Soils and Fertilizer

Objectives

- Discuss soil components, texture and chemistry
- Consider relationships between soil, water, plants and air
- Examine steps to prevent soil compaction and salt accumulation
- Identify common plant nutrient deficiencies in our region
- Calculate fertilizer requirements
- Review proper techniques in soil analysis collection

Function of Soil in the Landscape and Why We Care:

- Supports the roots and anchors the above ground plant material
- Provides the essential elements for uptake by trees and plants
- Holds and supplies water and essential elements to the plants
- Releases water vapor into the air, potentially creating a cooler microclimate

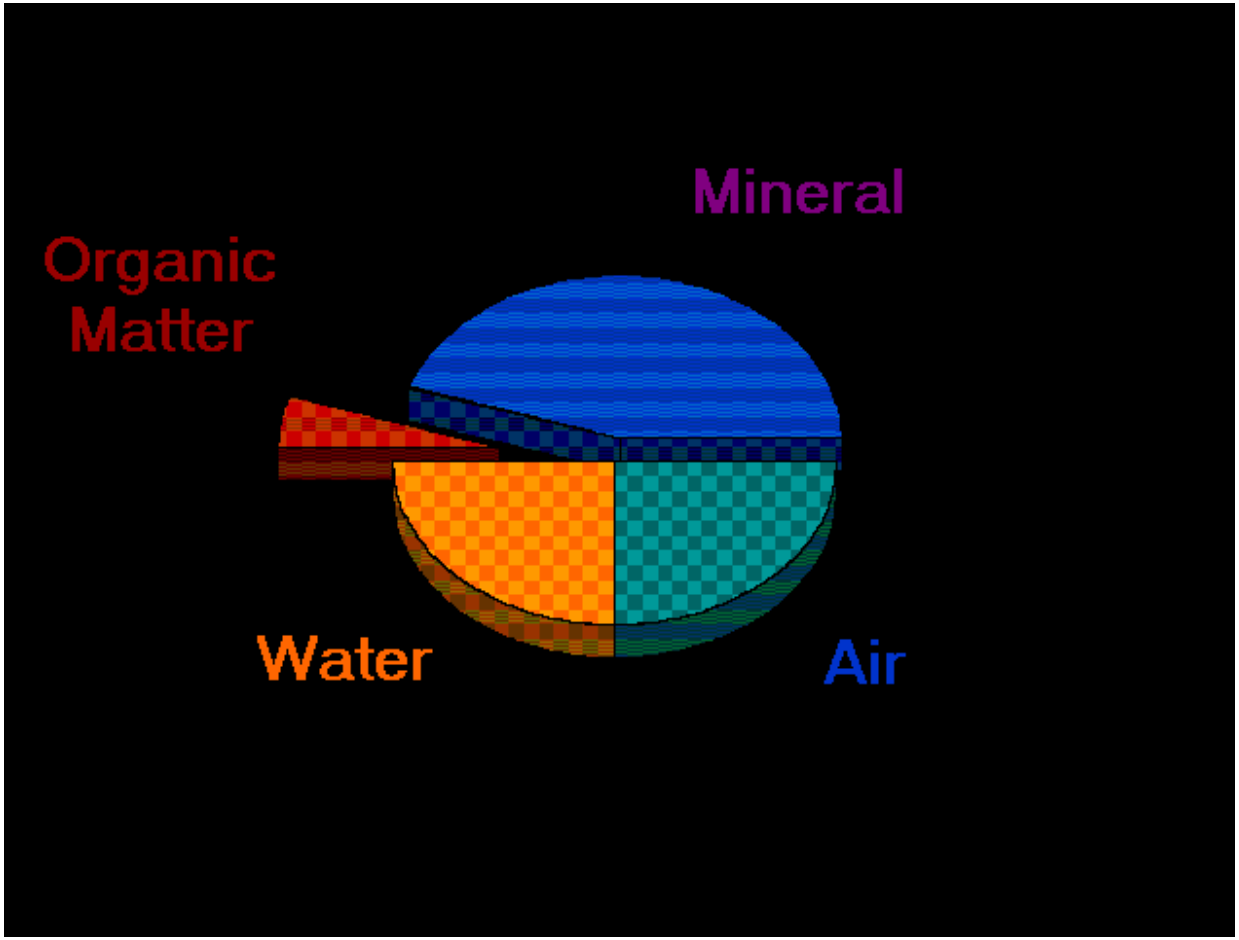
Knowing the characteristics of the soil on a particular job site can be the difference between success and failure.

Soil isn't "Just Dirt"! It is the ecosystem that supports our landscape plants. What we do to it matters.

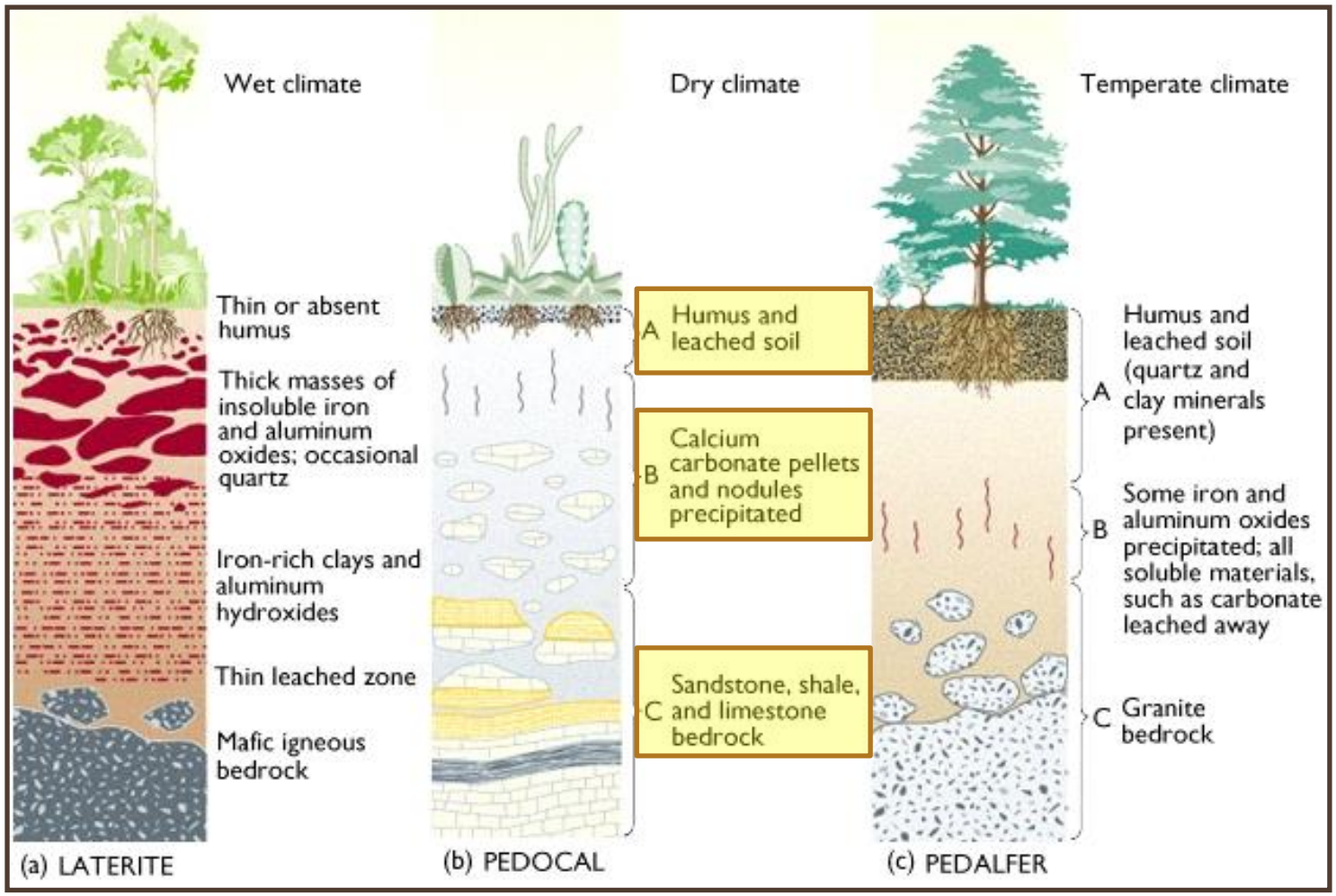
Arizona Desert Soils

- Mineral
- Alkaline
- Arid
- Probably some caliche
- May be rocky and shallow, particularly in foothills
- May be saline
- May be heavy

Ideal Soil Composition



Desert soils have significantly less than 5% organic matter. Why?

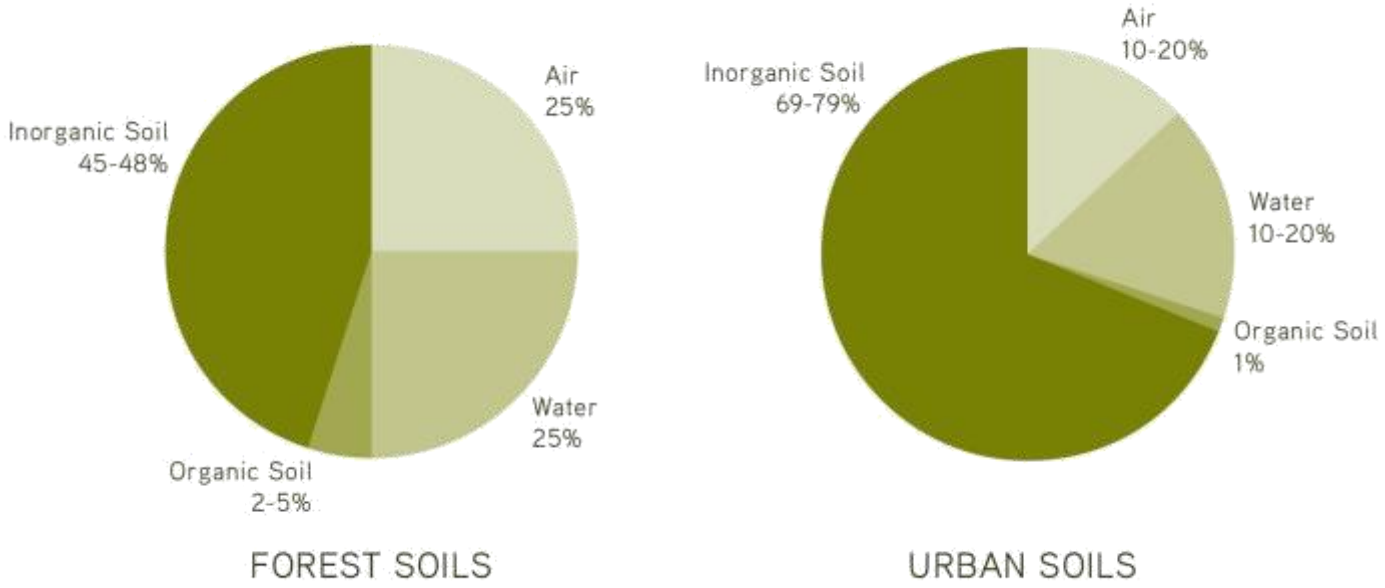


Desert soils have low organic matter because there is not enough precipitation to support lush wild plant growth

Urban Soil Challenges

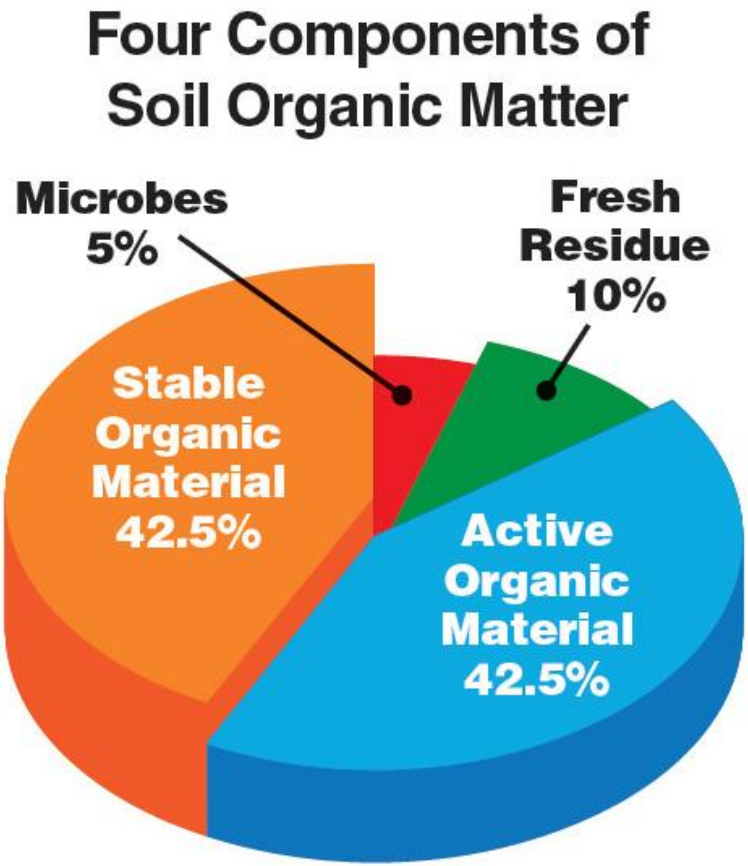
Soil quality directly impacts plant life

- ✓ Establishment
- ✓ Growth
- ✓ Health
- ✓ Longevity



In general, our desert, urban soils have low organic matter and less pore space

Organic Matter



- Group of carbon containing compounds
- Originated from living material and have been deposited on or within earths structural components
- Contains minerals and trace elements

Benefits of Organic Matter

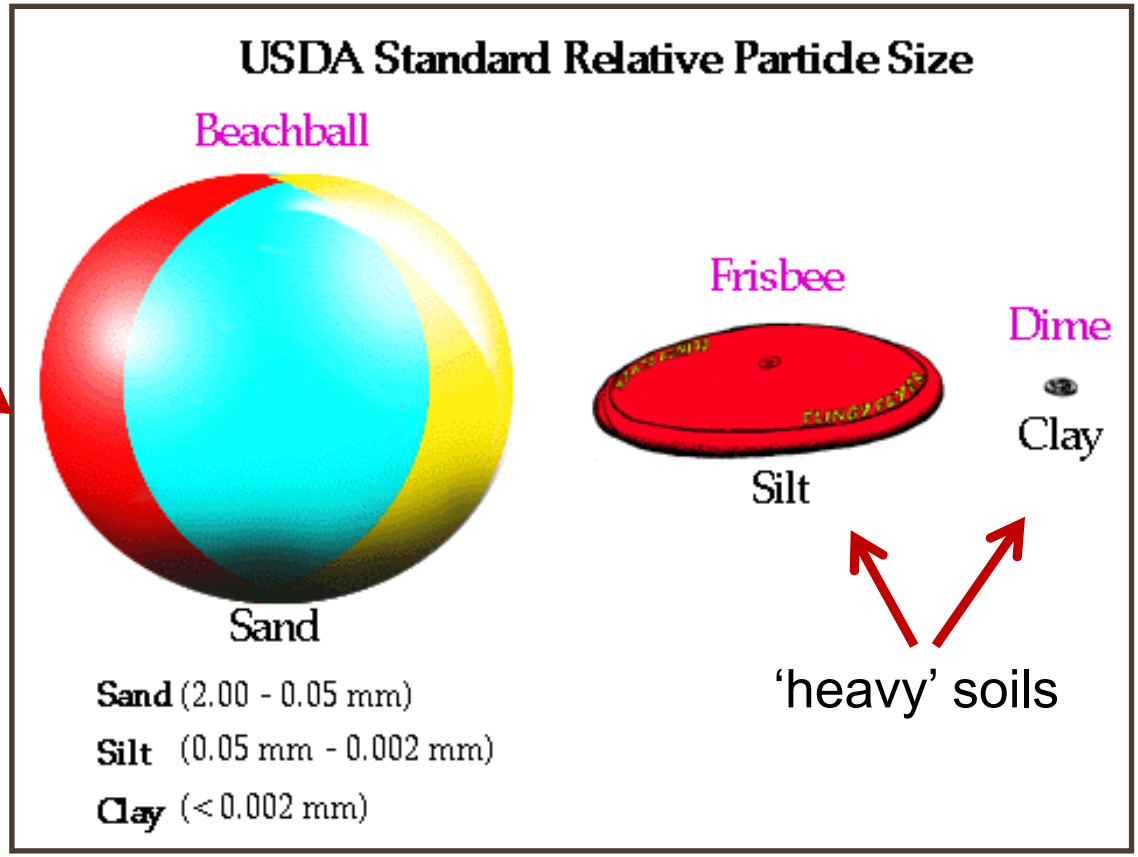
- Helps strengthen soil aggregates, thus improving soil structure
- Improve aeration and water infiltration
- Increases water-holding capacity
- Provides significant amounts of cation exchange capacity

- What do we do with organic matter in the landscape?
  Blow it, bag it and cart it away.

