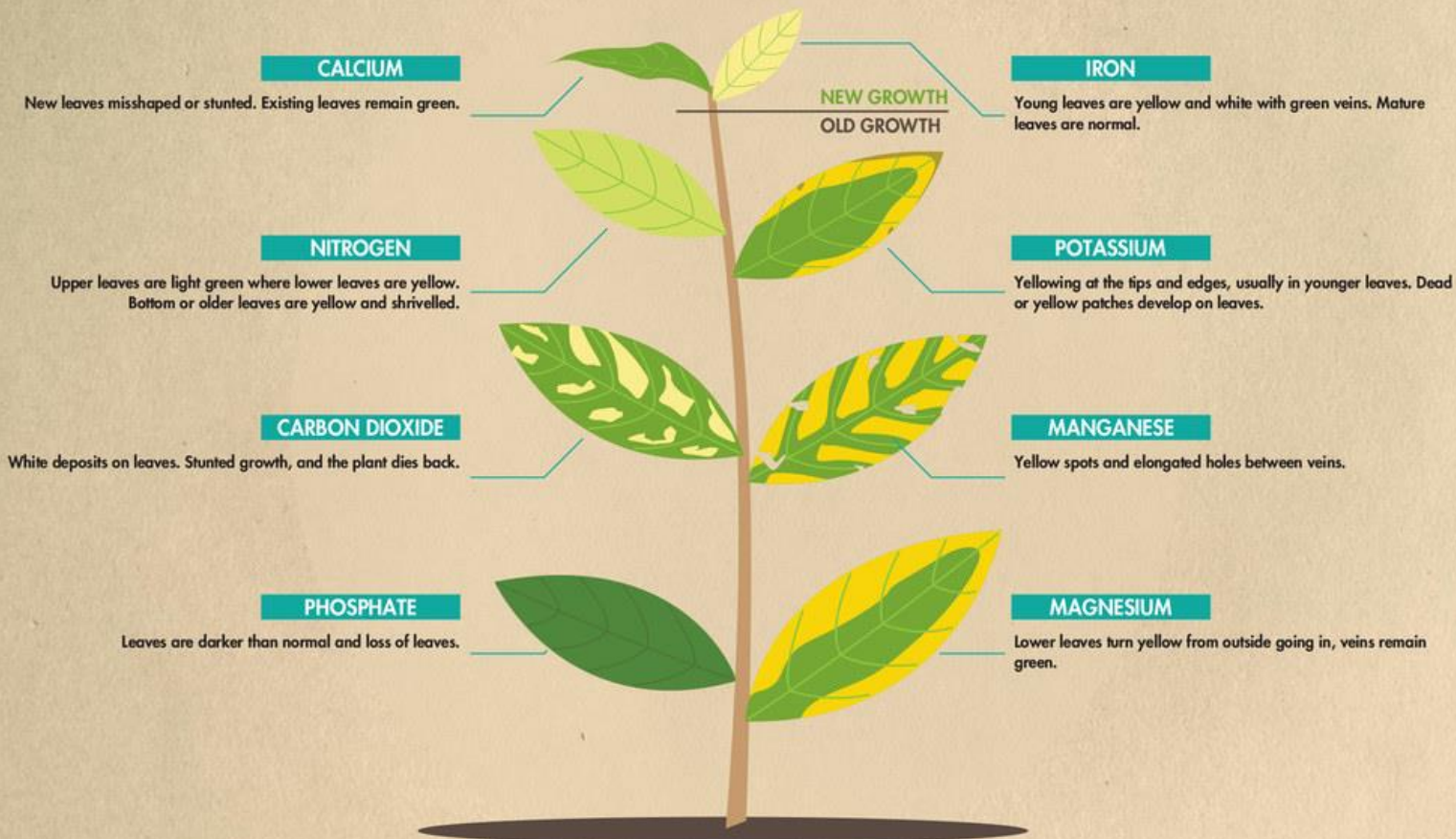


Organic Matter

Clay Particle



PLANT DEFICIENCY GUIDE



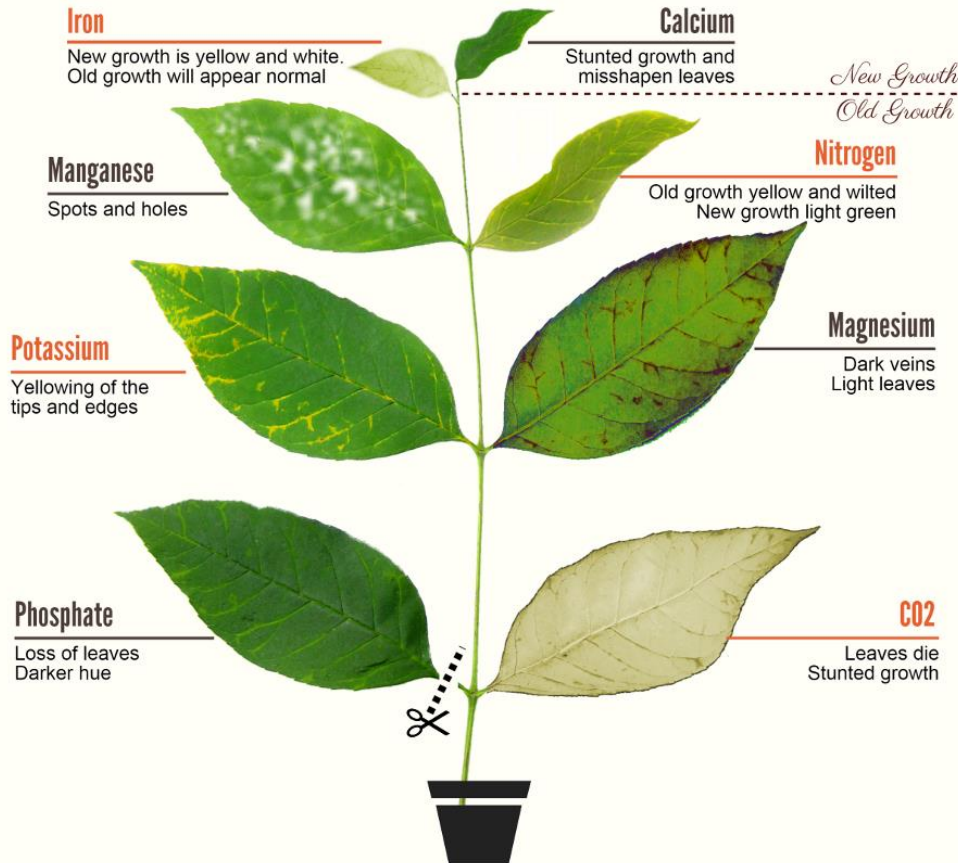
REFERENCES

<http://www.growrealfood.com/gardening/identifying-plant-nutrient-deficiencies/>

<http://extension.arizona.edu/sites/extension.arizona.edu/files/publications/az1106.pdf>

5 MIN GUIDE: FRESHWATER NUTRIENT DEFICIENCIES

BY: AQUATHUSIAST



FOR MORE INFO, VISIT:

aquathusiast.com/nutrientdeficiency

A PROJECT BY:



Sources:

aquathusiast.com
[flickr.com/photos/evelynfitzgerald/](https://www.flickr.com/photos/evelynfitzgerald/)

Old Leaves

Symptoms on entire plant

Plant light green. Lower leaves yellow, drying to brown

Nitrogen

Plant dark green with red or purple color. Lower leaves yellow, drying to dark green

Phosphorus

Symptoms on lower leaves only

Older leaves yellow at the edges, but stay green in the center.

Magnesium

Older leaves wilt or scorch. Edges necrotic with spots on leaves.

Potassium

New Leaves

Leaves distorted and/or necrotic

Leaves chlorotic

Terminal bud dies

Terminal bud does not die

Entire leaf chlorotic, spreading to entire plant

Interveinal chlorosis

Boron

New leaves distorted. Tips and edges necrotic.

Plant stunted. Leaves bluish-green, small and distorted.

