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Social Horticulture Specialist

Plant Nutrition & Fertilizers

Master Gardener Training
October 24, 2017

University of Nevada
Cooperative Extension

Pre-assessment

1. (select one) Two parts per million of boron is (essential/toxic) to many plants
2. Tip burn indicates (choose one)
   a) iron deficiency
   b) excess water
   c) excess phosphorus
   d) insufficient calcium
3. (true or false) Nitrogen promotes plant disease

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p. 2

4. (true or false) Potassium deficiency may be confused with salt burn
5. Two nutrients (there are several) required for healthy leaves are:

_____ & _____

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Goals of this class

By the end of class, students will be able to:

- Recognize the role of nutrients in plant health
- Read a fertilizer label
- Recognize common nutrient deficiency symptoms
- Recognize other factors that may confound diagnosis of plant stress

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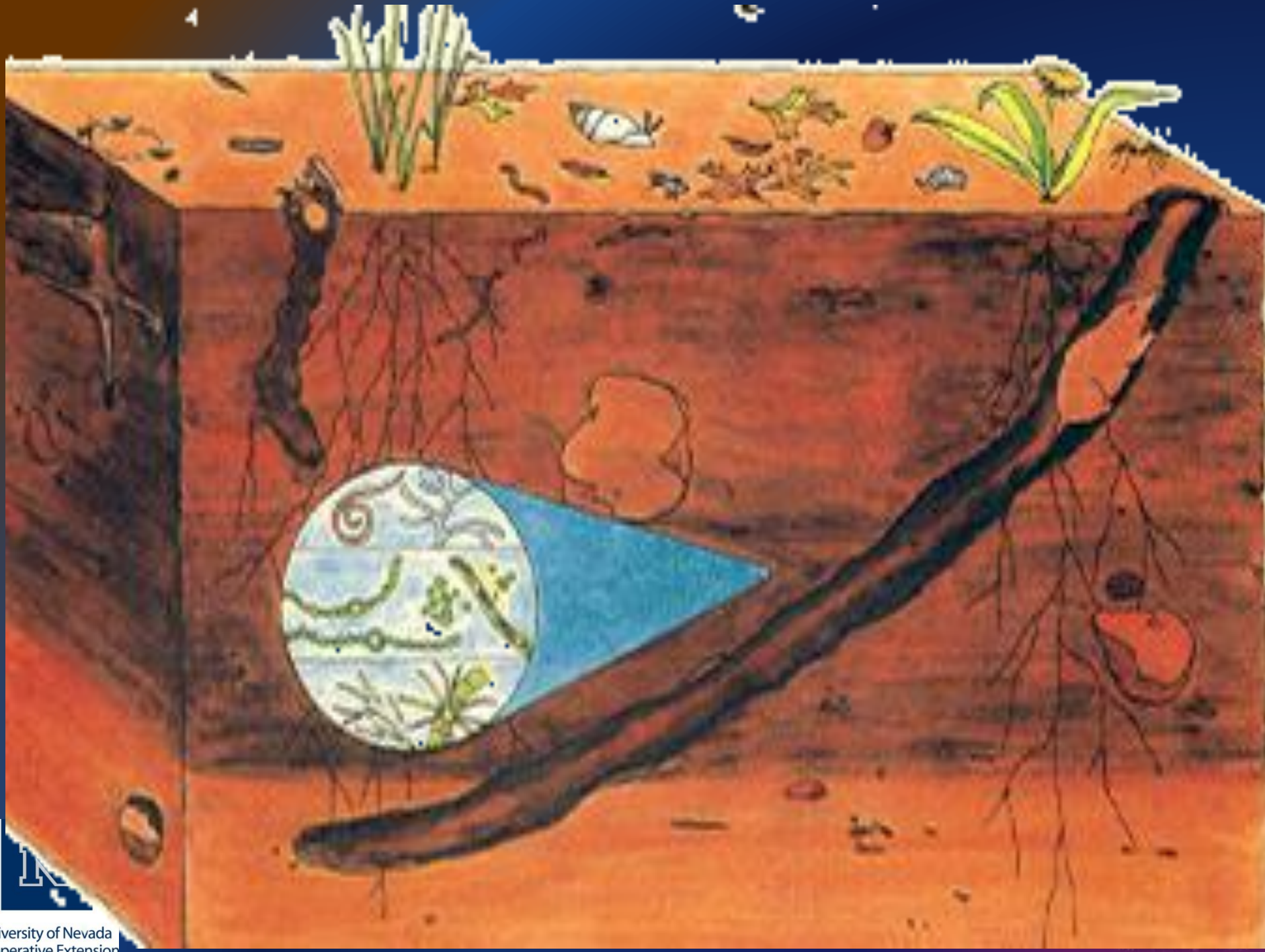
Proper plant nutrition

a balance among plant,

soil, soil organisms, and

the abiotic environment (light, air, water) that surrounds it



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Nutrient deficiency symptoms
Vocabulary

Chlorosis Yellowing of leaves

Interveinal chlorosis Striping; Leaf tissue between veins turns yellow but veins remain green

Necrosis drying and death of plant tissue

Stunting Shortened internodes

Abnormal coloration Red, purple, brown colors caused by pigments that serve other functions

Why nutrient deficiencies ?

1. Insufficient amount
2. Unusable form
3. Roots damaged
4. Poorly adapted plant

pH is measured

from **0**

(most acidic, concentrated acid)

to **14**

(most alkaline, concentrated base)

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Mineral Nutrients

Fertilizers

- Fertilizers are usually labeled either "general (or all) purpose" or are listed for a specific set of plants (e.g. rose fertilizer, cactus fertilizer)
- General purpose fertilizers have different concentrations of nutrients, but **will** have nitrogen, phosphorus and potassium, listed in that order

Read the Label

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—THE—

CLARK'S COVE GUANO CO.,

NEW BEDFORD, MASS.

CAPITAL, - - - $600,000.00.

EDMUND GRINNELL, PRES'T, SAMUEL IVERS, Treas.

MANUFACTURERS OF THE

Bay State Fertilizer!

WHICH GIVES AN **Early Start** to the young Plants; is lasting to end of season.

RESULTING IN **Large & Profitable CROPS** of Grass, Grain and Vegetables.

THE "BAY STATE" still leads in the field and that is where the farmer looks for returns for money invested. Very flattering reports are received daily from those who have given it a trial, and these are substantiated by the largely increased orders.

Remember that no worthless material enters its composition. It is compounded in such a way as not to strain or exhaust the soil, and to meet the requirements of *ALL CROPS*. Analysis guaranteed. Circulars and information mailed free on application.

Over.

han

"Major", "minor", "micro"

- Terms refer only to **the amount a plant needs** for survival.
- Nutrients are essential, but some may be toxic at high concentrations
- Different species, at different growth stages, need different levels of nutrients.

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The Major Nutrients

- Nitrogen (N)
- Phosphorus (P)
- Potassium (K)

Mobile nutrients

- Translocated from old tissue (bottom of the plant) to new tissue (top of the plant)
- Deficiency symptoms occur first on lower, older leaves
- Mobile nutrients are nitrogen (N), phosphorus (P), potassium (K), and magnesium (Mg)
- A plant that is not growing is dying

"minor" and "micro" nutrients

- Calcium* (Ca)
- Iron (Fe)
- Magnesium* (Mg)

* High concentration in desert soils.