- Mulching grass clippings and leaving some leaf litter as a natural mulch can increase the organic matter content of the soil over time.

Soil Texture

Refers to the size of particles that make up the soil: sand, silt and clay



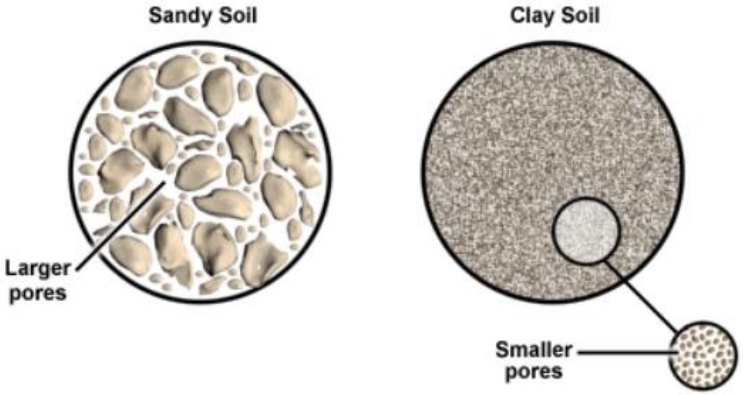
'light' soil

'heavy' soils

Heavy, Light or Just Right?

Clay

- “Heavy”
- Slow infiltration
- High water-holding capacity
- High nutrient-holding capacity

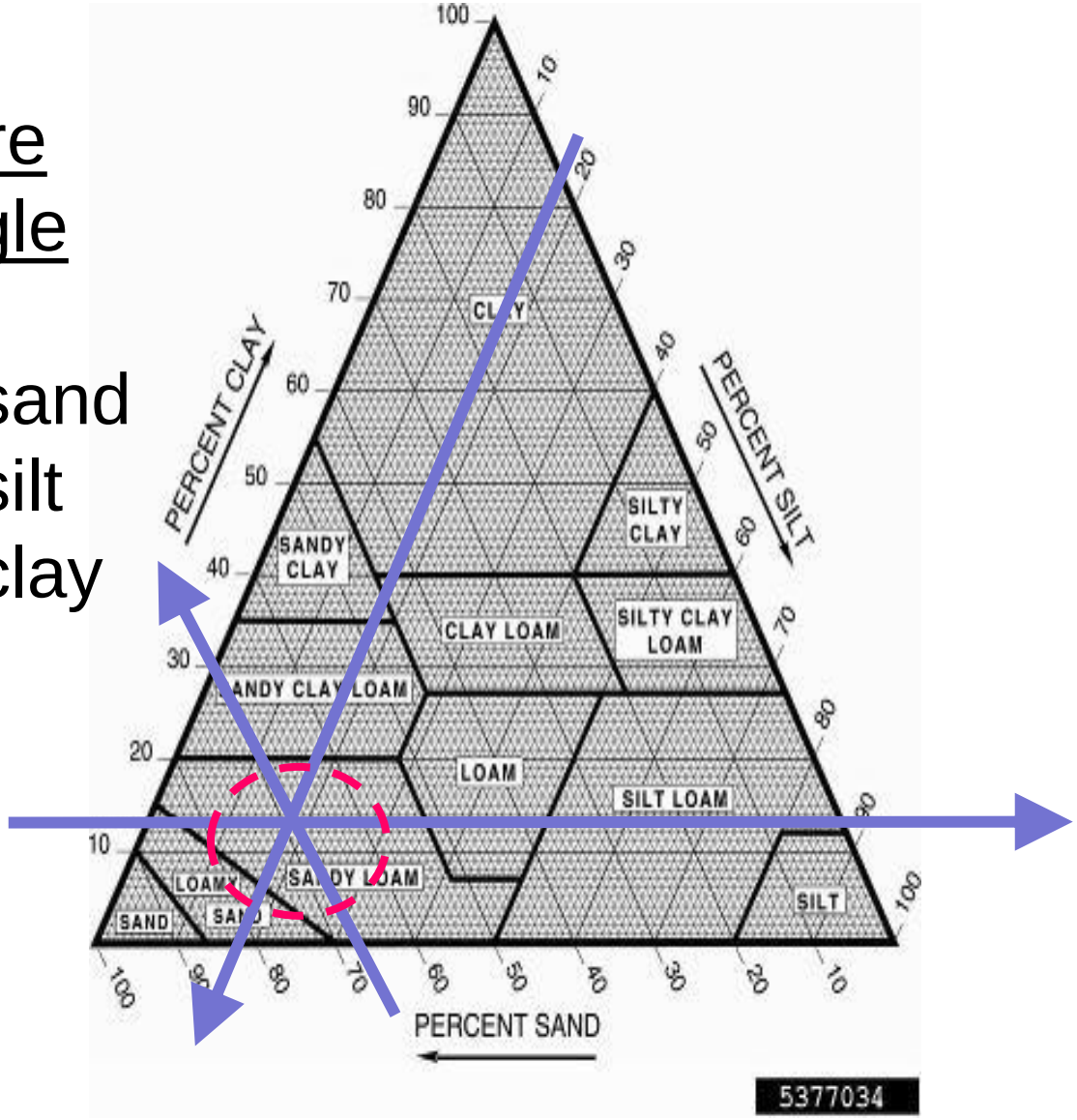


Sand

- “Light”
- Fast infiltration
- Low water-holding capacity
- Low nutrient-holding capacity

Soil Texture Triangle

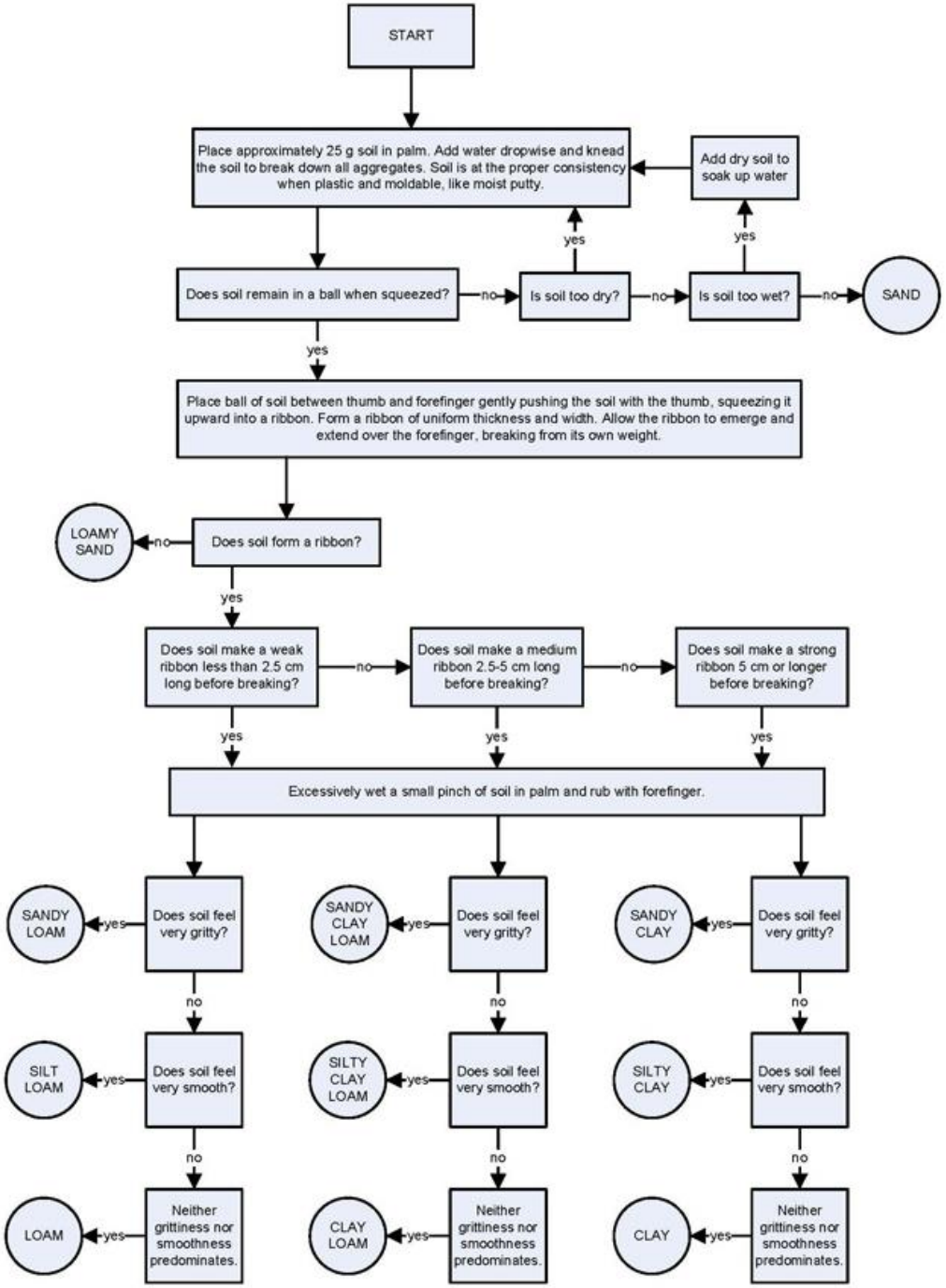
68% sand
18% silt
14% clay



International Society of Arboriculture, Bugwood.org

Determine your soil texture

The “Feel Method” of estimating soil texture

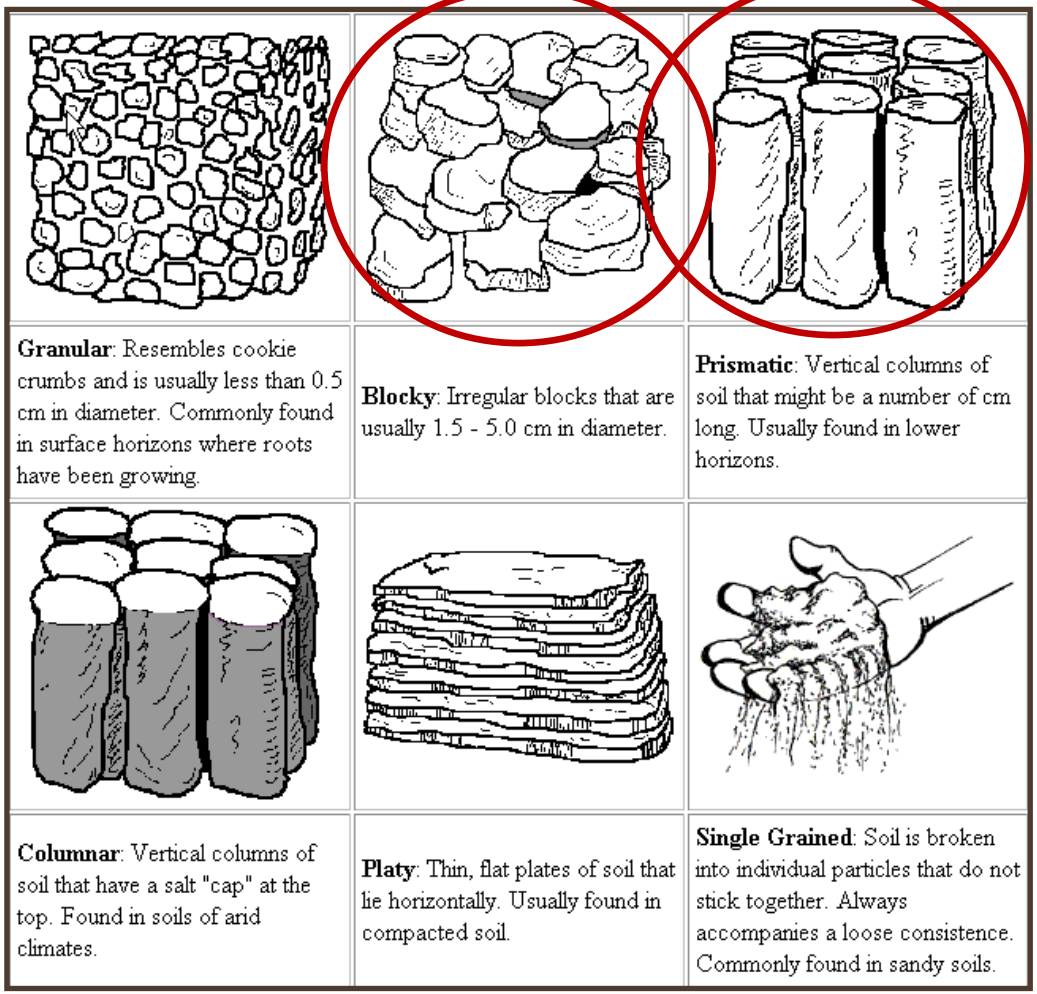


Can you alter soil texture?