Sulfur

Stems shortened and rosetted

Stems *not* shortened or rosetted

Zinc

Leaves *without* necrotic spots

Leaves develop necrotic spots

Calcium

Copper

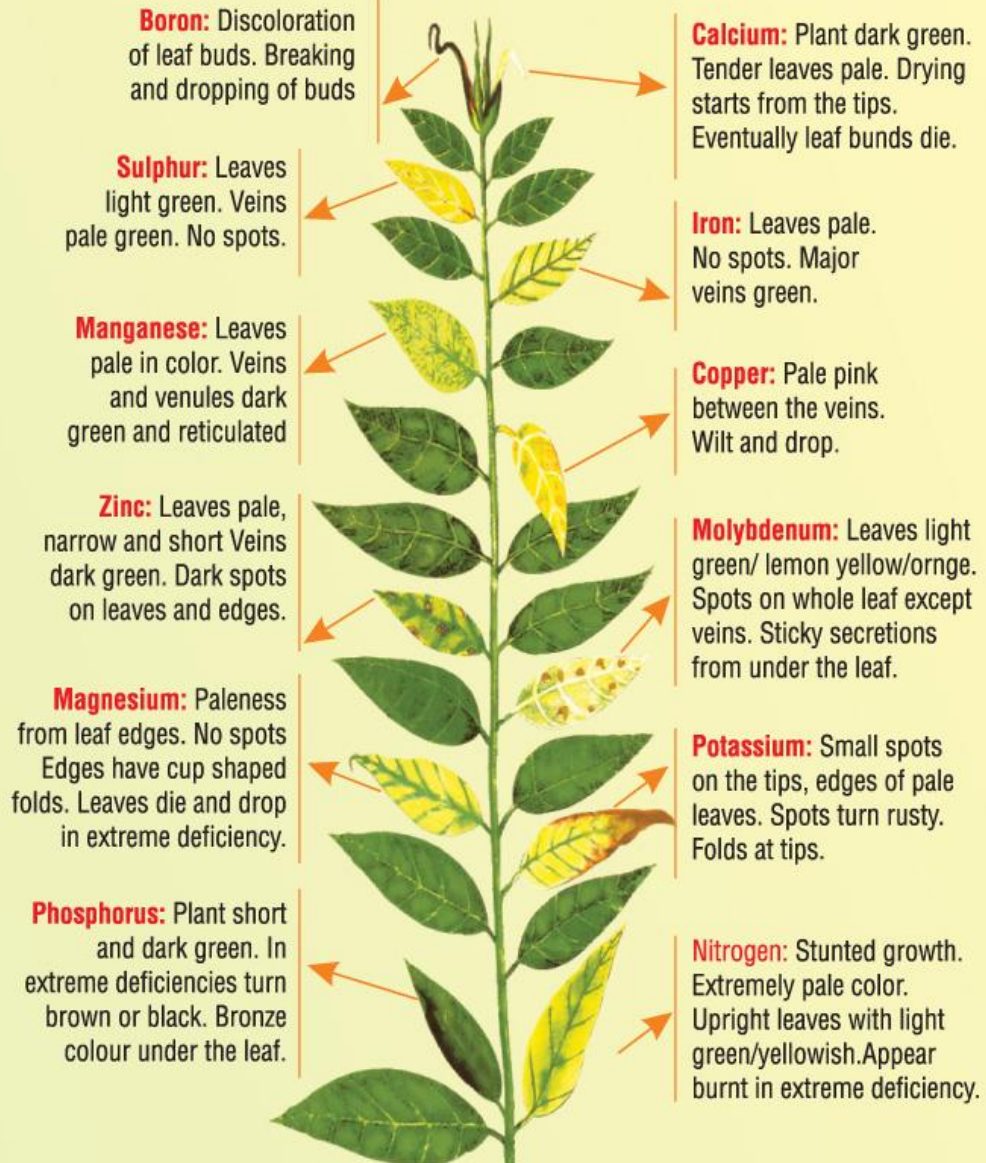
Iron

Manganese





Deficiency Chart of Micronutrients



**THE COLOUR REPRESENTED ARE INDICATIVE.
THEY MAY VARY FROM PLANT TO PLANT**

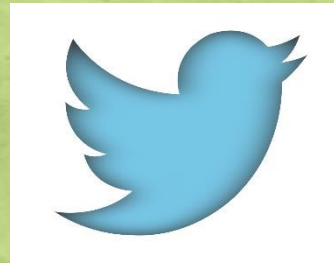


Program Announcements:
centraltexashorticulture.blogspot.com

**Questions?
Contact Extension for
more information**



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