- Boron* (B)
- Chlorine* (Cl)
- Cobalt (Co)
- Copper (Cu)
- Manganese (Mn)
- Molybdenum (Mo)
- Nickel (Ni)
- Selenium (Se)
- Sulfur (S)
- Zinc (Zn)

Immobile nutrients

- Deficiency symptoms occur mainly on upper, new leaves.
- Immobile nutrients: calcium (Ca), copper (Cu), iron (Fe), manganese (Mn), molybdenum (Mo), sulfur (S), and zinc (Zn).

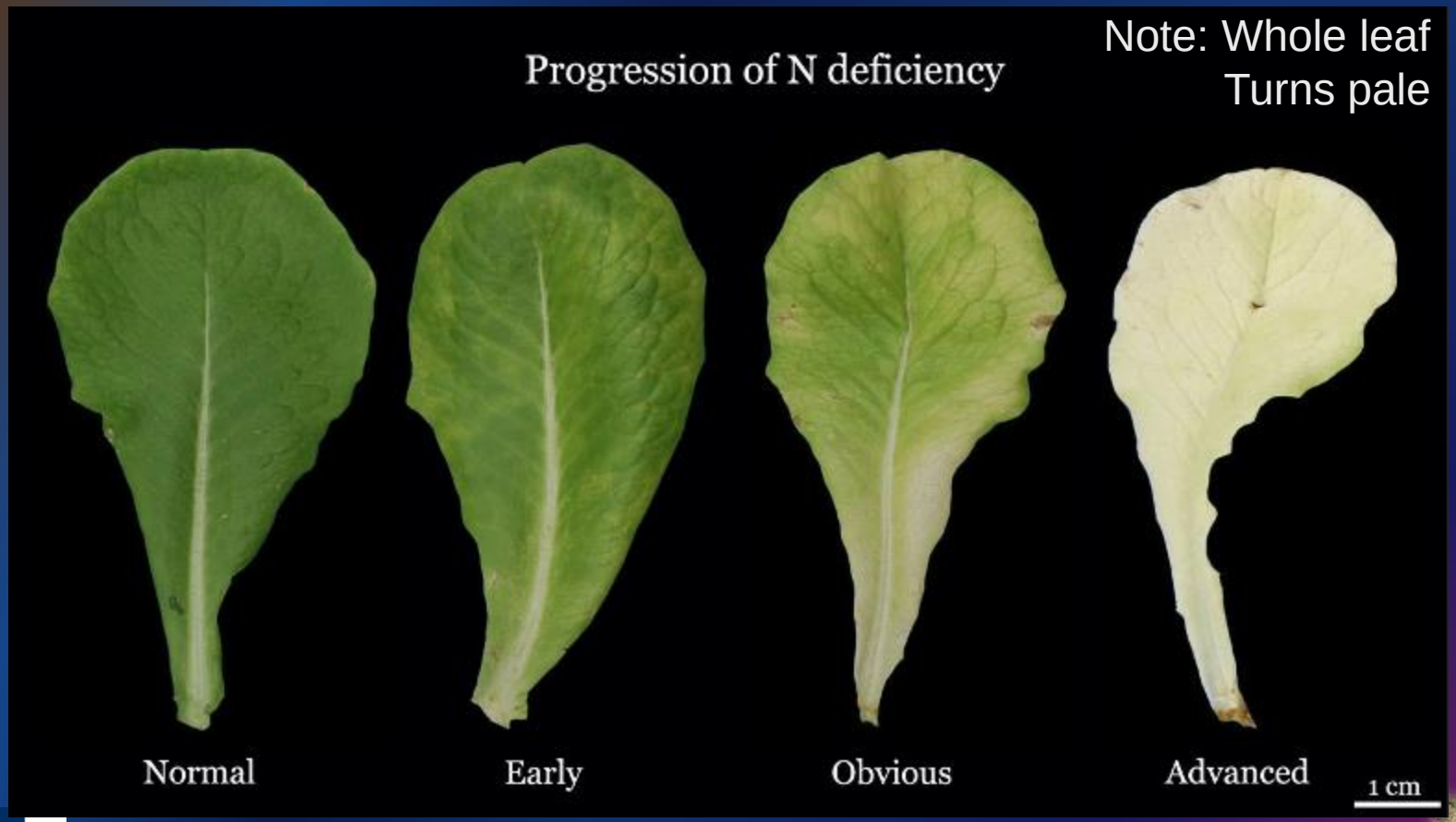
Old (wrong) rules of thumb

- Nitrogen tends to promote plant disease
- Phosphorus could promote or decrease plant disease
- Potassium tends to inhibit plant disease

Symptoms of plant nutrient problems

Leaf chlorosis

Nitrogen deficiency



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10/24/2017

Causes

- A major reason leaves develop an overall yellowish cast is lack of ***nitrogen***
- But this can also be the result of a lack of the element ***other nutrients*** **–**
- **Or**
  - Herbicide interference in nitrogen utilization
  - Plant disease
  - Waterlogged soil

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We think of nitrogen for healthy leaves, but nitrogenous compounds are also in leaves, flowers, seeds and roots

Nitrogen is also in:
Proteins

Nucleic acids

Chlorophyll
(and other color compounds like *anthocyanins*)

Obtaining N

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Soil organic matter

contains complex N compounds that are broken down by soil microbes & earthworms into usable chemicals (humus).

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Nitrogen fixation

Rhizobia = bacteria that form associations with roots of plants called legumes. Many native desert plants are leguminous (mesquite, cassia, acacia, silk tree).

Other bacteria fix N in vicinity of roots but do not form nodules. Plants benefit from their activities.

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Rhizobia nodules on legume roots

- Nodules are created by the plant in response to infection
- Only appear on legumes

Photo credit: Julie Grossman, North Carolina State University

Fertilizers

- General purpose fertilizers have nitrogen.
- First number on container
- In one of three forms
  - "ammonium" (volatile)
  - "nitrate" (leaches)
  - "urea" (urease)

PATENTED EXCLUSIVE FORMULA

Miracle-Gro® Water Soluble All Purpose Plant Food 24-8-16

F 1198

GUARANTEED ANALYSIS

Total Nitrogen (N)	24%
3.5% Ammoniacal Nitrogen	
20.5% Urea Nitrogen	
Available Phosphate (P_2O_5)	8%
Soluble Potash (K_2O)	16%
Boron (B)	0.02%
Copper (Cu)	0.07%
0.07% Water Soluble Copper (Cu)	
Iron (Fe)	0.15%
0.15% Chelated Iron (Fe)	
Manganese (Mn)	0.05%
0.05% Chelated Manganese (Mn)	
Molybdenum (Mo)	0.0005%
Zinc (Zn)	0.06%
0.06% Water Soluble Zinc (Zn)	

Derived from Ammonium Sulfate, Potassium Phosphate, Potassium Chloride, Urea, Urea Phosphate, Boric Acid, Copper Sulfate, Iron EDTA, Manganese EDTA, Sodium Molybdate, and Zinc Sulfate.

Information regarding the contents and levels of metals in this product is available on the internet at: http://www.regulatory-info-sc.com.

KEEP OUT OF REACH OF CHILDREN

MANTENER FUERA DEL ALCANCE DE LOS NIÑOS

Scotts Miracle-Gro Products, Inc.
14111 Scottslawn Road
Marysville, OH 43041

What's it for?

- If a plant has a large amount of N relative to other nutrients, it is probably meant for leaves

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Timing is everything

Applying nitrogen

- after a plant has begun flowering can interfere with flower production.
- after a plant has begun fruiting can interfere with fruit ripening.
- after a plant has begun producing a storage organ can stop it from developing.
- at the wrong time can promote disease.