- “You get what you get and you don’t throw a fit!”
- Not practical to try to alter on a large scale
- Not financially feasible on a large scale
- Better to focus on selecting plants that are more tolerant of current site conditions

Soil Structure:

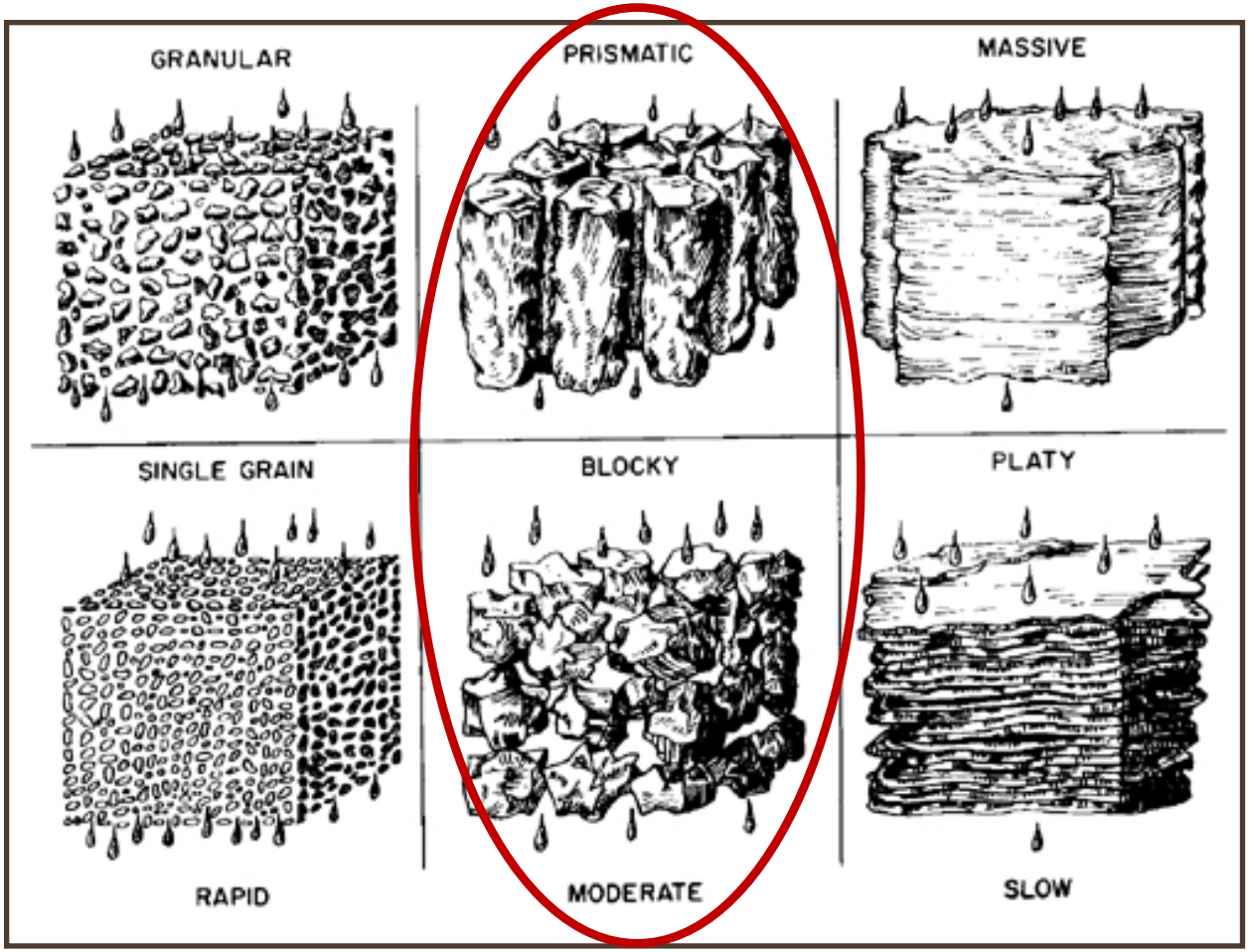
*Arrangement of soil particles into groups called soil **aggregates**.*



Granular: Resembles cookie crumbs and is usually less than 0.5 cm in diameter. Commonly found in surface horizons where roots have been growing.	**Blocky**: Irregular blocks that are usually 1.5 - 5.0 cm in diameter.	**Prismatic**: Vertical columns of soil that might be a number of cm long. Usually found in lower horizons.
Columnar: Vertical columns of soil that have a salt "cap" at the top. Found in soils of arid climates.	**Platy**: Thin, flat plates of soil that lie horizontally. Usually found in compacted soil.	**Single Grained**: Soil is broken into individual particles that do not stick together. Always accompanies a loose consistence. Commonly found in sandy soils.

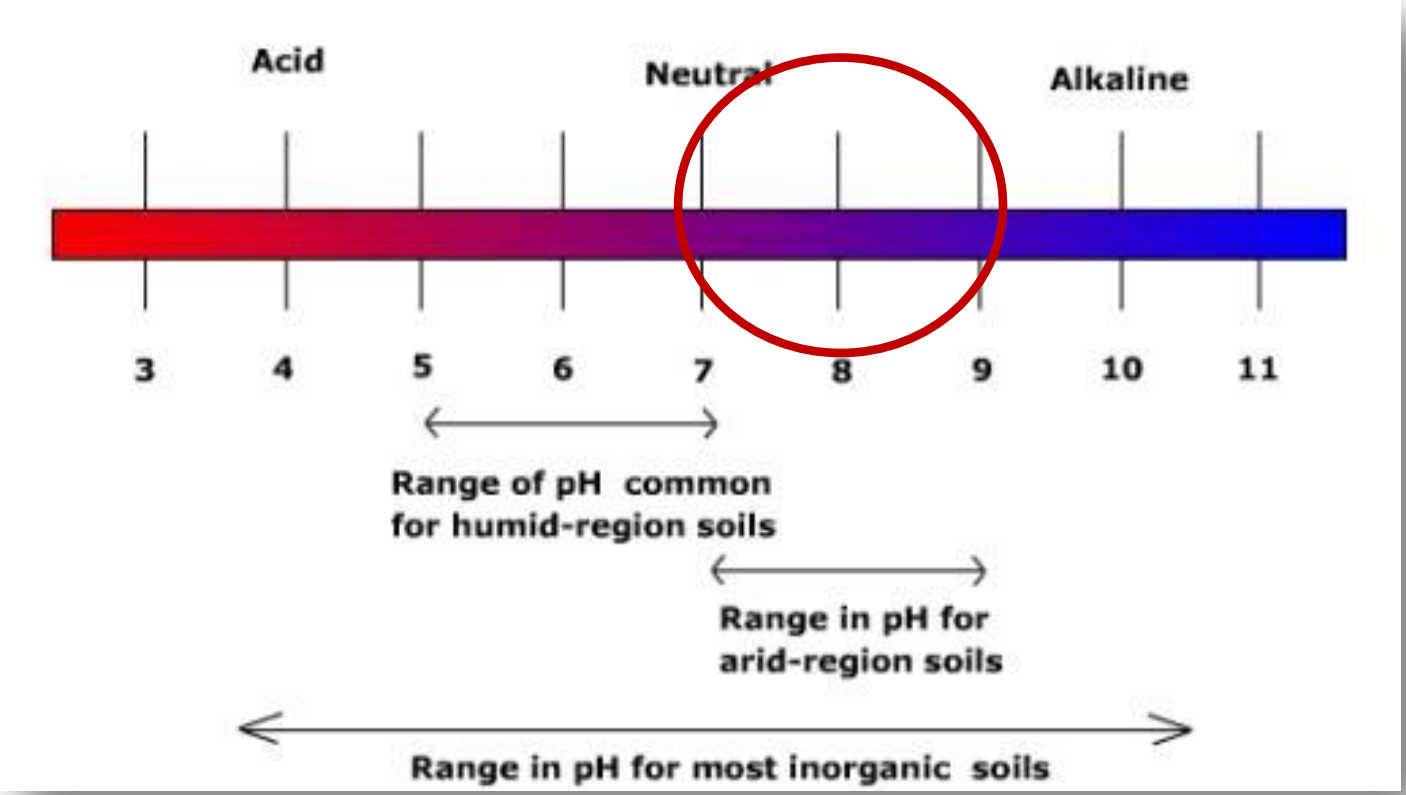
desert soils

Soil Structure



Impacts water infiltration

pH



pH is a measure of acidity/alkalinity

desert soils tend to be high in pH

Salinity

Sodium(Na), Calcium (Ca), Potassium (K) and salts accumulate in soils

Peeling of the soil surface is a sign of poorly drained, salty soil and remediation is required for plants to grow

Salts contained in irrigation water will accumulate unless adequate leaching is provided.

*Excess water (more than plants require) must be added to flush salts below the root zone. This excess irrigation is called the "**leaching requirement**".*

How does soil become saline?

- Shallow watering
- Fertilizers
- Irrigation water quality
- Application of other salty substances to soil

Frequent, shallow irrigation is the leading cause of salt build up. Watering more deeply and less frequently helps flush salts out of the root zone of plants.

MOTZZ LABORATORY, INC.

Soil Analysis Report

Project:
Sampler:
Date Received: 9/14/2012
Date Reported: 9/19/2012
PO Number: Flower Beds

Lab Number: 906095-01
Sample ID: Flower Beds
Description: 09/14/12

Crop: Landscape
Growth Stage:

Soil Complete Test

Test	Method	Result	Units	Levels
pH	1:1	7.6	SU	Medium
Electrical Conductivity, EC	1:1	2.1	dS/m	Medium
Calcium, Ca	NH4OAc (pH 8.5)	4,300	ppm	Very High
Magnesium, Mg	NH4OAc (pH 8.5)	620	ppm	Very High
Sodium, Na	NH4OAc (pH 8.5)	580	ppm	Very High
Potassium, K	NH4OAc (pH 8.5)	390	ppm	High
Zinc, Zn	DTPA	33	ppm	Very High
Iron, Fe	DTPA	77	ppm	Very High
Manganese, Mn	DTPA	23	ppm	High
Copper, Cu	DTPA	4.5	ppm	Very High
Nickel, Ni	DTPA	0.52	ppm	
Nitrate-N, NO3-N	Cd Reduction	13	ppm	Medium
Phosphate-P, PO4-P	Olsen	150	ppm	Very High
Sulfate-S, SO4-S	Hot Water	73	ppm	Very High
Boron, B	Hot Water	2.4	ppm	High
Free Lime, FL	Acid Test	None		
ESP	Calculated	8.4	%	
CEC	Calculated	30.2	meq/100g	

Levels are generalized and apply to most cropping environments.
Low means a high probability that applying nutrient will elicit a growth response.
Medium means a moderate probability of plant growth from application.
High means little or no response expected from application of this nutrient.
Very High means adding the nutrient may reduce growth or cause imbalance.

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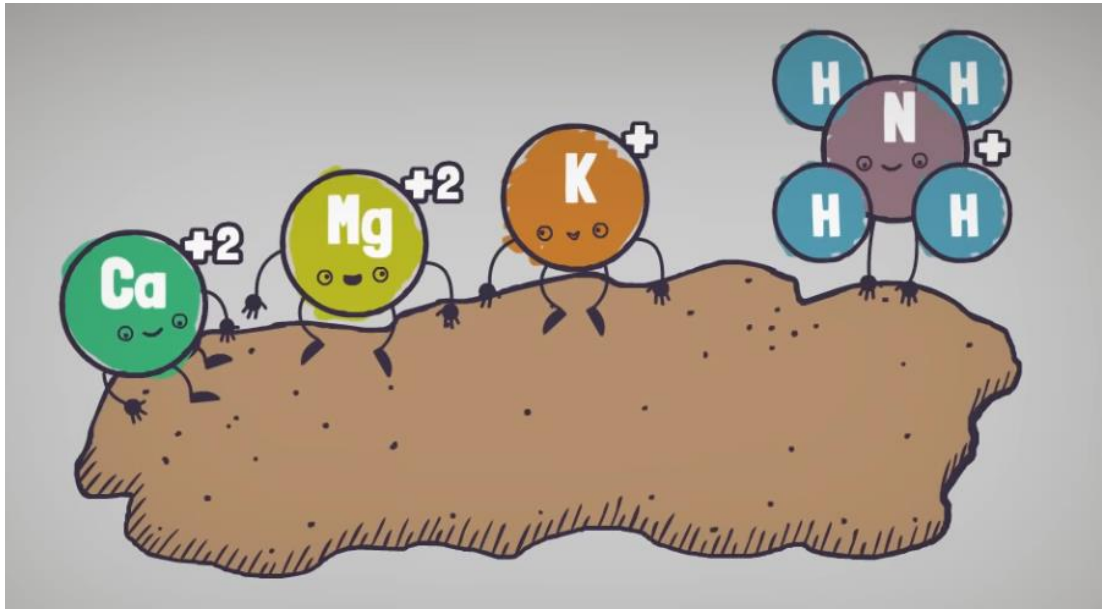
Cation Exchange Capacity (CEC)

The total number of cations a soil can hold--or its total negative charge--is the soil's cation exchange capacity. The higher the CEC, the higher the negative charge and the more cations that can be held.

Cations held on the clay and organic matter particles in soils can be replaced by other cations; thus, they are exchangeable. For instance, potassium can be replaced by cations such as calcium or hydrogen, and vice versa.

Cation Exchange Capacity



Cations:

- NH_4^+, K^+, Fe^{++}, Ca^{++}

Anions:

- NO_3^-, $SO4^{2-}$

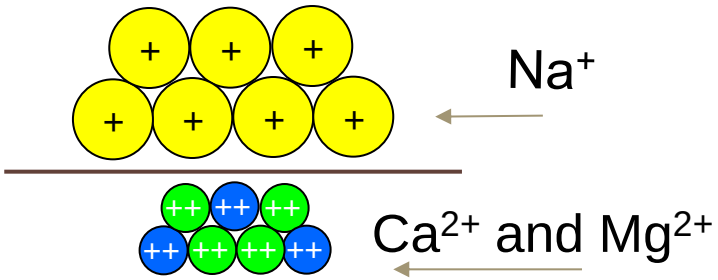
*Humus and clay carry a **negative** charge, and so attract positively charged cations*

Cation Exchange Video

- https://www.youtube.com/watch?v=HmEyymGXOfI&feature=youtu.be

Sodium Adsorption Ratio (SAR)

The ratio of 'bad' to 'good' flocculators gives an indication of the relative status of these cations:

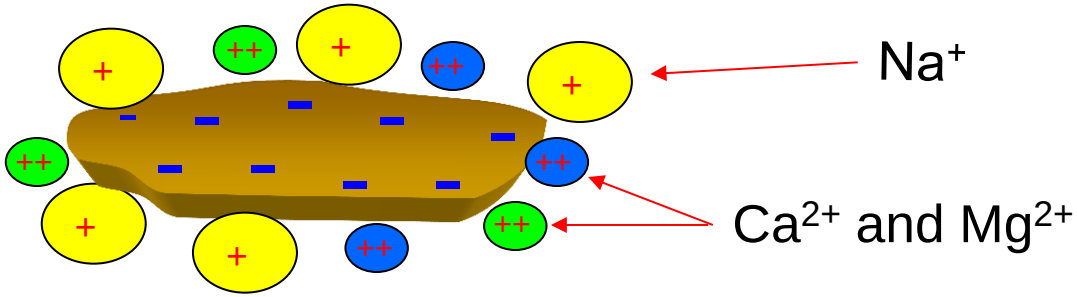


Mathematically, this is expressed as the 'sodium adsorption ratio' or SAR:

$$SAR = \frac{[Na^+]}{\sqrt{[Ca^{2+}] + [Mg^{2+}] \div 2}}$$

where concentrations are expressed in mmoles/L

Exchangeable Sodium Percentage (ESP)



Mathematically, this is expressed as the percentage of the CEC (cation exchange capacity) that is filled with sodium in units of charge per mass ($cmol_c/kg$)

An alternative to SAR is ESP (Exchangeable Sodium Percentage)

SAR and ESP are approximately equal numerically

$$ESP = \frac{Na^+}{\text{Cation Exchange Capacity}}$$

Salt-affected Soil Classification

	pH	EC (dS/m)	ESP
Normal soils	6.5-7.2	<4	<15
Acid soils	<6.5	<4	<15
Saline soils	<8.5	**>4**	<15
Sodic soils	**>8.5**	<4	**>15**
Saline-Sodic	<8.5	**>4**	**>15**

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Test soil to determine sodium level

Soil sodium tests:

SAR - sodium adsorption ratio

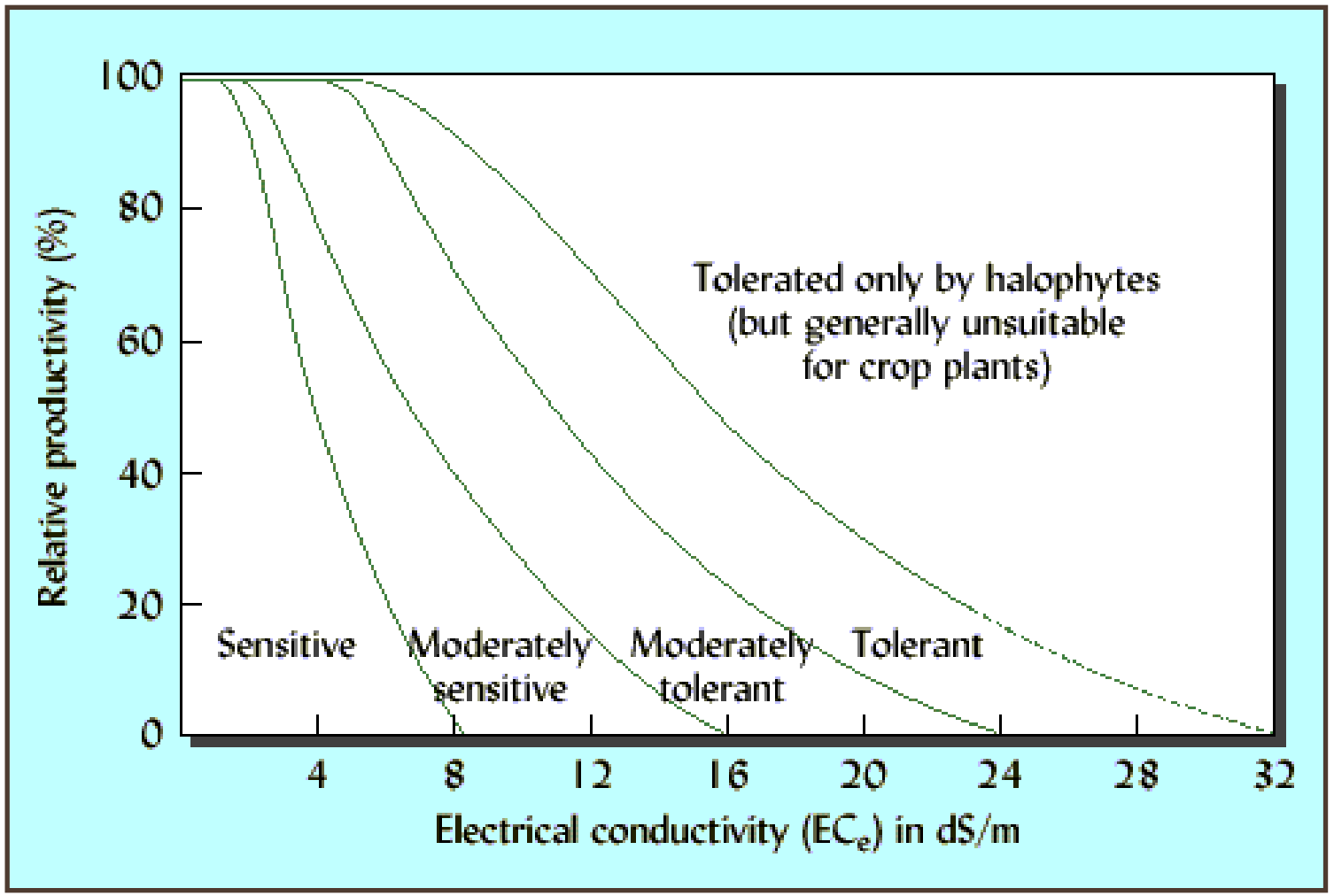
ESP - exchangeable sodium percentage

If SAR or ESP are ≥ 10 the soil is likely to disperse.

You should consider treating the soil.

Lower ESP and SAR numbers are always good

Plant Salinity Tolerance



Brady and Weil, Figure 9.27

Managing Salt

- Apply extra water to prevent excessive salt buildup
  - The amount of extra water needed is called the ***leaching requirement*** **(LR)**
    - LR is higher when using salty irrigation water
    - LR is higher when growing salt-sensitive plants
- You can save water and prevent salt buildup by using adapted plant species

Salty Soil – Saline or Sodic?

Why does it matter? The treatment is different!

- **Saline**
  - *Non-sodic soil containing sufficient soluble salt to adversely affect the growth of most crop plants with a lower limit of electrical conductivity of the saturated extract (ECe) being 4 deciSiemens / meter (dS/m), which is equivalent to a value of 4 mmhos/cm*
- **Sodic**
  - *Non-saline soil containing sufficient exchangeable sodium (Na) to adversely affect crop production and soil structure under most conditions of soil and plant type. The sodium adsorption ratio of the saturation extract (SARe) is at least 13*

Salty Soil Treatments

- **Sodic soils**
  - Gypsum applications (replaces Na with Ca)
  - Leaching program
- **Saline soils**
  - Leaching program (best way)
  - Elemental sulfur applications (soil incorporation is best)
- **Sodic-saline soils**
  - Gypsum applications
  - Leaching program

Caliche

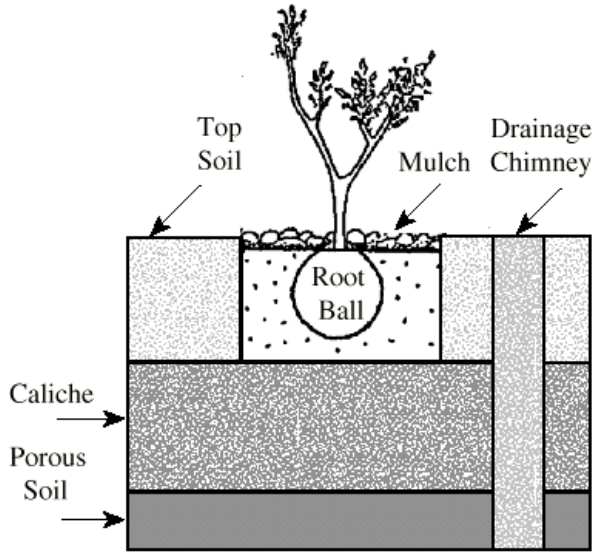
- Layer of soil where soil particles have been cemented together by lime (calcium carbonate, $CaCO_3$)
- Common in arid areas due to low precipitation
- Light in color
- Thickness of layers vary, few inches to several feet thick
- May be more than one layer of caliche in the soil profile

Caliche

- Reduces water movement through soil profile
- Restricts root growth to upper levels of soil (may reduce growth)
- Leads to salt accumulation and reduced aeration in soil
- High pH can cause nutrient deficiencies in plants, especially iron

Caliche Management

- Keep roots out of the caliche zone
- Physically remove caliche layers if possible to allow for water drainage out of root zone
- Check drainage on property prior to planting by performing a percolation test
  - Dig plant hole, fill with water and confirm drainage is at rate of 4” per 4 hours
- Utilize chimney drainage holes to provide drainage



Soil Amendments

Used to modify soil chemistry in our region

- **Gypsum** (Calcium sulfate)
  - temporarily removes Na from soil, helps break apart hardened soils
- **Soil sulfur**
  - may eventually reduce pH after repeated applications
- **Organic matter**
  - Microbial degradation and production of organic acids
  - Large amounts are required
- **Fertilizers**
  - Ammonium products (especially ammonium sulfate)

How do you know if you need to apply gypsum?

Observe the soil:

- Soil cracks when dry
- Soil won't absorb water
  - Rainwater soaks in more slowly than irrigation water

Soil Amendments

Elemental Sulfur

- Slow reaction- may take many months to change pH
- Dependent on microbial action (*Thiobacillus*)
- Soil incorporation is necessary
- Sulfur neutralizes the free calcium carbonate
- Not practical to change soil pH over large areas, but may be appropriate for directed applications to specific plants
- Monitor results with soil sample to confirm desired pH is achieved

Sulfur is oxidized by bacteria to form sulfuric acid

$$S + O_2 + H_2O = H_2SO_4$$

(elemental S + oxygen + water + soil microorganisms + time = sulfuric acid)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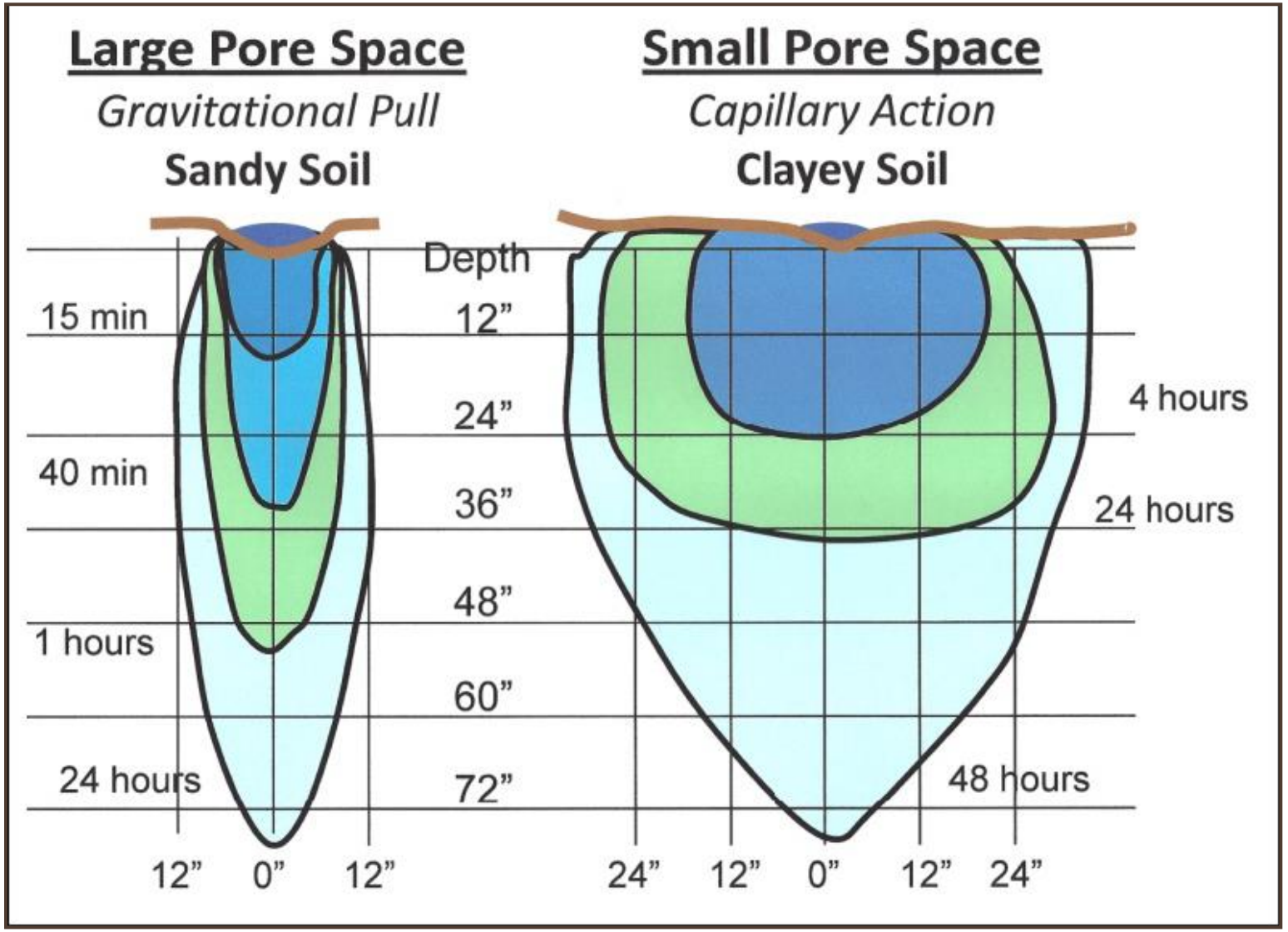
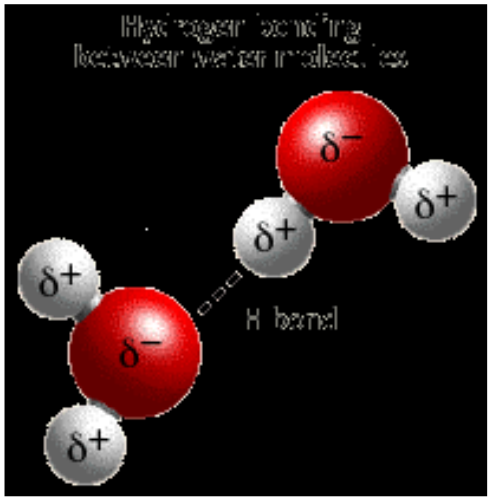
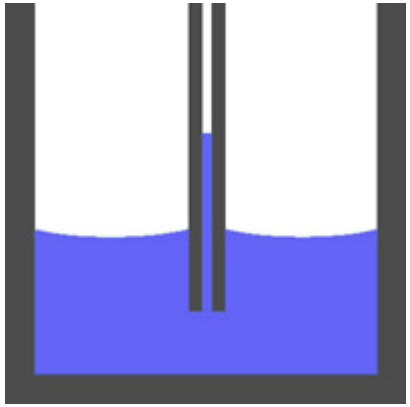
Soil Texture Affects Water Movement



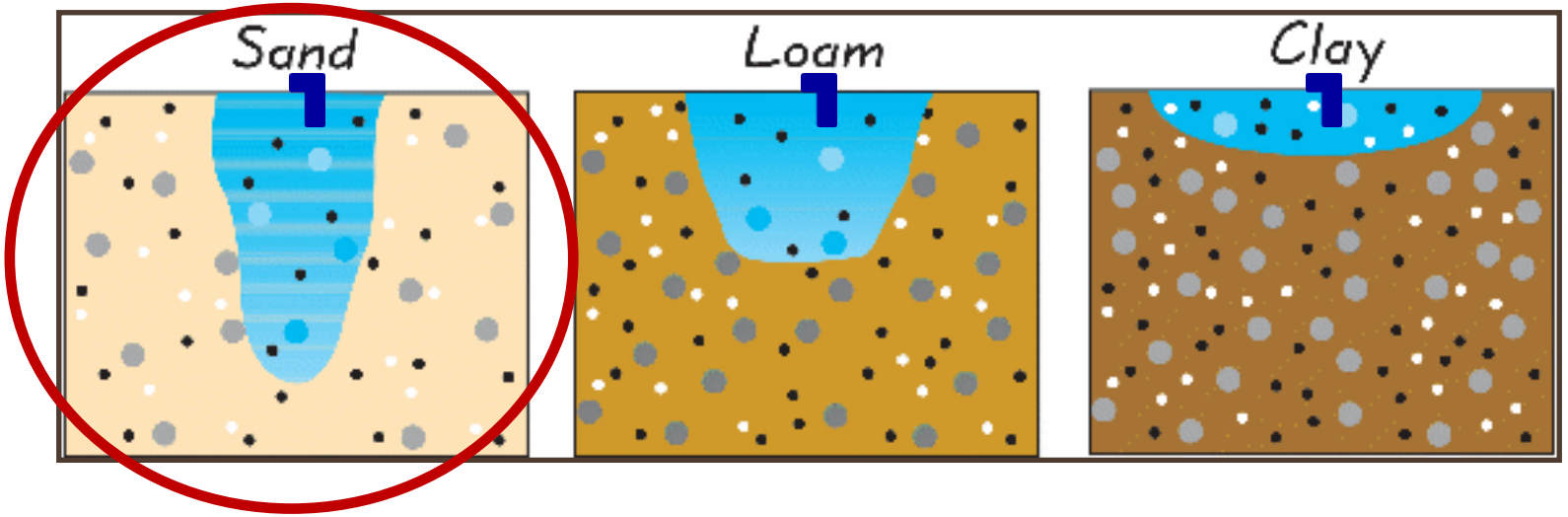
Capillary Action

- Cohesion – “like sticking to like”
  - Water molecules stick together
- Adhesion – “sticking to unlike”
  - Water molecules stick to certain surfaces
- Capillary action – drawing of water in a narrow tube



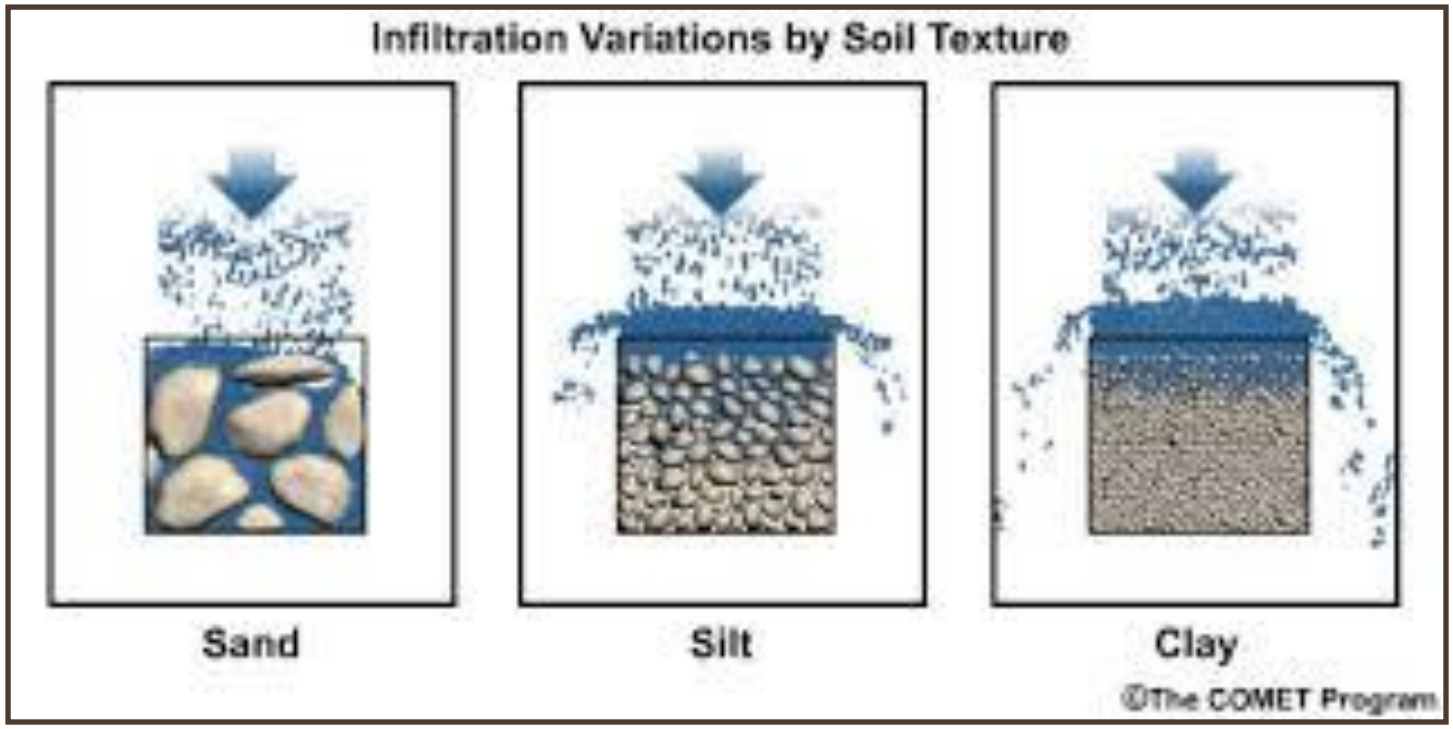


Which soil texture warrants the greatest number of drip emitters to wet an area?



Water Infiltration

Rate which water enters the soil surface

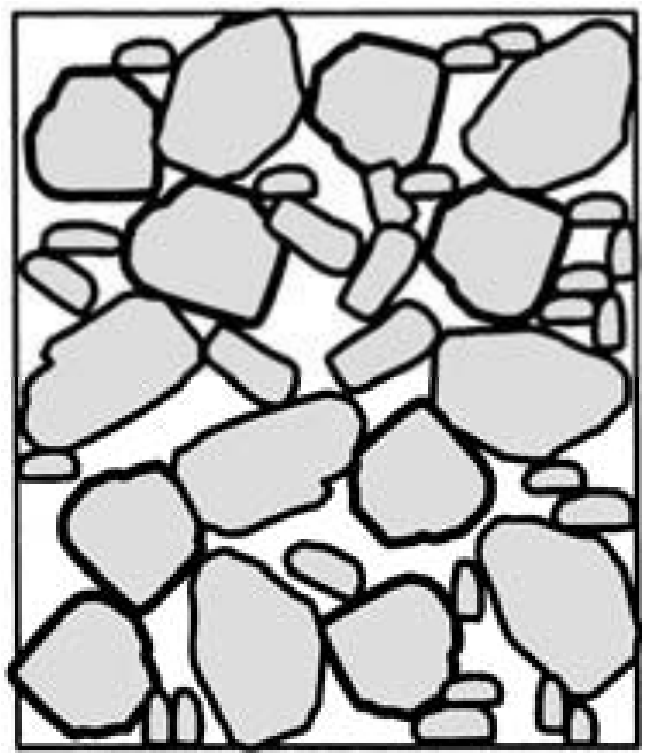


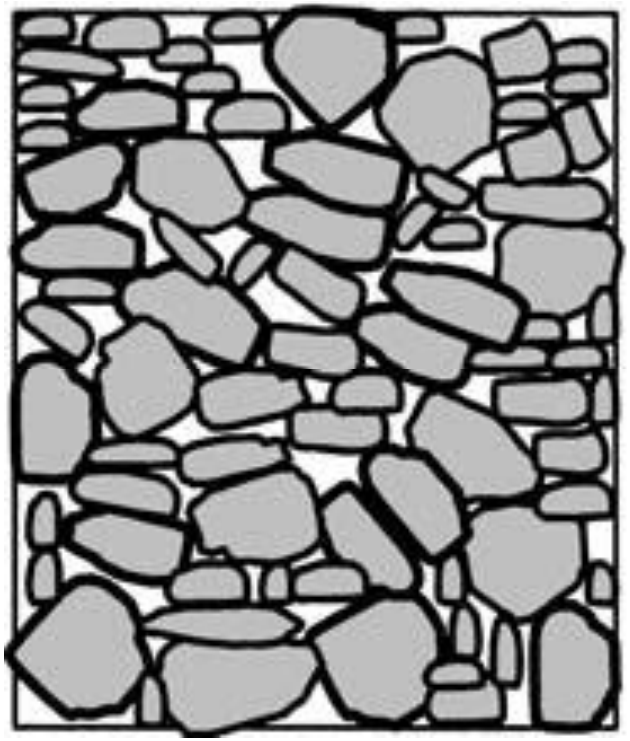
Soil Compaction

Increased density of soil by packing the soil particles closer together causing a reduction in the volume of air.

Compaction reduces pore space:

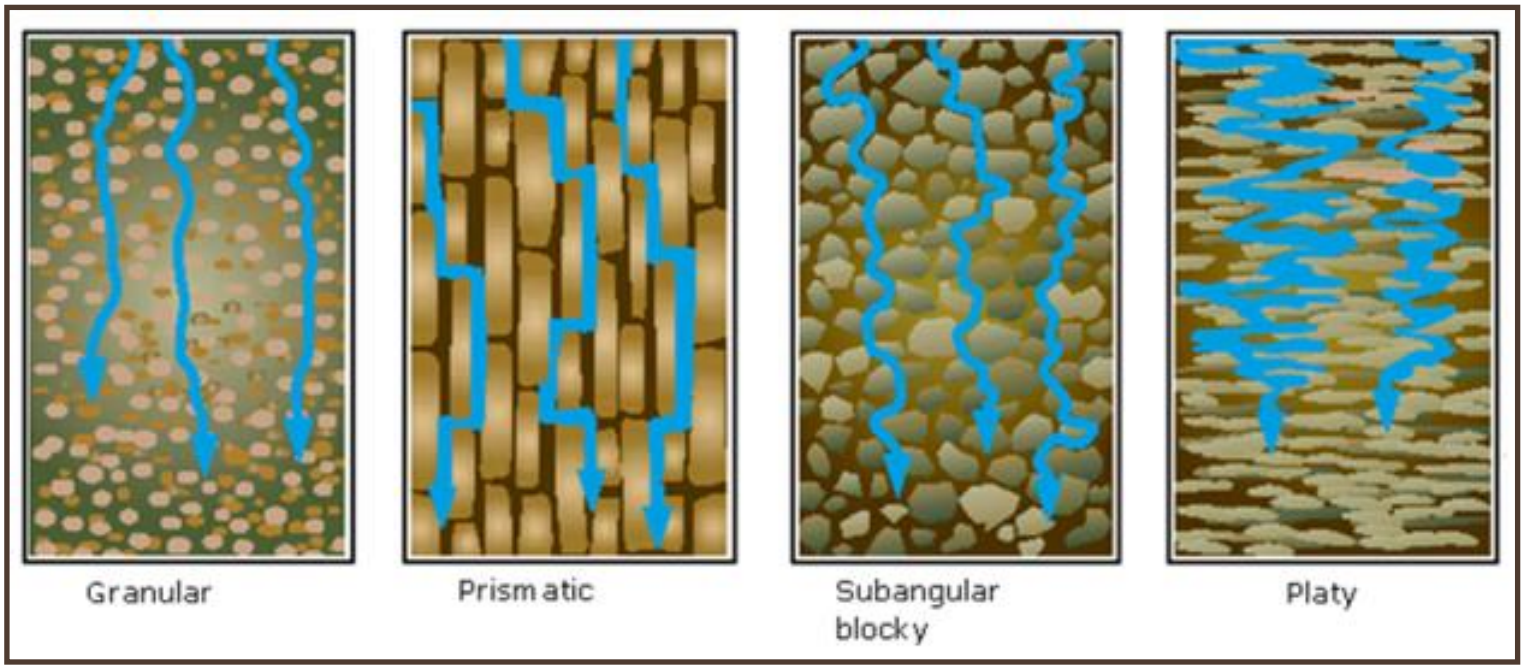
Restricts H_2O and O_2= Poor root development



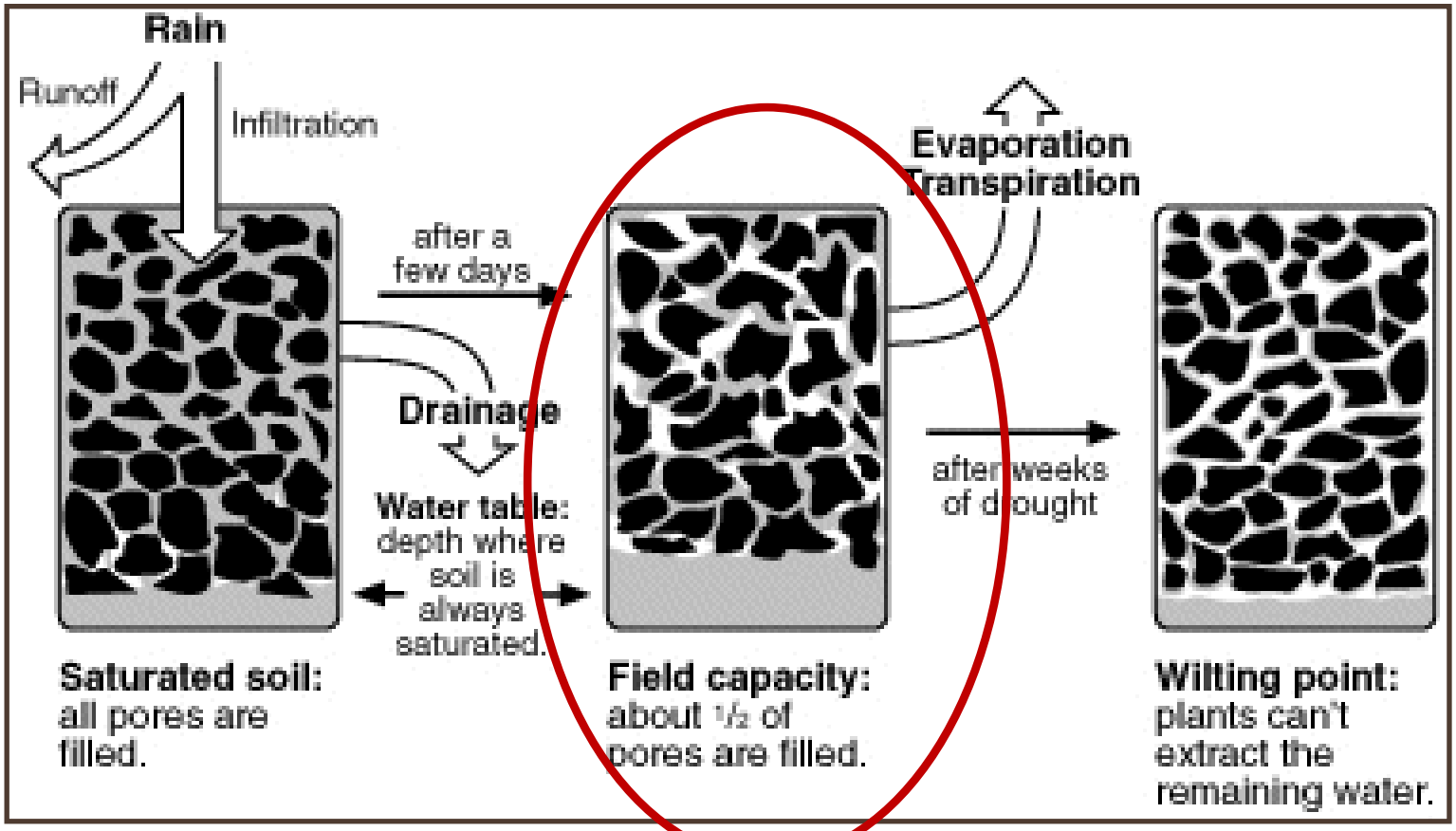


Soil Percolation

Movement of water through the soil profile

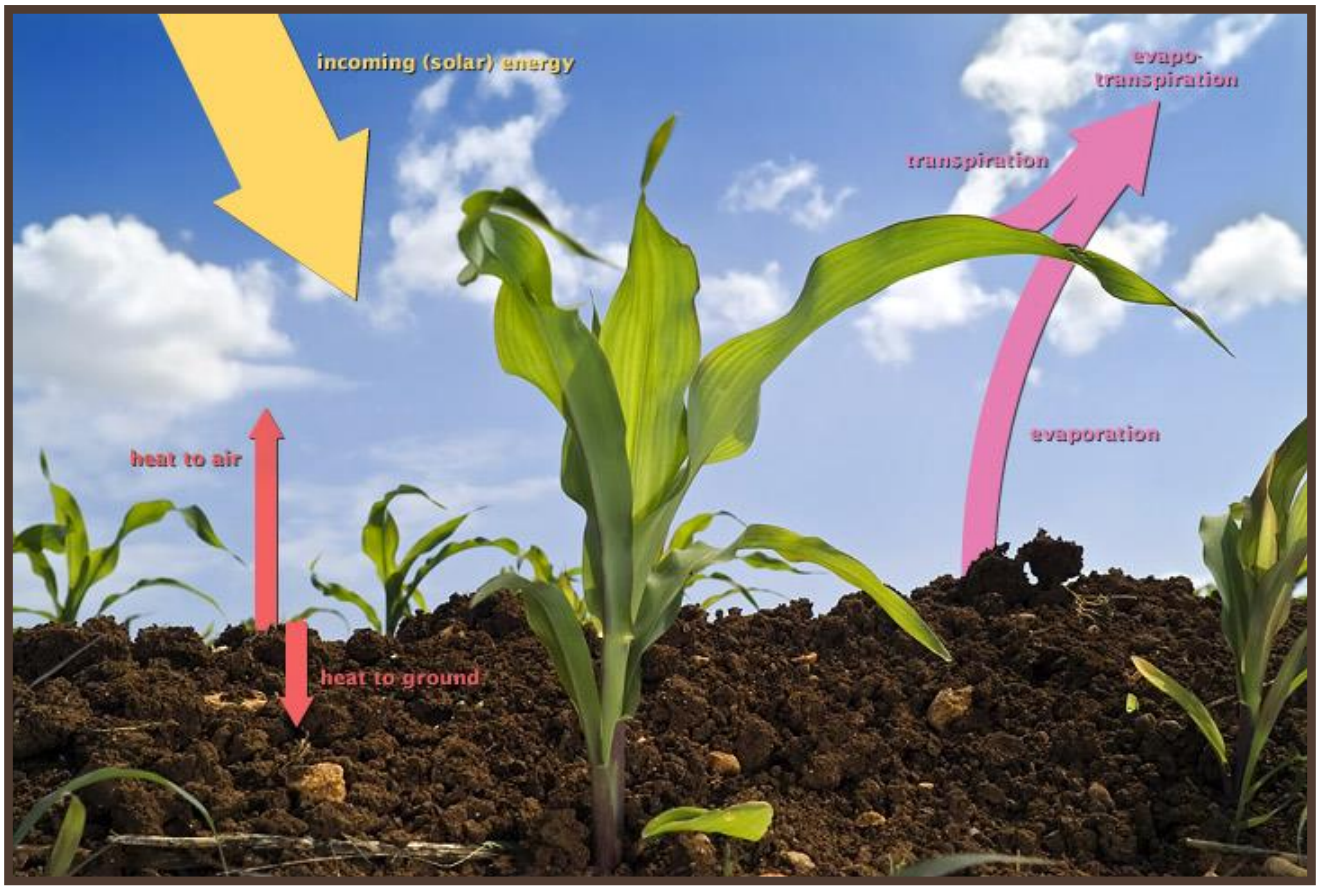


Soil Moisture Levels



Sweet spot

Evapotranspiration (Et)