*Diseases occur in N **deficient** plants*

especially

- Wilts (caused by blockages of plant's circulatory system)
- Soft rots (caused when pathogen "chews up" plant's cell walls)

Nitrogen for disease control and prevention

Fertilize at plant establishment and times of most vigorous growth

Most pathogens prefer one form of N, so use a mixture of forms
- Ammonium, nitrate, urea, organic

Over-fertilizing with N

- Excess succulence
- May lead to sulfur deficiency
- May result in disease

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Break!

Leaf Bronzing

A common cause of the purplish tinge affecting leaves is a deficiency of ***phosphorus***

Bronzing cont.

- Other causes include –
  - Spider mite damage
  - Nematode infection
  - Environmental (e.g. ozone) damage
  - Herbicide damage

Phosphorus - involved in

Reactions that require **energy** - in a plant (or a person or a bacteria, or any animal or fungus).

Anything related to **reproduction**: flower color, seed set

Root formation and leaf color

Merlot with advanced P deficiency symptoms.

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P Deficiency

- Purple on upper and lower leaf surfaces
- Leaves dark green and smaller than normal - Stunting
- Plants smaller than normal
- Dark purple stems

http://ag.montana.edu/warc/Peppermint%20deficiency%20symptoms_files/frame.htm#slide0031.htm

Streaking on monocots - similar to bronzing

Cell membrane disruptor herbicide (triazolinone) damage
➔bronzing

Spider mite caused bronzing on raspberry (below) and soybean →

Ozone damage → bronzing on bean

Obtaining phosphorus

Pools of phosphorus may exist

- But may be unavailable :
  - When soil pH is too low, tightly bound to soil aluminum
  - **When soil pH is too high, tightly bound to calcium.**
- Plant roots readily take up the limited amount of **soluble** P.

Mycorrhizae

- fungi plus roots.
- hyphae form a huge extension of root system.
- many desert plants **rely on these associations to obtain phosphorus**, as do forest plants, blueberries and alliums.

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Mycorrhizae

- take up certain elements
- drought resistance
- survival after planting
- growth rate
- protect from fungal root pathogens

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http://www.hawaii.edu/scb/images/photos/Fig4_pittosporum.jpg

Root associations – not the same

Rhizobia

- Bacteria
- Only legumes
- Only nitrogen fixation
- N fixation inhibited by excess N fertilization

Mycorrhizae

- Fungus & roots
- Many plants
- Many nutrients
- Disease protection
- Drought protection

Fertilizers

The second number on any container of fertilizer is the phosphorus percentage

It may be listed as

- phosphoric acid
- phosphate

(Technically, it's neither.)


Green Light Super Bloom®
12-55-6 with 0.10% Chelated Iron
Green Light Super Bloom® is a concentrated water soluble plant food immediately available to plants.
Guaranteed Analysis
Total Nitrogen (N) 12%
9% Ammoniacal Nitrogen 55%
3% Urea Nitrogen 6%
Available Phosphate (P_2O_5) 0.10%
Soluble Potash (K_2O)
Iron (Fe)
0.10% Chelated Iron (Fe)
Derived from Ammonium Phosphate, Urea, Monopotassium Phosphate, Iron Lignosulfate.
Directions:
Dissolve in water before using. Use any convenient applicator such as a sprinkling can or pail to dissolve plant food in water and apply as directed. Feed all blooming and fruiting plants every 10 to 14 days. Be sure soil is moist before applying.
Plants in pots and other containers:
Dissolve two TEAspoons Super Bloom® in one gallon water.
Outdoor flowers and fruiting plants in containers, planters, or bed areas:
Dissolve one TABLEspoon Super Bloom® in one gallon water.
CAUTION: Keep Out of Reach of Children
Super Bloom® is a Registered Trademark of Green Light Company. Information regarding the contents and levels of metals in this product is available on the Internet at http://www.regulatory-info-gl.com
GREEN LIGHT
Super Bloom
Flower Food
12-55-6
0.10% Chelated Iron
09.13.2007

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Higher levels of P tend to:

- increase resistance to bacterial disease
- increase resistance to fungal disease
- increase resistance to viral disease

- *Decrease resistance to nematode disease*

Applying surplus P

Generally not a good idea

- Plants do not use excess P efficiently
- Excess may run off (pollution source)
- Excess may be taken up by fungal pathogens

Best to maintain a balanced fertilizer regime, and try to keep pH lower than ~ 7.5

Excess P

may cause deficiencies of other minerals, e.g. zinc, iron and copper;

could be considered “expensive lime”

can cause plants to increase uptake of sodium, increasing salinity stress

Browning of leaf margins

- Most often due to ***potassium*** deficiency
- Can be an indication of salt damage
- Herbicide damage
- May also be an effect of spider mites

K deficiency

- Tends to show up as browning along leaf margins
- But in palms, see yellow or brownish spots

K

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But other causes may result in similar symptoms

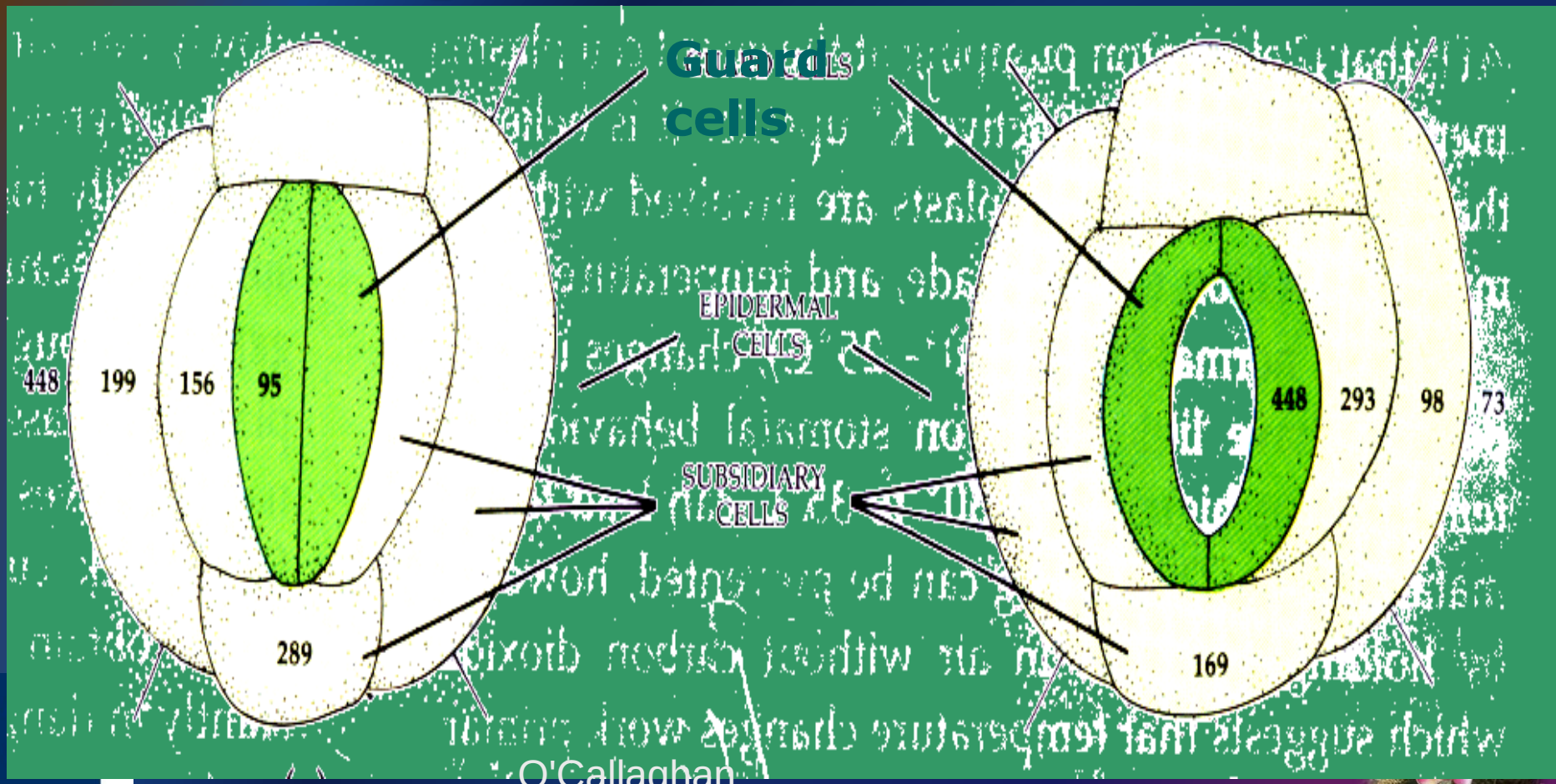
Herbicide carryover

Salt accumulation

Potassium is essential:

- **Water** relations
- Maintaining acid/base balance
- Sugar transport (leaves to rest of plant)
- Cell wall structure
- Maintaining plant stalk strength
- Hormonal action
- Activating enzymes for photosynthesis and respiration
- Flowering and producing fruit
- Fruit ripening

Potassium triggers guard cell action; causes stomata to open and release water vapor, or close to conserve it.



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(Graphic from Biology of Plants, Raven, et al)

Obtaining potassium

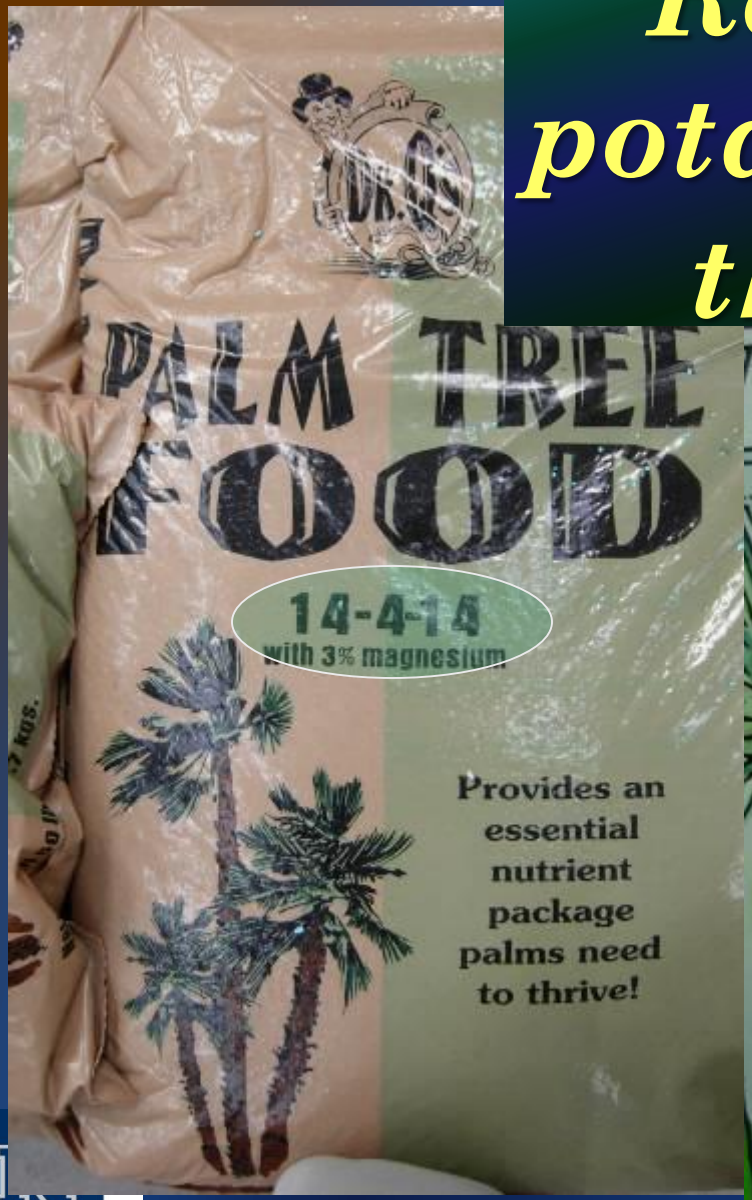
The soil

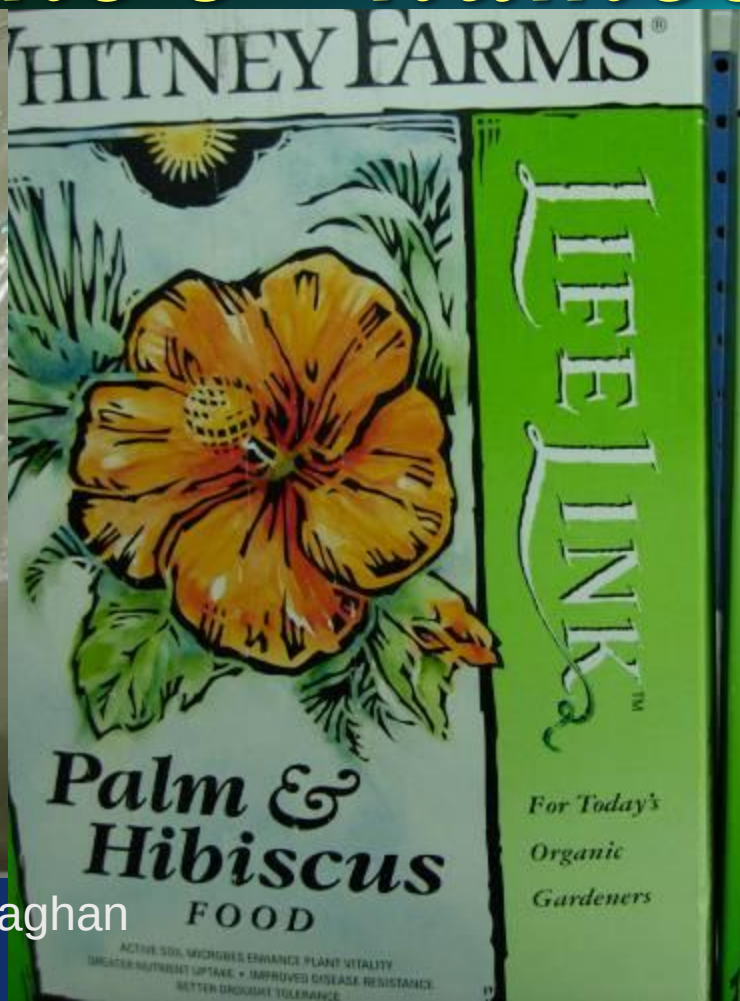
Relatively abundant in the desert, except on sandy soils.
Some clays are high in potassium at first, but become deficient due to agriculture, erosion and leaching.

If deficient, non-conventional K forms can be added to the soil: cottonseed meal, granite dust, and greensand.

Excess potassium may interfere with manganese uptake.