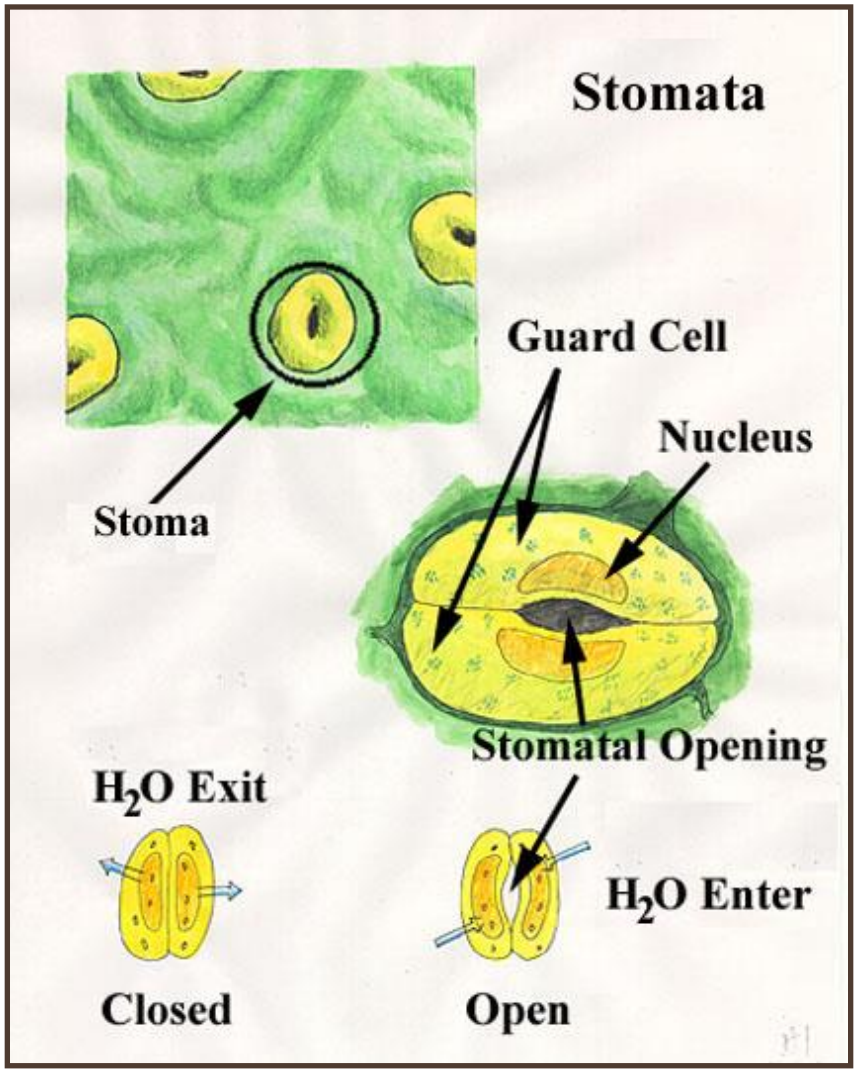


Evaporation + Transpiration= Evapotranspiration

Factors that Affect ET

- Temperature
- Relative humidity
- Wind speed
- Light intensity
- Type of plant

Stomata



Factors affecting opening and closing:

- Light, especially blue light
- Water
- Temperature
- CO_2

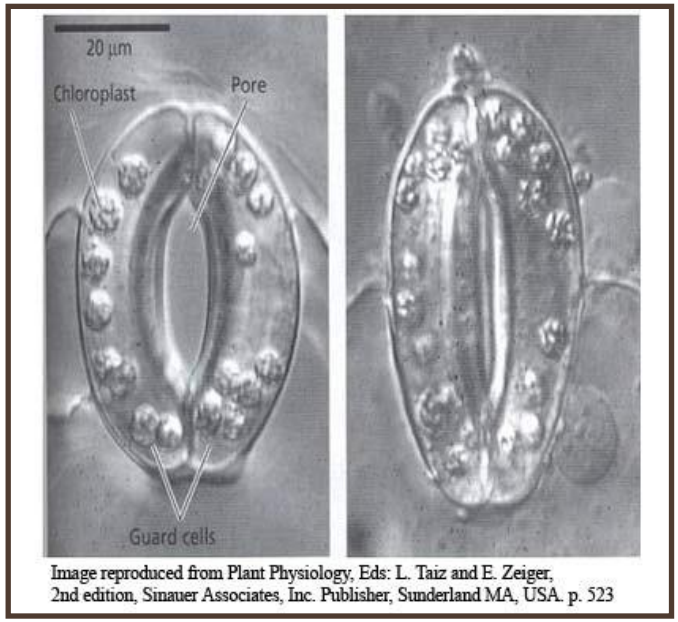


Image reproduced from Plant Physiology, Eds: L. Taiz and E. Zeiger, 2nd edition, Sinauer Associates, Inc. Publisher, Sunderland MA, USA. p. 523

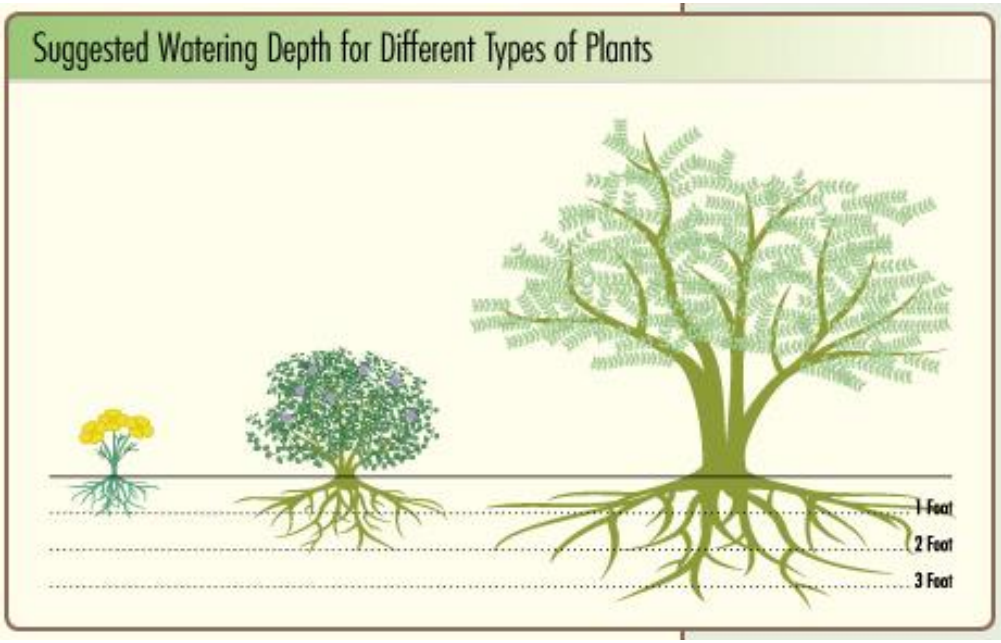
1-2-3 Rule of Irrigation

Watering depth

1 ft - Flowers, vegetables and other small annuals

2 ft – Shrubs

3 ft – Trees



FERTILIZING

Essential Plant Elements

Macronutrients

- **Needed in larger amounts**
- Primary macronutrients
  - Nitrogen (N)
  - Phosphorus (P)
  - Potassium (K)
- Secondary macronutrients
  - Calcium
  - Sulfur
  - Magnesium

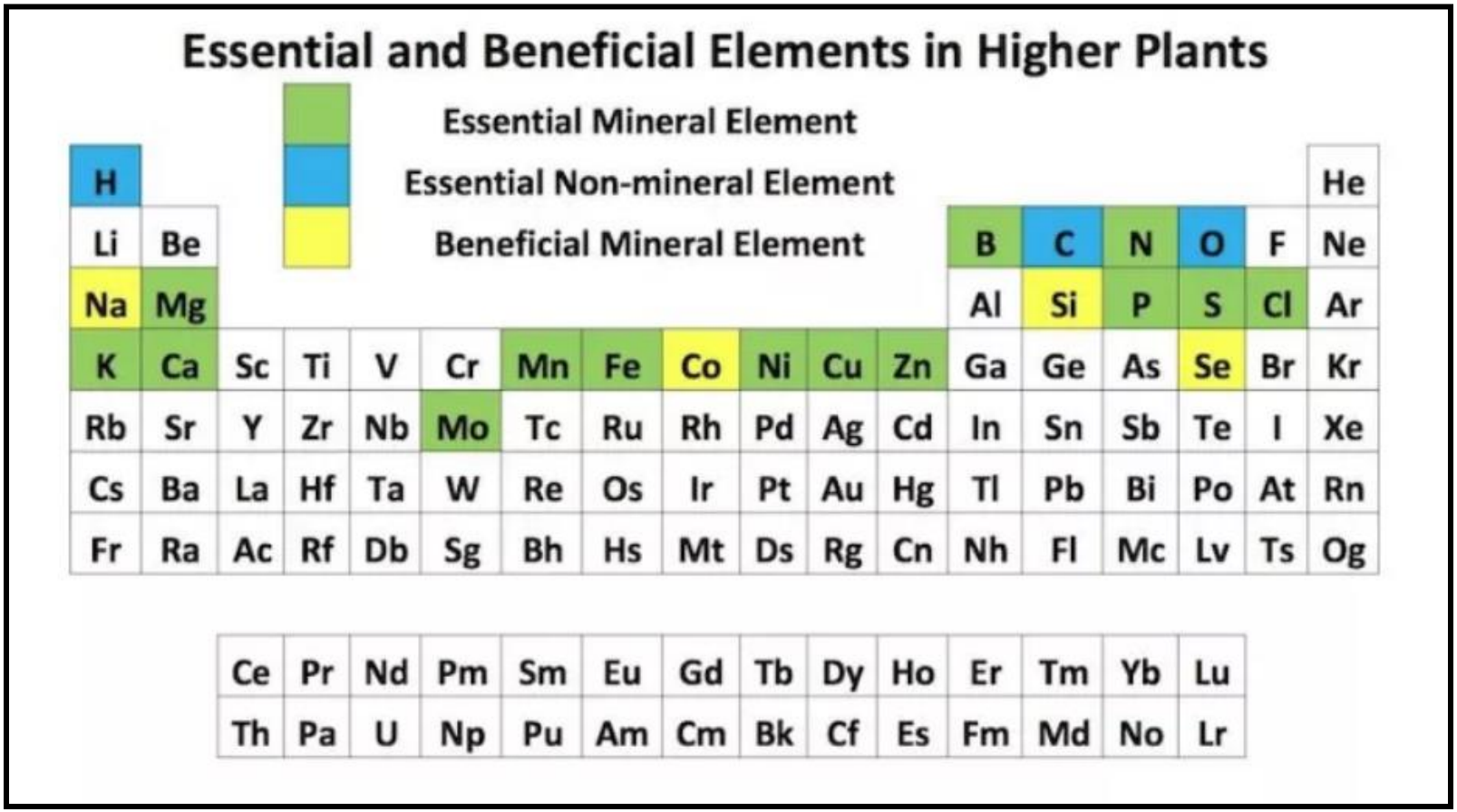
Micronutrients

- **Needed in smaller amounts**
  - Iron
  - Boron
  - Manganese
  - Zinc
  - Copper
  - Chlorine
  - Molybdenum
  - Nickle*

* recently added

- Other essential plant elements include Hydrogen, Carbon & Oxygen

Essential and Beneficial Elements for Plants



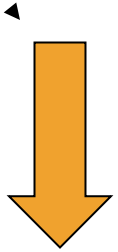
Soil Testing

- **Find a local, reliable lab** – see AZ Cooperative Extension Publication AZ1111 in the resources
- **Collect a representative sample** – ask your lab for specifics or see AZ Coop Ext Publication AZ1412
- **Make decisions based on the results** - pay extra for the recommendations – worth it unless you are very experienced

Nitrogen (N)

- Originates from decomposing organic material, from rainfall and from nitrogen-fixing bacteria
- Generally, in short supply in western (desert) soils
- Required in large amounts by plants
- Readily lost through leaching & microbe activity

Ammonium



Nitrite

Nitrate

To get quick 'greening', use a fertilizer with nitrogen in the ammonic form

Examples: Ammonium Sulfate (21-0-0)

Ammonium Nitrate (33-0-0)

Nitrogen Deficiency

- Nitrogen (N)
  - Yellowing of older leaves, bottom of plant
  - Rest of the plant is often light green
  - Stunted growth
  - Foliage may drop early in fall
  - Mobile in plants so overwatering can cause deficiency
- Treatment
  - Ammonium, Urea, Nitrate, manures, blood meal

Nitrogen-Fixing Bacteria on the roots of Acacia

Phosphorus Deficiency

- Phosphorus (P)
  - Leaf tips look burnt
  - Older leaves turning a dark green or reddish purple
  - Stunting
  - Loss of lower leaves
  - Poor root growth
  - Mobile in plants
- Treatment
  - Phosphate products
  - Bone meal
  - Greensand

Phosphorus Deficiency

Iron Deficiency

- Iron (Fe)
  - Interveinal chlorosis (yellowing leaf with green veins)
  - Found on newer growth
  - Leaves may be small
  - Immobile in plants
- Treatment
  - Iron chelates
  - Ferrous sulfate

Zinc Deficiency

- Zinc (Zn)
  - New leaves interveinal chlorosis, thicker green pattern around veins
  - Necrotic spots on margins or tips
  - Dwarfed new leaves, cupped upward or distorted