Read the label – potassium is always the 3rd number





K deficiency

May occasionally be confused with symptoms of insufficient nitrogen

Photosynthesis decreases

K deficient plants tend to have lower resistance to disease

Diseases tend to be more severe in K deficient plants

K and disease resistance

Potassium fertilization tends to

Decrease fungal disease (89-33)*
Decrease bacterial disease (19-5)*
Decrease viral disease (4-5)*

*Increase nematode disease (3–6)**

**** journal articles where found – where not found***

Adding extra K

Probably a waste

Pathogens can take up excess K

Plant with excess K may be more of a target for pathogens

K -more available in high calcium soils

Keep plants well nourished – apply at planting time and at periods of most rapid growth


Old Leaves
Symptoms on entire plant
Symptoms on lower leaves only
Plant light green. Lower leaves yellow, drying to brown
Plant dark green with red or purple color. Lower leaves yellow, drying to dark green
Older leaves yellow at the edges, but stay green in the center.
Older leaves wilt or scorch. Edges necrotic with spots on leaves.
Nitrogen
Phosphorus
Magnesium
Potassium

Break!

Interveinal chlorosis

Caused by

- Nutrient deficiencies(frequently confused)
  - Iron
  - Manganese
  - Zinc
- Photosynthesis inhibition
  - Herbicide

Very common in desert southwest

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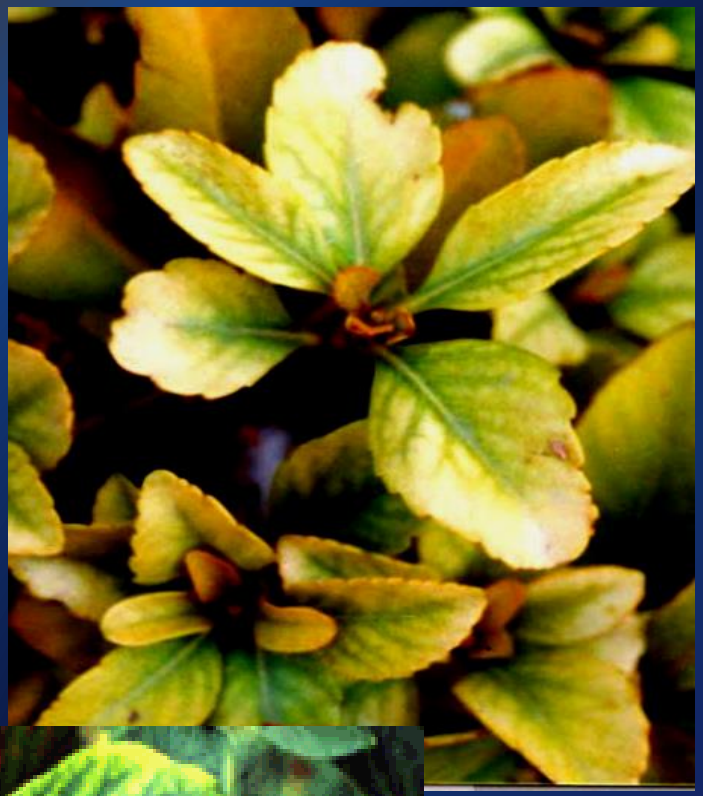
Fe



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Mn

Interveinal chlorosis

Zn

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Older green; younger yellow


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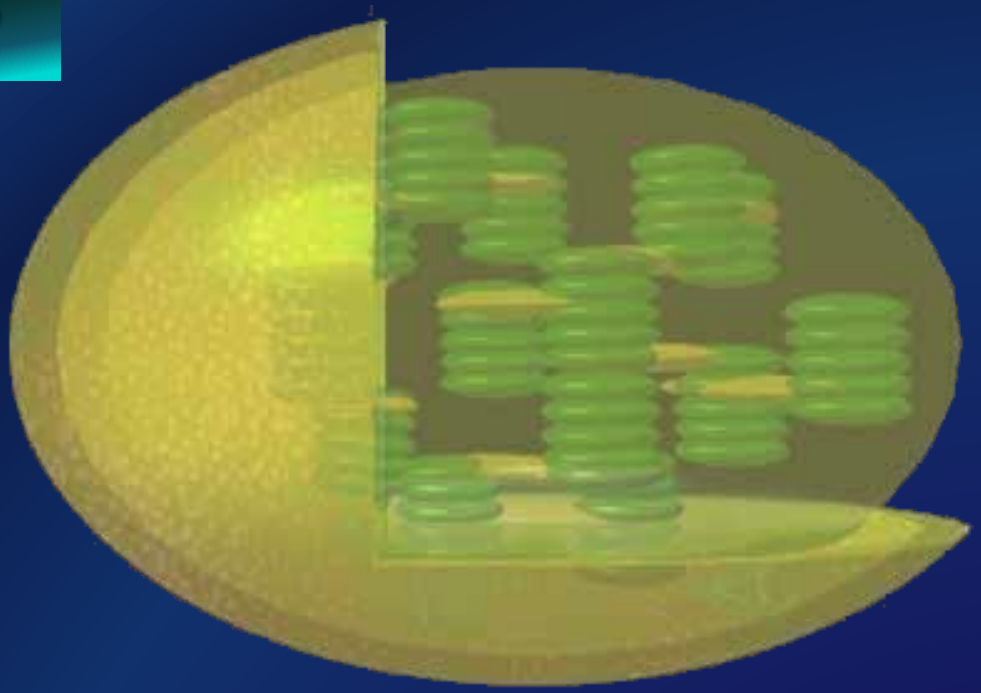
Iron is essential for

- Photosynthesis
- Proper chloroplast size
- N utilization
- Production of gaseous plant hormone *ethylene*
- Fatty acid breakdown (recycling within plant)

Manganese

creating and maintaining the proper structure of **chloroplasts**



- Essential for many enzymes, including a key one in photosynthesis

may help roots resist pathogenic nematodes

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Zinc

- Proper **leaf and petiole** development
- Plant hormone *auxin*
- Production of chlorophyll

- Other deficiency symptoms:
  - White bud of corn
  - Little leaf
  - Premature leaf drop in trees

Amending deficiency

- Add iron (if it's an iron deficiency)
- Add other nutrient (if another element is lacking)

Add micronutrient

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Atrazine drift

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ON THE OTHER HAND

- Deficiency often a result of high pH,
- Long term solution: lower pH by adding **sulfur** (not gypsum).

pH measurement

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Most acidic; Concentrated acid						Neutral								Most alkaline; Concentrated base

How does sulfur lower pH?

$$S + H_2O \Rightarrow H_2SO_4$$

Sulfur = S

Water = H_2O

Sulfuric acid = H_2SO_4

MMON ACIDIFYING MATERIALS [1]

Material	Chemical Formula	Sulfur (%)	Acidifying Material (lb) Necessary to Equal 100 lb of Soil Sulfur
il sulfur	S	99.0	100
lfuric acid (98%)	H_2SO_4	32.0	306
lfur dioxide	SO_2	50.0	198
me–sulfur solution (32° Baumé)	CaS_x + water	24.0	417
on sulfate	$FeSO_4 \cdot 7H_2O$	11.5	896
luminum sulfate	$Al_2(SO_4)_3$	14.4	694

[1] Certain fertilizer materials also markedly increase soil acidity when used in large quantities (see page 142).

Lowering pH


DR. Q'S®
SOIL SULFUR
GUARANTEED ANALYSIS
Sulfur (S)----------90.0%
90.0% Free Sulfur as (S)
Derived from secondary nutrient sources: Sulfur.
GRANULATED, EASY TO USE.
Soil Sulfur is used to correct alkaline soils, and those with a high pH. An absence of sulfur in the soil is indicated by plant leaves turning yellow.
Slow acting, but long lasting.
DR. Q'S
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APPROXIMATE QUANTITY OF SOIL SULFUR NEEDED TO INCREASE SOIL ACIDITY TO ABOUT pH 6.5

Change in pH Desired	Sulfur (lb/acre)		
	Sands	Loams	Clays
8.5–6.5	2000	2500	3000
8.0–6.5	1200	1500	2000
7.5–6.5	500	800	1000
7.0–6.5	100	150	300

Sulfur's role within plant

- Critical component of many proteins
- Important in nitrogen ar iron metabolism
- Essential for auxin production / root elongation

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Fruit problems

- Production -disrupted by incorrect timing of N application, or boron **insufficiency**
- Development -stunted by lack of K
- Ripening - interfered with by lack of K
- Blossom end rot - due to early lack of Ca

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Blotchy ripening of tomatoes is caused by deficient K

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Blossom end rot

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Tip burn

Tip burn is Everywhere!

often caused by

Calcium deficiency

Calcium

- Keeps soil pH high (>/= 8.0)
- Controls stomata opening and closing
- Plant defenses
- Cell membranes and cell division
- Cell walls
- Enzyme activation processes.

- In humid environments (where rainfall is >10” per year), calcium may be deficient.

However…

- In the desert, such as the Las Vegas Valley, calcium is present in the soil (“Caliche”).

- Even with the large amount of calcium in the soils here, it is still possible to see Ca deficiencies.

Calcium is present in the soil

But needs to be transported to growing tissues

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Watering

Almost always, **blossom end rot or tip burn is caused by irregular watering**.

(M*ay also be due to using a cultivar that cannot transpire rapidly enough to bring the calcium to the developing tissue*.)

Do not add calcium,

as this will only increase problems.

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Leaf deformation

- Often due to excess **boron**
- May also result from
  - insect or mite infestation
  - Herbicide damage (2,4,D)

Our soils generally have sufficient B; even excessive.

toxicity on tamarillo leaf

On citrus

High pH limits plant uptake of boron

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2,4 – D damage

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Leaf Symptoms of Broad Mite Damage on Pepper

plantpathology.tamu.edu/Texlab/ Vegetables/pep...

Plants need little boron, but…

- Necessary for **root** development
- For **cell division** (walls & membranes)
- Involved in the proper development of structures involved in plant **fertilization**
- Necessary for **carbohydrate transport**

Boron can be toxic at high concentrations (>2 ppm)

Salt? Sun scald? K? B?

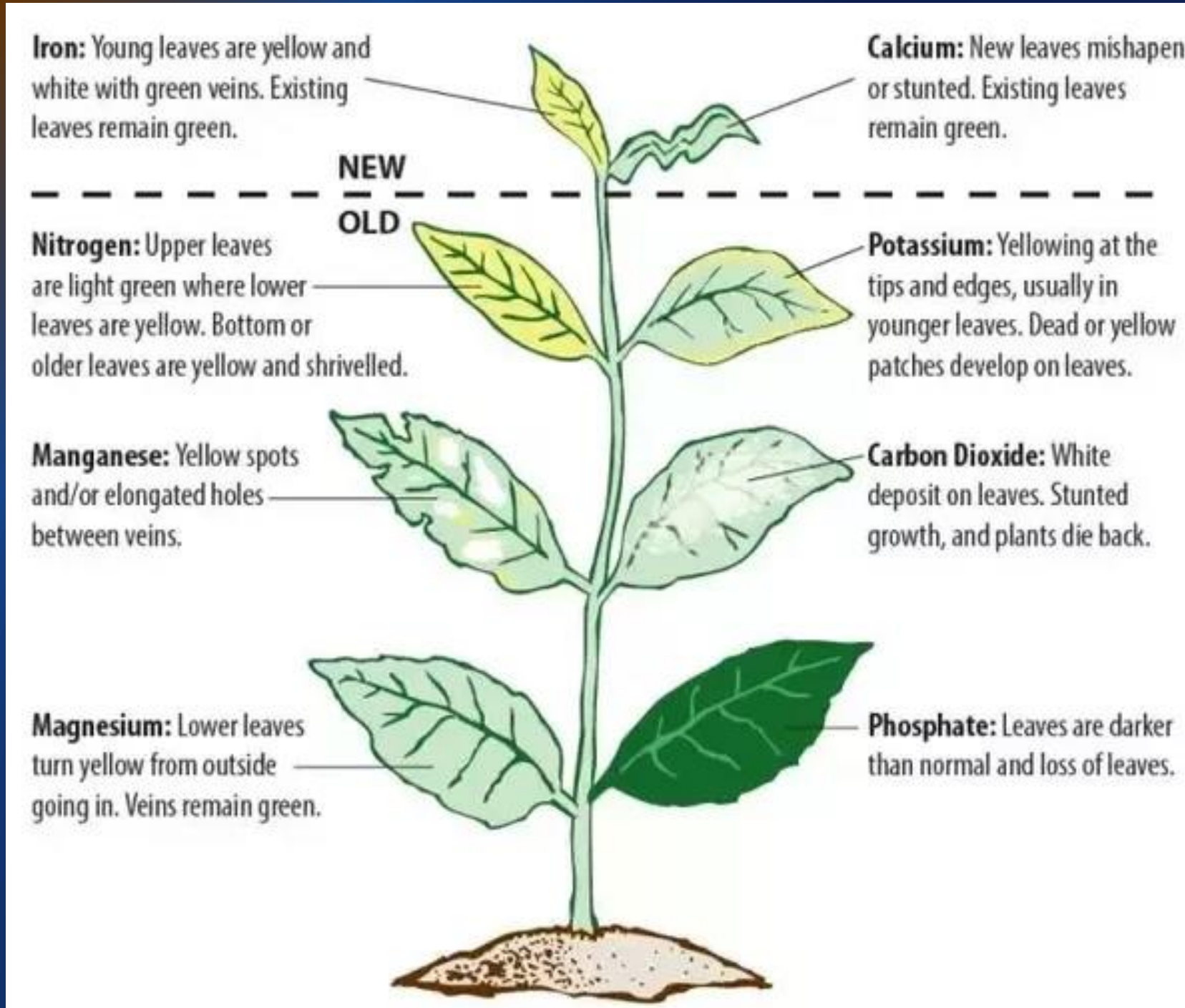
Provide adequate nutrition

- Make sure soil is providing proper nutrient levels for plants
- Enrich soil with compost when necessary
- Ensure that pH is appropriate
- Fertilizers supplement what soil provides

Plant Part Nutrient

- **Root** Phosphorus, Potassium, Boron
- **Stem** Potassium, Calcium
- **Leaf** Nitrogen, Magnesium, Iron, Manganese, Molybdenum, Zinc
- **Flower** Phosphorus
- **Seed** Phosphorus, Boron
- **Fruit** Phosphorus, Potassium

Nutrient summary



Diagnosing problems

- Examine plant for obvious signs and symptoms of insects or disease
- Find out where plant is located
- Learn what chemicals were applied in the area of the distressed plants
- Learn fertilization history
- Perform Soil test
- Perform Tissue test

Break!

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Reading a soil analysis report

Soil & Plant Laboratory, Inc.