Deficiency on citrus, normal leaf on right

Zn deficiency

Fe deficiency

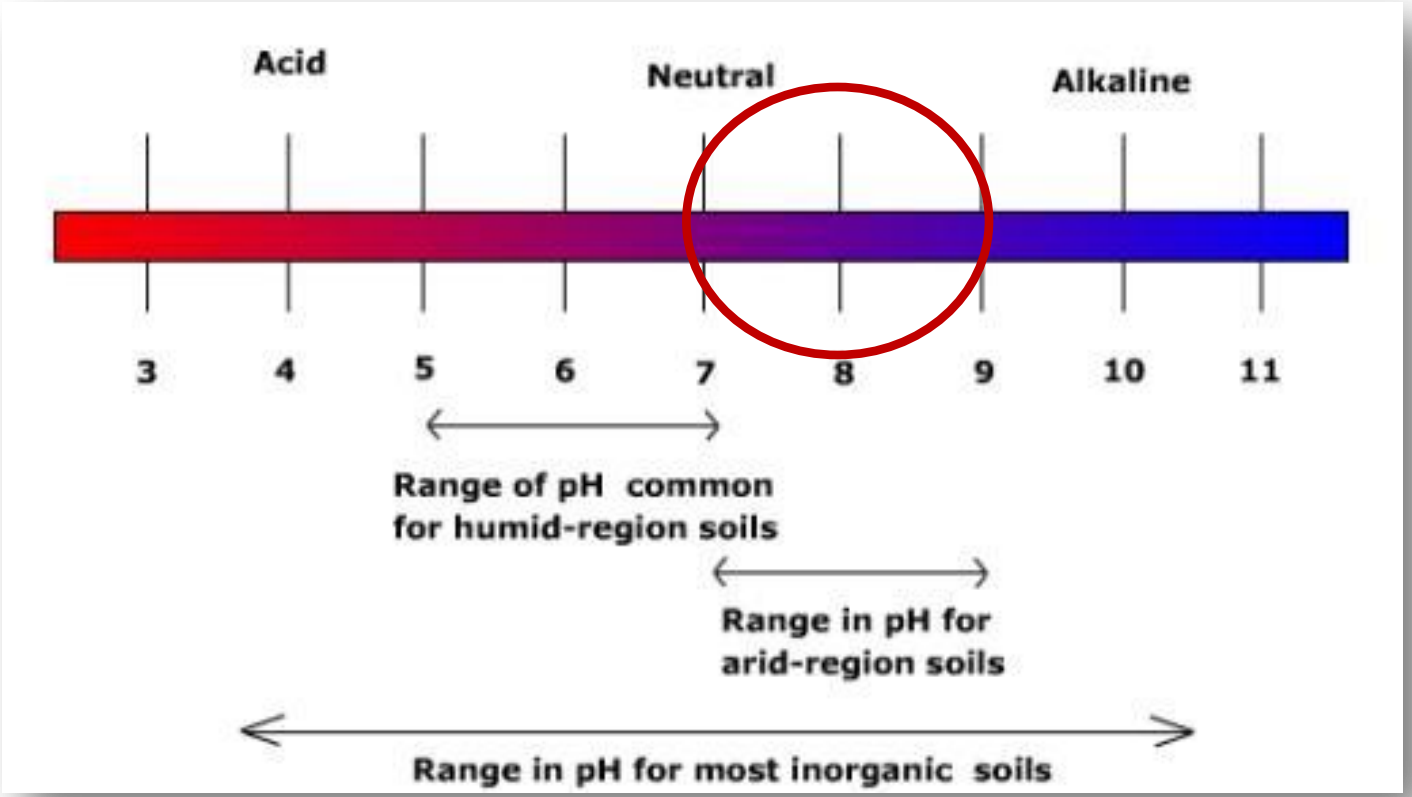
Other Micronutrient Deficiencies

Zinc (Z) Deficiency

Manganese (Mn) Deficiency

- **Micronutrient deficiencies may be caused by multiple minerals lacking**
- **Application of micronutrient packages will help broaden the spectrum**
- **Foliar testing to confirm mineral deficiency**

Magnesium (Mg) Deficiency

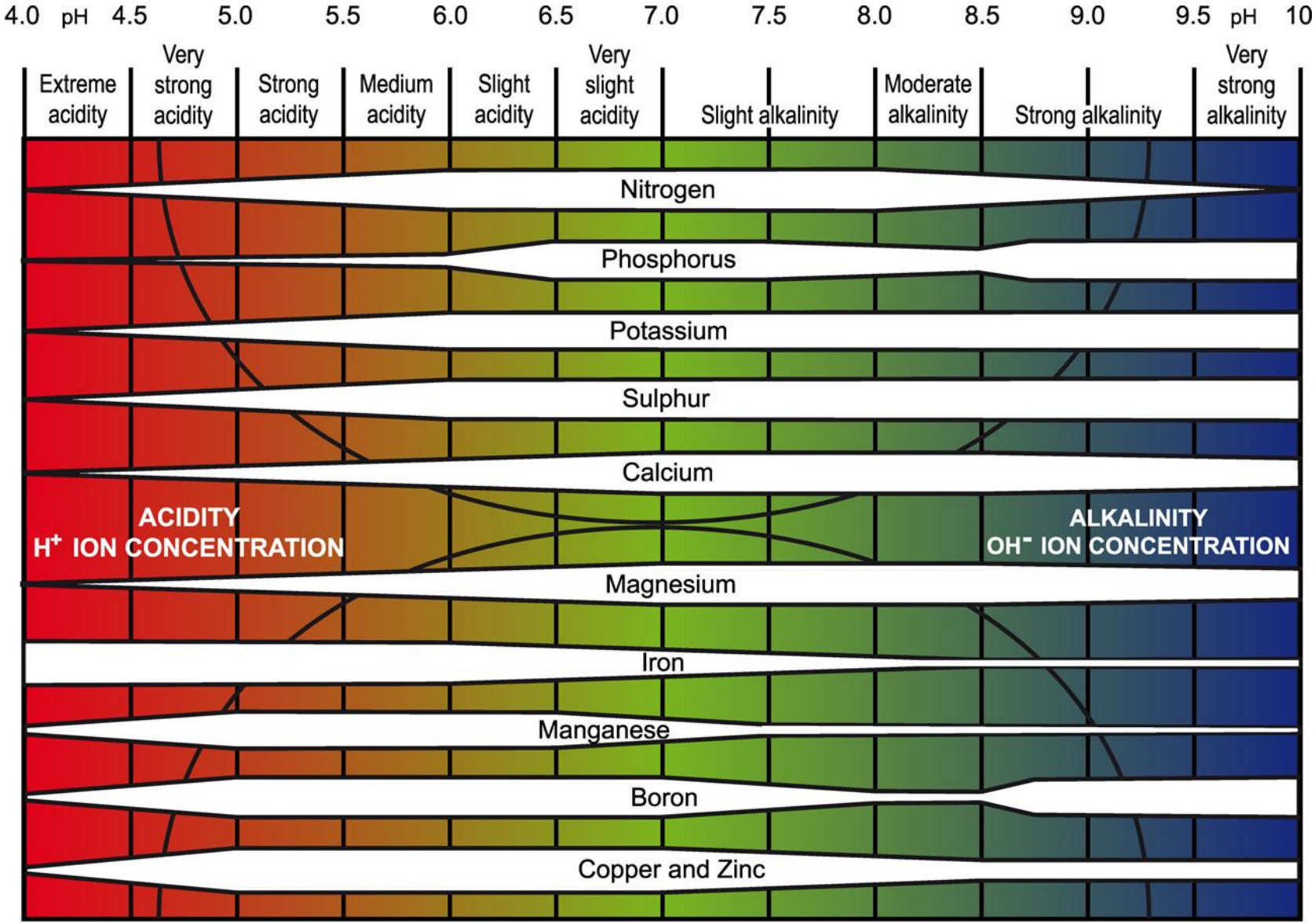


pH is a measure of acidity/alkalinity

Understanding Soil pH

https://www.youtube.com/watch?v=7Z15h189LCc

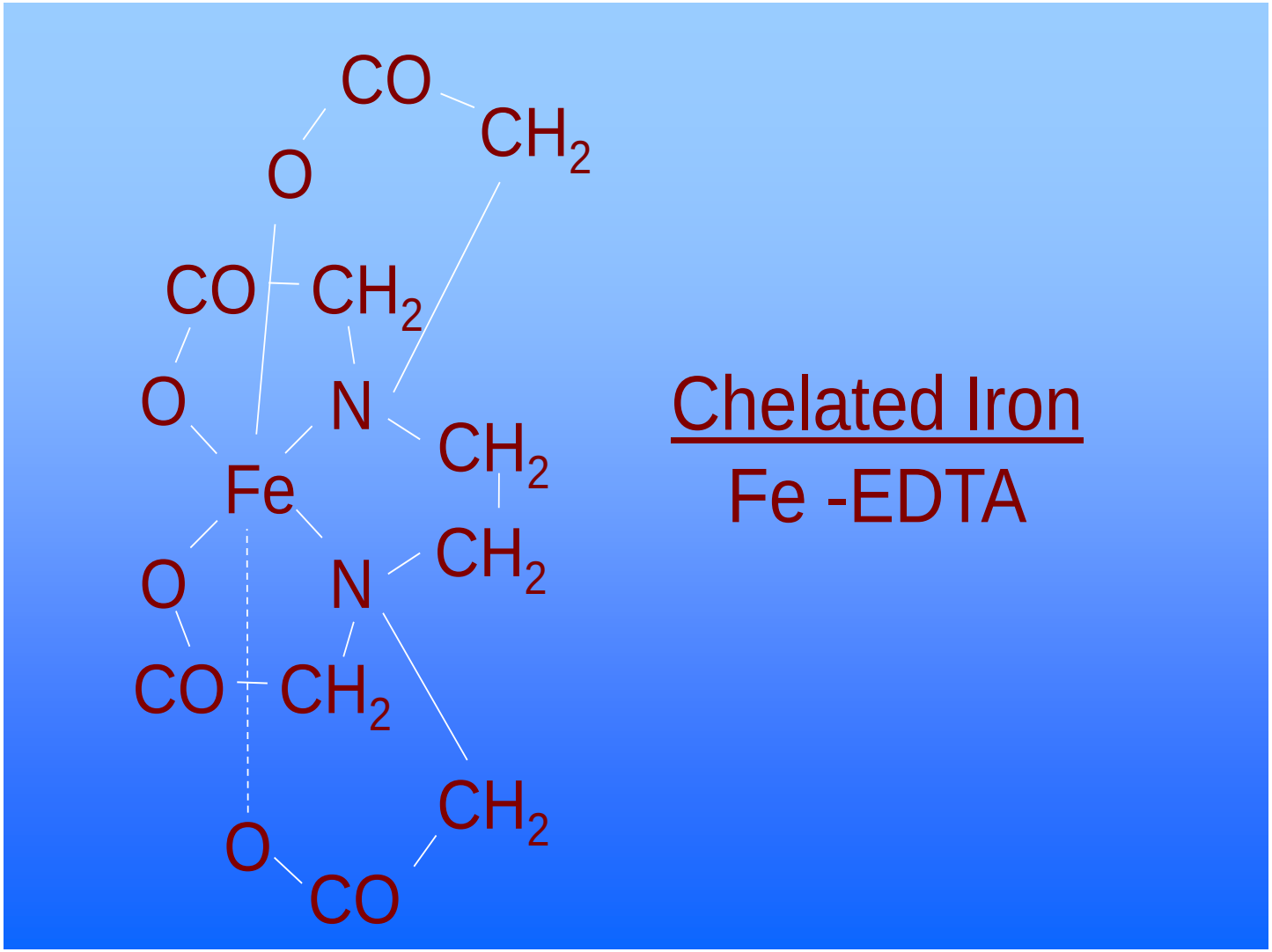
Nutrient Availability and pH



Treating Plants in Alkaline Soils

- Metal nutrients are insoluble in alkaline soils (iron, manganese, zinc)
- Apply nutrients directly to plant foliage
    - use sulfate salts
        - iron sulfate
        - copper sulfate
        - zinc sulfate
- Use chelated forms
    - more soluble than un-chelated forms
    - stay in solution longer
    - more available to plants
        - EDTA
        - DTPA
        - others

Chelates



Chelated Iron

Fe -EDTA

Other Factors Affecting Uptake

Raises Fertility	Lowers Fertility
High clay content	High sand content
High humus content	Loss of organic matter
Good structure	Compaction
Warm soil	Cold soil
Deep soil	Shallow soil
Moist soil	Dry or wet soil
Good drainage	Excess irrigation or drainage
Fertilization	Erosion
Desirable microbes	Root damaging pests
Near neutral pH	pH too acid or alkaline

Fertilizers

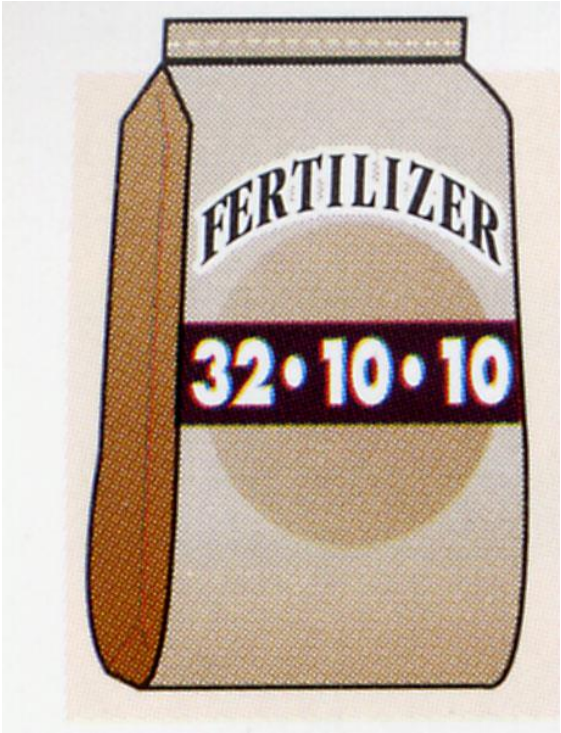
- Add nutrients to the soil
- Organic and inorganic forms
- Usually salts
- Can burn plants
- Must be watered in

Fertilizer analysis

$N\text{-}P_2O_5\text{-}K_2O$

(nitrogen-phosphate-potash)

- **Complete** fertilizer
  - 21-7-14 (contains N-P-K)
- **Incomplete** fertilizer
  - 21-0-0 (contains only N)
- **Slow release** fertilizers
  - Coated to promote slow release of minerals



Organic vs. Chemical Fertilizers

Organic

- Often recycle waste materials
- May be resource intensive
- Can be bulky, heavy
- Micronutrients
- May contain pathogens, weeds
- Salt
- Requires more fertilizer to get the same amount of N as chemical fertilizer
- Generally slow-release
- Can improve soil structure as they break down

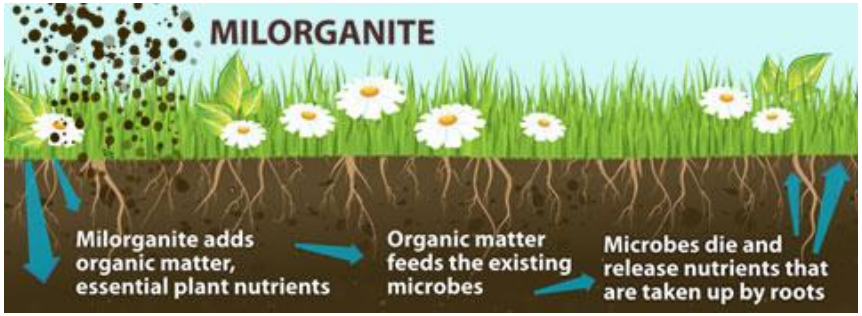
Chemical (Inorganic)

- Can be energy intensive to make
- Lighter weight
- Less material required
- Minerals in formulations readily available for plants
- Must be purchased
- Salt
- May provide more predictable results
- More risk of over fertilization

Organic vs. Chemical Fertilizers

Organic

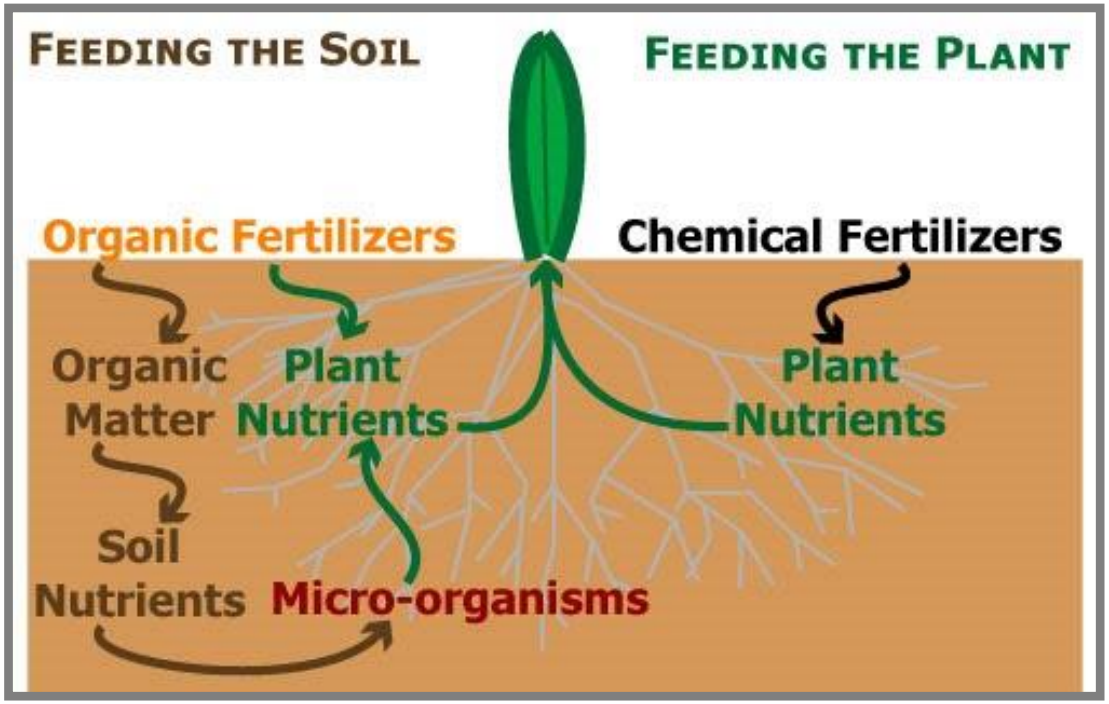
- Manure
- Compost
- Fish emulsion
- Guano
- Milorganite
- Bone meal, blood meal
- Cottonseed meal



Chemical/ Inorganic

- Ammonium nitrate
- Ammonium sulfate
- Urea
- Superphosphate
- Potassium nitrate
- Calcium nitrate

Organic vs Chemical Fertilizers



https://worcesterallotment.wordpress.com/page/25/

Fertilizer Application Methods

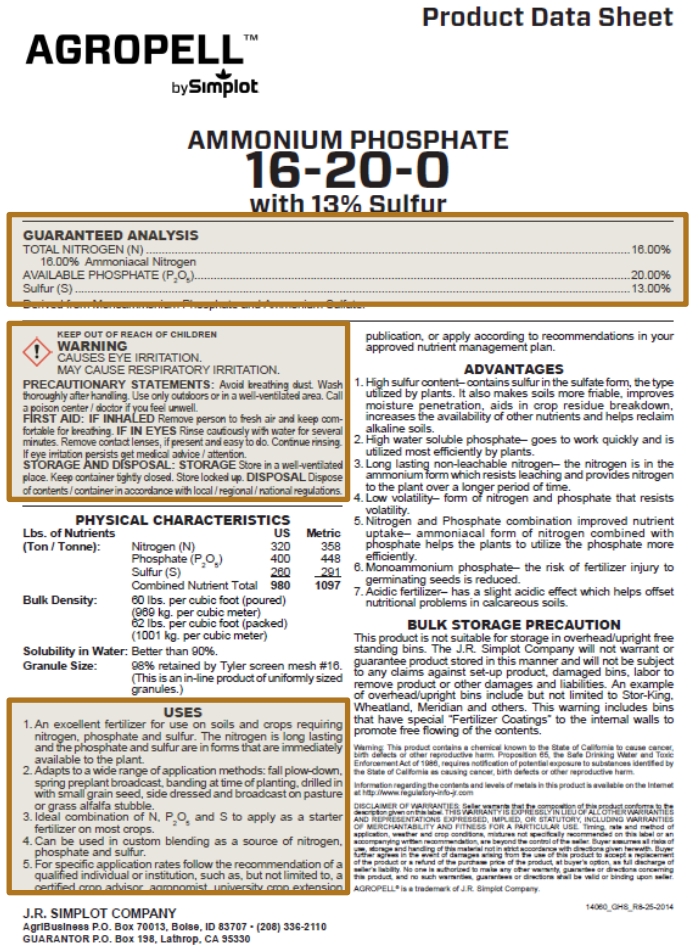
Solid

- Broadcast
- Placement

Liquid

- Foliar
- Soak
- Fertigation

Fertilizer Labeling



Product Data Sheet

AGROPELL™ by Simplot

AMMONIUM PHOSPHATE
16-20-0
with 13% Sulfur

GUARANTEED ANALYSIS

TOTAL NITROGEN (N)	16.00%
16.00% Ammoniacal Nitrogen	
AVAILABLE PHOSPHATE (P_2O_5)	20.00%
Sulfur (S)	13.00%

Derived from Monoammonium Phosphate and Ammonium Sulfate.

KEEP OUT OF REACH OF CHILDREN

WARNING
CAUSES EYE IRRITATION.
MAY CAUSE RESPIRATORY IRRITATION.

PRECAUTIONARY STATEMENTS: Avoid breathing dust. Wash thoroughly after handling. Use only outdoors or in a well-ventilated area. Call a poison center / doctor if you feel unwell.
FIRST AID: IF INHALED Remove person to fresh air and keep comfortable for breathing. **IF IN EYES** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists get medical advice / attention.
STORAGE AND DISPOSAL: STORAGE Store in a well-ventilated place. Keep container tightly closed. Store locked up. **DISPOSAL** Dispose of contents / container in accordance with local / regional / national regulations.

PHYSICAL CHARACTERISTICS

Lbs. of Nutrients (Ton / Tonne):		US	Metric
	Nitrogen (N)	320	358
	Phosphate (P_2O_5)	400	448
	Sulfur (S)	260	291
	Combined Nutrient Total	980	1097
Bulk Density:	60 lbs. per cubic foot (poured) (969 kg. per cubic meter) 62 lbs. per cubic foot (packed) (1001 kg. per cubic meter)		
Solubility in Water:	Better than 90%.		
Granule Size:	98% retained by Tyler screen mesh #16. (This is an in-line product of uniformly sized granules.)		

USES

1. An excellent fertilizer for use on soils and crops requiring nitrogen, phosphate and sulfur. The nitrogen is long lasting and the phosphate and sulfur are in forms that are immediately available to the plant.
2. Adapts to a wide range of application methods: fall plow-down, spring preplant broadcast, banding at time of planting, drilled in with small grain seed, side dressed and broadcast on pasture or grass alfalfa stubble.
3. Ideal combination of N, P_2O_5 and S to apply as a starter fertilizer on most crops.
4. Can be used in custom blending as a source of nitrogen, phosphate and sulfur.
5. For specific application rates follow the recommendation of a qualified individual or institution, such as, but not limited to, a certified crop advisor, agronomist, university crop extension publication, or apply according to recommendations in your approved nutrient management plan.

ADVANTAGES

1. High sulfur content– contains sulfur in the sulfate form, the type utilized by plants. It also makes soils more friable, improves moisture penetration, aids in crop residue breakdown, increases the availability of other nutrients and helps reclaim alkaline soils.
2. High water soluble phosphate– goes to work quickly and is utilized most efficiently by plants.
3. Long lasting non-leachable nitrogen– the nitrogen is in the ammonium form which resists leaching and provides nitrogen to the plant over a longer period of time.
4. Low volatility– form of nitrogen and phosphate that resists volatility.
5. Nitrogen and Phosphate combination improved nutrient uptake– ammoniacal form of nitrogen combined with phosphate helps the plants to utilize the phosphate more efficiently.
6. Monoammonium phosphate– the risk of fertilizer injury to germinating seeds is reduced.
7. Acidic fertilizer– has a slight acidic effect which helps offset nutritional problems in calcareous soils.

BULK STORAGE PRECAUTION

This product is not suitable for storage in overhead/upright free standing bins. The J.R. Simplot Company will not warrant or guarantee product stored in this manner and will not be subject to any claims against set-up product, damaged bins, labor to remove product or other damages and liabilities. An example of overhead/upright bins include but not limited to Stor-King, Wheatland, Meridian and others. This warning includes bins that have special "Fertilizer Coatings" to the internal walls to promote free flowing of the contents.

Warning. This product contains a chemical known to the State of California to cause cancer, birth defects or other reproductive harm. Proposition 65, the Safe Drinking Water and Toxic Enforcement Act of 1986, requires notification of potential exposure to substances identified by the State of California as causing cancer, birth defects or other reproductive harm.

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

DISCLAIMER OF WARRANTIES. Seller warrants that the composition of this product conforms to the description given on this label. THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES AND REPRESENTATIONS EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR USE. Timing, rate and method of application, weather and crop conditions, mixtures not specifically recommended on this label or an accompanying written recommendation, are beyond the control of the seller. Buyer assumes all risks of use, storage and handling of this material not in strict accordance with directions given herewith. Buyer further agrees in the event of damages arising from the use of this product to accept a replacement of the product or a refund of the purchase price of the product, at buyer's option, as full discharge of seller's liability. No one is authorized to make any other warranty, guarantee or directions concerning this product, and no such warranties, guarantees or directions shall be valid or binding upon seller.

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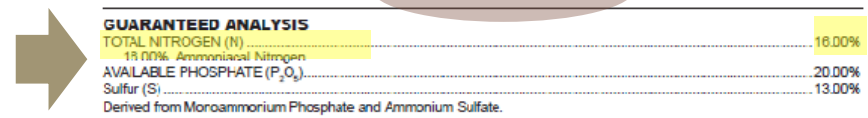
AgriBusiness P.O. Box 70013, Boise, ID 83707 • (208) 336-2110
GUARANTOR P.O. Box 198, Lathrop, CA 95330



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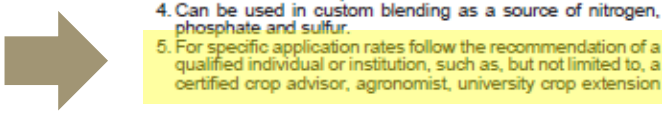
Derived from Monoammonium Phosphate and Ammonium Sulfate.

Yes but where is the rate?



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5. For specific application rates follow the recommendation of a qualified individual or institution, such as, but not limited to, a certified crop advisor, agronomist, university crop extension

Determining the amount of a fertilizer for a given area

1. Take the measurements (in feet) of the area in question
2. Multiply the length by the width; this gives you the area in square feet (sq ft.)
3. Read the label. Determine how much product is required per 1000 sq. ft. Measure the amount fertilizer needed
4. Calibrate your spreader, load and distribute

Example #1

A lawn is 100 by 50 ft. How much fertilizer is necessary if the label states that you need 1 lb. of the product per 1000 square feet?

Determine the area. 100 ft. X 50 ft. = 5000 sq. ft.

Since you need 1 lb. of fertilizer/ 1000 sq. ft. Divide 5000 sq.ft. by 1000

This tells you how many 1000 sq. ft. units there are in the lawn. This is 5.

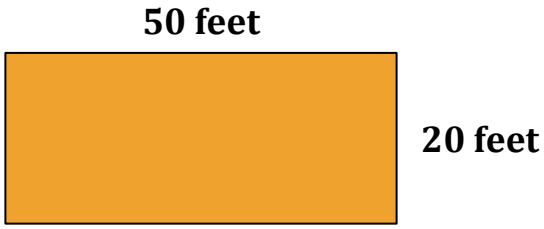
5 x 1 lb/1000 = 5 lbs per 5000 sq.ft. Answer is 5 lbs.

Example # 2

How many lbs. of 16-20-0, applied to a 50' by 20' lawn, requiring 1 lb. of nitrogen per 1000 sq. ft.?

Step 1: Determine the area

50' X 20' = 1000 sq. ft.



Step 2: Calculate how many pounds of 16-20-0 it takes to get one pound of nitrogen (N)

Divide 100 by 16 (10÷1.6 or 1 ÷ 0.16 same results)

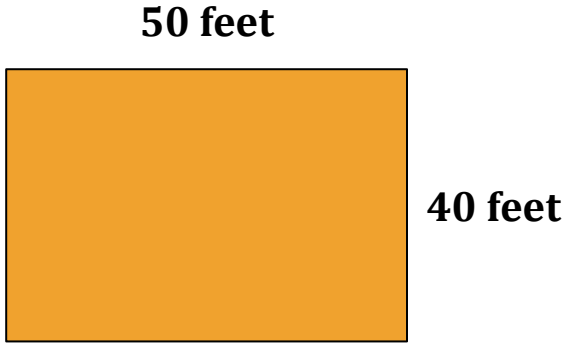
100 ÷ 16 = 6.25 lbs. of 16-20-0

Step 3: Since you have 1000 sq. ft., you'll need

6.25 lbs. of 16-20-0 for the lawn

Example 3:

How many pounds of 16-20-0 should be applied to a lawn measuring 50' by 40' that requires 2 lbs of phosphorus per 1000 sq. ft.?



Step 1: Determine the area.

50 ft. X 40 ft. = 2000 sq. ft.

Step 2: Determine the number of lbs. of 16-20-0 to get 1 lb of Phosphorous. 100 divided by 20 = 5 lbs.

(5 lbs of 16-20-0 has 1 lb of Phosphorus)

Step 3: Calculate the number of lbs of 16-20-0 that supplies the rate of 2 lbs. of phosphorus per 1000 sq. ft.

Remember that 5 lbs of 16-2-0 has 1 lb of phosphate

2 x 5 lbs = 10 lbs of ammonium phosphate

Your rate of 16-20-0 is:
10 lbs/1000 sq ft to apply 2 lbs of P per 1000 sq ft

Please ask questions! Then go calibrate your equipment and get the job done!

Spreader Calibration

https://www.youtube.com/watch?v=BT4kzNq7750

You can apply these principals to calibrating a drop spreader and handheld belly-grinder.

Resources

- **Laboratories Conducting Soil, Plant, Feed, or Water Testing**
- https://extension.arizona.edu/pubs/laboratories-conducting-soil-plant-feed-or-water-testing

- **Fertilizing Home Gardens in Arizona**
- http://extension.arizona.edu/pubs/fertilizing-home-gardens-arizona

- **Soil Sampling and Analysis**
- http://extension.arizona.edu/pubs/soil-sampling-and-analysis

- **Using Gypsum and Other Calcium Amendments in Southwestern Soils**
- https://extension.arizona.edu/pubs/using-gypsum-other-calcium-amendments-southwestern-soils

- **Diagnosing Nutrient Deficiencies Quick-Reference**
- https://extension.arizona.edu/pubs/diagnosing-nutrient-deficiencies-quick-reference

- **Nitrogen in Soil and the Environment**
- https://extension.arizona.edu/pubs/nitrogen-soil-and-environment

- **Recognizing and Treating Iron Deficiency in the Home Yard**
- https://extension.arizona.edu/pubs/recognizing-treating-iron-deficiency-home-yard

- **University of Arizona publication search**
- https://extension.arizona.edu/pubs

Soil Testing Laboratories

Local

IAS Laboratories 602-273-7248

2515 E. University Dr. Phoenix, AZ

Motzz Laboratory, Inc. 602-454-2376

3540 E. Corona Ave. Phoenix, AZ

National

AgSource/ Harris Labs 402-476-0300

harrislabs.agsource.com

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Thank you to those who contributed to this program:

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