Leaders in Soil & Plant Testing Since 1946

4741 E. Hunter Ave, Suite A Anaheim, CA 92807 714-282-8777 (phone) 714-282-8575 (fax)

www.soilandplantlaboratory.com

SOIL ANALYSIS

Send To:	Project:	
UNR Cooperative Extension 8050 Paradise Rd. Las Vegas NV 89123	Windmill	Report No: 10-228-0003 Cust No: 04401 Date Printed: 08/18/2010 Date Received: 08/16/2010 Page: 1 of 1 Lab Number: 05902

Sample Id: **Windmill Soil**

SATURATION EXTRACT - PLANT SUITABILITY

Test	Result	Effect on Plant Growth: Negligible	Sensitive Crops Restricted	Many Crops Restricted	Only Tolerant Crops Satisfactory	Few Crops Survive
Salinity (ECe)	8.7 dS/m					
Sodium Adsorption Ratio (SAR) *	10.57					
Boron (B)	1.21 ppm					
Sodium (Na)	55.8 meq/L					
Chloride (Cl)						
Carbonate (CO3)						
Bicarbonate (HCO3)						
Fluoride (F)						

* Structure and water infiltration of mineral soils potentially adversely affected at SAR values higher than 6.

Test	Result	Strongly Acidic	Moderately Acidic	Slightly Acidic	Neutral	Slightly Alkaline	Moderately Alkaline	Strongly Alkaline	Qualitative Lime
pH	7.8 s.u.								High

EXTRACTABLE NUTRIENTS

Test	Result	Sufficiency Factor	SOIL TEST RATINGS: Very Low / Low / Medium / Optimum / Very High
Available-N	9 ppm	0.3	
Phosphorus (P) - Olsen	8 ppm	0.5	
Potassium (K)	163 ppm	1.4	
Potassium - sat. ext.	3.7 meq/L		
Calcium (Ca)	2227 ppm	1.4	
Calcium - sat. ext.	40.8 meq/L		
Magnesium (Mg)	177 ppm	0.9	
Magnesium - sat. ext.	14.9 meq/L		
Copper (Cu)	0.1 ppm	0.1	
Zinc (Zn)	1 ppm	0.1	
Manganese (Mn)	4 ppm	0.4	
Iron (Fe)	9 ppm	0.2	
Boron (B) - sat. ext.	1.21 ppm	4.0	
Sulfate - sat. ext.	63.6 meq/L	21.2	
Exch Aluminum			

NO3-N	NH4-N	Total Exchangeable Cations(TEC)
7 ppm	2 ppm	130 meq/kg

Cu, Zn, Mn and Fe were analyzed by DTPA extract.

PARTICLE SIZE ANALYSIS

Half Sat	Organic Matter	Gravel: Coarse 5-12	Gravel: Fine 2-5	Weight Percent of Sample Passing 2mm Screen: Sand: Very Coarse 1-2	Sand: Coarse 0.5-1	Sand: Med. to Very Fine 0.05-0.5	Silt .002-.05	Clay 0-.002	USDA Soil Classification
14 %									

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A & L WESTERN AGRICULTURAL LABORATORIES

1311 WOODLAND AVE #1 • MODESTO, CALIFORNIA 95351 • (209) 529-4080 • FAX (209) 529-4736

REPORT NUMBER: 10-228-053 CLIENT NO: 99999

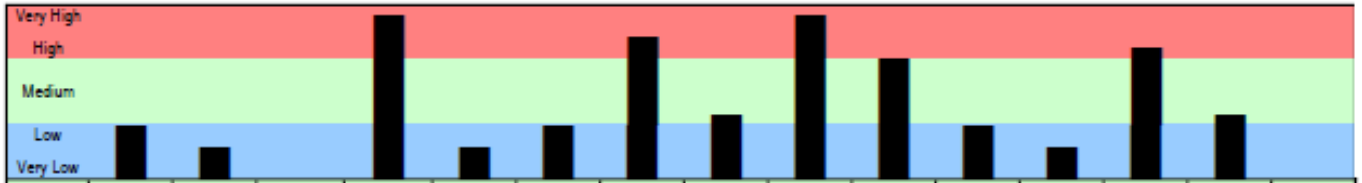
SEND TO: UNIV OF NEVADA-COOP EXT
8050 PARADISE RD, STE 100
LAS VEGAS, NV 89123-

GROWER:

SUBMITTED BY: ANGELA O'CALLAGHAN

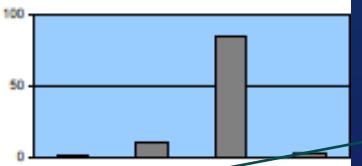
Graphical Soil Analysis Report

DATE OF REPORT: 08/19/10 LAB NO: 56116 SAMPLE ID: FAGIN PAGE: 1



Analyte	Organic Matter %	Nitrogen NO_3-N ppm	Phosphorus Weak Bray ppm	Phosphorus $NaHCO_3$-P ppm	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	Sodium Na ppm	Sulfur SO_4-S ppm	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Chloride Cl ppm
Results	2.3	8	27	66	138	369	4612	216	1787	4.3	2	6	2.1	0.7	
			LOW		AVERAGE		HIGH								

Percent Cation Saturation (computed)



Potassium K %	Magnesium Mg %	Calcium Ca %	Sodium Na %
1.3	11.1	84.2	3.4
ACIDIC		BASIC	

2.5 ECe dS/m — INCREASING SALINITY →

27.3 CEC meq/100g

H Ex. Lime

8.3 pH ← INCREASING NEED FOR LIME

Buffer pH:

Weak Bray P unreliable at M or H excess lime or pH > 7.5

Soil Fertility Guidelines

CROP: RATE: NOTES:

Dolomite (70 score)	Lime (70 score)	Gypsum	Elemental Sulfur	Nitrogen N	Phosphate P_2O_5	Potash K_2O	Magnesium Mg	Sulfur SO_4-S	Zinc Zn	Manganese Mn	Iron Fe	Copper Cu	Boron B	

COMMENTS

Mike Buttress, CPAg
A & L WESTERN LABORATORIES, INC.

CEC > 10 is high

Salinity

Expressed as Ece, dS/m, or mho/cm	Plant response
0 - 2	Negligible
2 - 4	Very sensitive plants affected
4 – 8	Many plants affected
8 – 16	Only tolerant plants survive and grow
➢16	Very few (highly tolerant) plants can survive and grow

Salinity of fertilizers

- http://bulletin.ipm.illinois.edu/print.php?id=1305
- Soluble fertilizers are soluble because they are salts
- If we are not careful, we could increase the salinity of our soil by fertilizing our plants!

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Laboratories

- May give recommendations for fertilizer applications
- Nitrogen recommendations are usually for N
  - Not nitrate, not ammonium, not urea
- Important to know how much N is in the fertilizer.

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Examine Fertilizer Labels

- Plant food?
- Relative amounts of NPK

DR. Q's®
VEGETABLE & TOMATO FOOD
6-10-6 with soil conditioners

GUARANTEED ANALYSIS

Total Nitrogen (N)	6.0%
4.69% ammoniacal nitrogen	
0.20% water soluble organic nitrogen	
1.11% water insoluble organic nitrogen	
Available Phosphate (P_2O_5)	10.0%
Soluble Potash (K_2O)	6.0%
Calcium (Ca)	5.0%
Sulfur (S)	9.0%
Iron (Fe)	1.5%
Manganese (Mn)	0.15%
Zinc (Zn)	0.15%

Derived from: blood meal, bone meal, ammonium phosphate, ureaform, sulfate of potash, gypsum, iron sucrate, manganese sucrate, zinc sucrate, kelp (Ascophyllum nodosum), Australian Seagrass (Posidonia Australis).

HOMOGENEOUS / CONTINUOUS RELEASE GRANULES

The smart, safe way to feed your plants and bring your soil to life at the same time. DR. Q's® Vegetable & Tomato Food contains a combination of unique natural soil conditioners: blood meal, bone meal, kelp (Ascophyllum nodosum), Australian Seagrass (Posidonia Australis), and natural aged compost.

We are so confident that DR. Q's® Vegetable & Tomato Food works better than any other fertilizer of it's type on the market, that if for any reason you are not satisfied return it for a full refund

09. 13


OASIS
Natural & Organic
Plant Food
ROSES, BLOOMS & WILDFLOWERS 6-6-5
Organic
Plant Food
GUARANTEED ANALYSIS
Total Nitrogen (N) 6.00%
6.00% Water Insoluble Organic Nitrogen
Available Phosphate (P_2O_5) 6.00%
Soluble Potash (K_2O) 5.00%
Derived from poultry protein meal, poultry bone meal and sulfate of potash.
ALSO CONTAINS NON-PLANT FOOD INGREDIENT:
6.0% HUMATE (DERIVED FROM LEONARDITE)
Water in thoroughly after application.
Net Weight 6 lbs. / 2.72 kgs.
LONG LASTING,
NON-BURNING
09 . 13 . 2007


Guaranteed Analysis
Total Nitrogen (N).....2%
0.5% Ammoniacal Nitrogen
0.5% Nitrate Nitrogen
1.0% Urea Nitrogen
Available Phosphate (P_2O_5).....7%
Soluble Potash (K_2O).....7%
Iron (Fe).....0.10%
0.10% Chelated Iron (Fe)
Manganese (Mn).....0.05%
0.05% Chelated Manganese (Mn)
Zinc (Zn).....0.05%
0.05% Chelated Zinc (Zn)
Derived from: Ammonium and Potassium Phosphates, Potassium Nitrate, Urea, Iron EDTA, Manganese EDTA, Zinc EDTA.
Net wt 4.9 oz (138 g)
F644
Concentrate
Succulent Formula
Feeds through roots as you water.
Excellent for transplanting repotting and rooting.
CONCENTRAT
SCHUL
2 • 7 • 7
Cacti
with Micronutrients
Liquid Plant F
For All Cacti & Other Succ
Jade, Aloe Vera, Etc.
Net 4 fl oz (1
09 . 13 . 2007
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Equivalences of fertilizer materials

Soil nutrient and fertilizer equivalency charts2013.pdf

But watch out for some curious readings!

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Questions?

Pre-assessment

1. (select one) Two parts per million of boron is (essential/toxic) to many plants
2. Tip burn indicates (choose one)
   a) iron deficiency
   b) excess water
   c) excess phosphorus
   d) insufficient calcium
3. (true or false) Nitrogen promotes plant disease

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4. (true or false) Potassium deficiency may be confused with salt burn
5. Two nutrients (there are several) required for healthy leaves are:

_____ & _____

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Post-assessment

1. (select one) Two parts per million of boron is (essential/toxic) to many plants
2. Tip burn indicates (choose one)
   a) iron deficiency
   b) excess water
   c) excess phosphorus
   d) insufficient calcium
3. (true or false) Nitrogen promotes plant disease

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4. (true or false) Potassium deficiency may be confused with salt burn
5. Two nutrients (there are several) required for healthy leaves are:

_____ & _____

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Practical exercises

Fertilizers

If we have time

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Example:

Using *18-6-12 fertilizer to provide 1 lb. of total N per 1000 sq. ft. of area. The area is 7,000 sq. ft. How much to fertilize it?*

(Area to be fertilized) x (recommended rate of N) = Total lbs. of N needed
(7,000 sq. ft.) x (1 lb. N per 1000 sq ft) = *7 lbs. **N** needed*

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Calculations

- (lbs. nutrient) / (% nutrient in analysis)= lbs. of **fertilizer** needed
- (7 lbs. N)/(.18N/lb. of fertilizer) = 38.9 lbs. of fertilizer
- ~ 39 lbs. of 18-6-12 to supply 1 lb. N per 1000 sq. ft. on 7000 sq. ft.

Same calculation can determine how much of ANY fertilizer to purchase to apply ANY nutrient if you know:

- area (in sq. ft.) to be treated,
- fertilizer analysis and
- recommended nutrient application rate

Sample park

- 1 acre = 43,560 ft^2
- 71,949 ft^2
- 1.65 acres

Lab analysis report

- N low
- P ok
- K low
- pH high
- Ca ok
- Mg ok

Need to increase N & K

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Analysis recommendations/1000 ft²

- KNO_3 13-0-44 — 8 lb*
- CH_4N_2O 37-0-0 19 S — 5 lb S coated urea
  - Every 2 – 3 months
- General Purpose 16-6-8 — 6 lb
  - early fall & spring
  - Instead of scu

*Note: KNO_3 has equivalent of 1.8 lb. of lime per lb. of N

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Calculation

How much N would be added if both KNO_3 and SCU were applied?

- KNO_3 = 13% N – 8 lbs.
  - 8*0.13 = 1.04 lbs. N
- CH_4N_2O = 37% N – 5 lbs.
  - 5*0.37 = 1.85 N
- 1.04 + 1.85 = 2.89 lbs. N applied

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How many 50-lb bags of 26-5-10 needed to fertilize a 30,000 sq ft lawn at 1.0 lb nitrogen per 1000 sq ft?

50-lb bag of 26-5-10 fertilizer covers 13,200 sq ft at 1.0 lb nitrogen per 1000 sq ft, determine how many times 13,200 goes into 30,000.

30,000 ÷ 13,200 = 2.3 bags of 26-5-10 will cover 30,000 sq ft.

Another way to calculate

- Recommended: 1 lb/1000 sq ft
- Need 30 lb/ 30,000 sq ft
- 26-5-10 Fertilizer has 26% N
- 50 * 0.26 = 13 lb N in 50 lb bag
- Total needed = 30 lb/13
- 2.3 bags

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L I Q U I D S

Calculations

- Remember - water weighs 8.8 lb/gal.
- Grade or analysis is given on a **weight** % basis, not per gallon
- **Must know weight/gallon of material (**label)
- 10 - 34 - 0 weighs 11.4 pounds per gallon
- 11.4 × .10 = 1.14 pounds nitrogen /gallon 11.4 × .34 = 3.88 pounds phosphate /gallon
- *Different fertilizers have different weights*

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Example

"The Classic" (liquid fertilizer solution)

On Label

- 18 -3- 6 liquid fertilizer
- Weight / gallon = 10.58 lbs
- pH = 9
- 1 gallon contains 1.9 lbs N
- Equivalent to 573 lbs CaCO3 per ton (liming effect)

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Turf conversion trees that tolerate well:

- Pine species
- Palm species
- Acacia, Chilopsis, Prosopis, Parkinsonia, Sophora and related plants (desert species!)
- Brachychiton species (bottle tree)
- Eucalyptus species
- Gleditisia species (locust)
- Olea
- Pistacia species
- Rhus

Sensitive to turf conversion

- Albizia (silk tree)
- Ash species
- Eriobotrya (loquat)
- Ligustrum
- Melia (chinaberry, persian lilac)
- Morus (mulberry)

Sensitive (cont)

Most fruit & flowering fruit trees, e.g.:

- Malus (apple)
- Prunus (plum)
- Pyrus (pear)
- Platanus species
- Populus species
- Robinia species (black locust)
- Salix (weeping willow) species