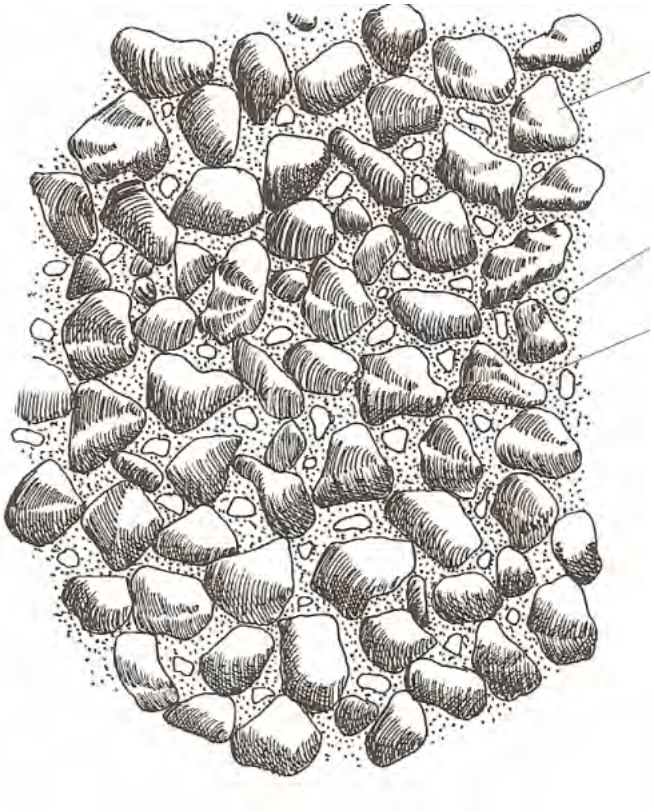
Soils for salad and sweet box

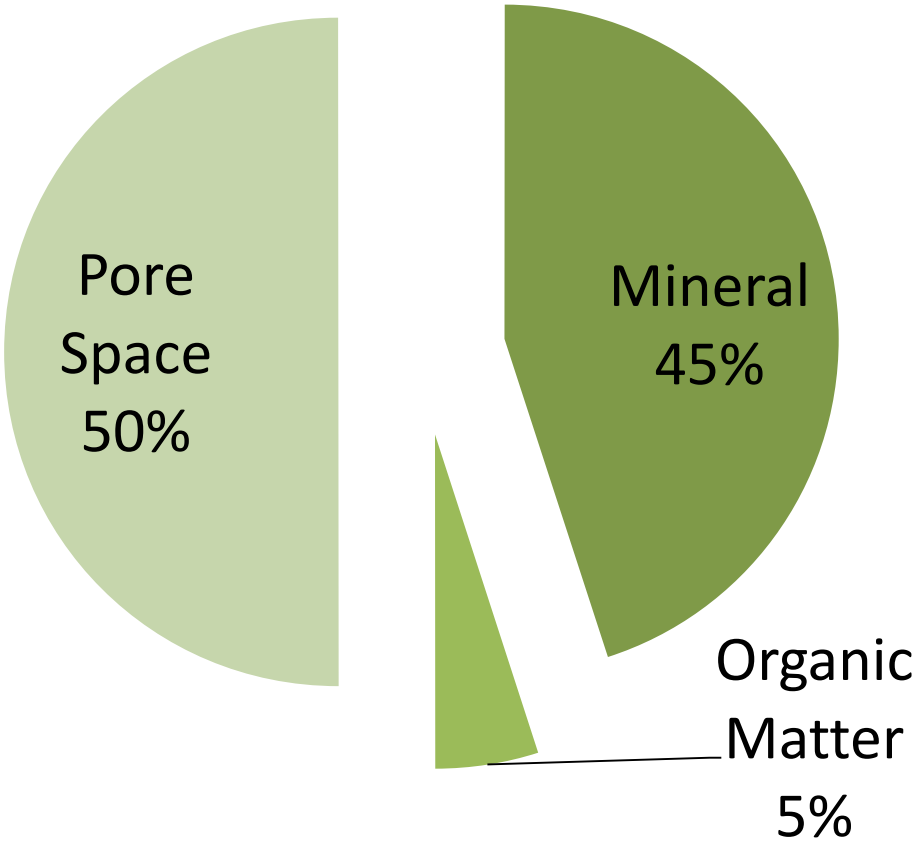
Cultivating success from the ground up

Kate Kurtz
Soil scientist, biosolids project manager, King County


What is soil?
How is it made?
Texture
Structure
Biology
Fertility/nutrients

What is soil?





How is soil made?

Parent Material: rocks or alluvium

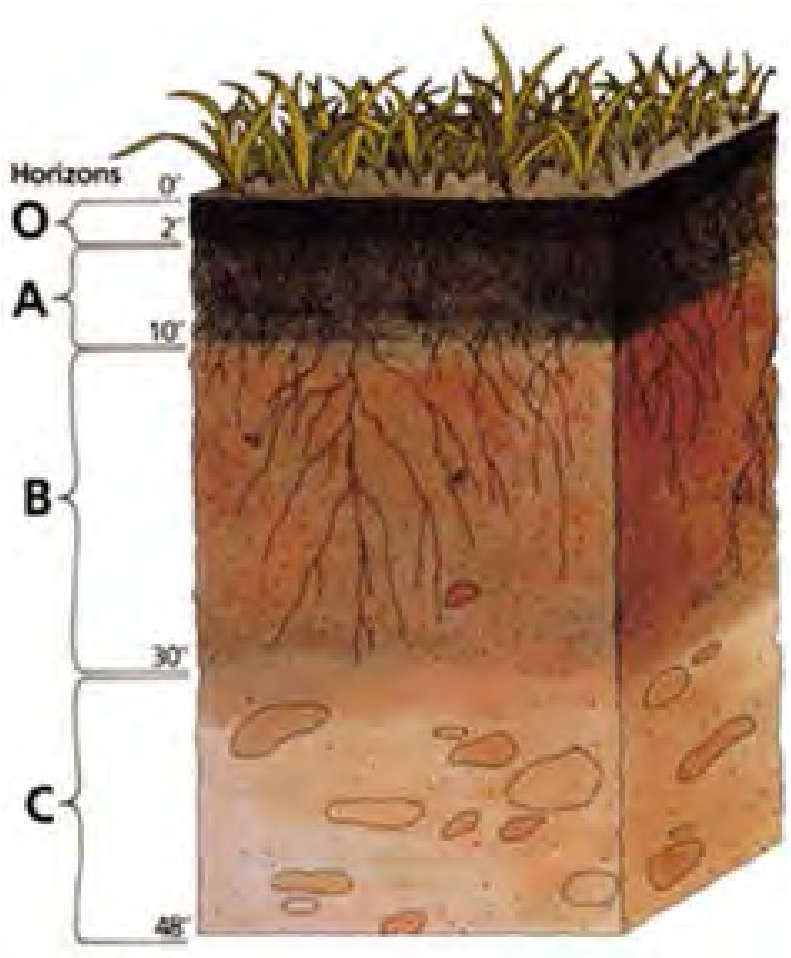
Climate: Temperature, moisture, weather, and seasonal distribution.

Topography: Slope, aspect, shape.

Living organisms: animals and plants are often source of organic matter and many nutrients.

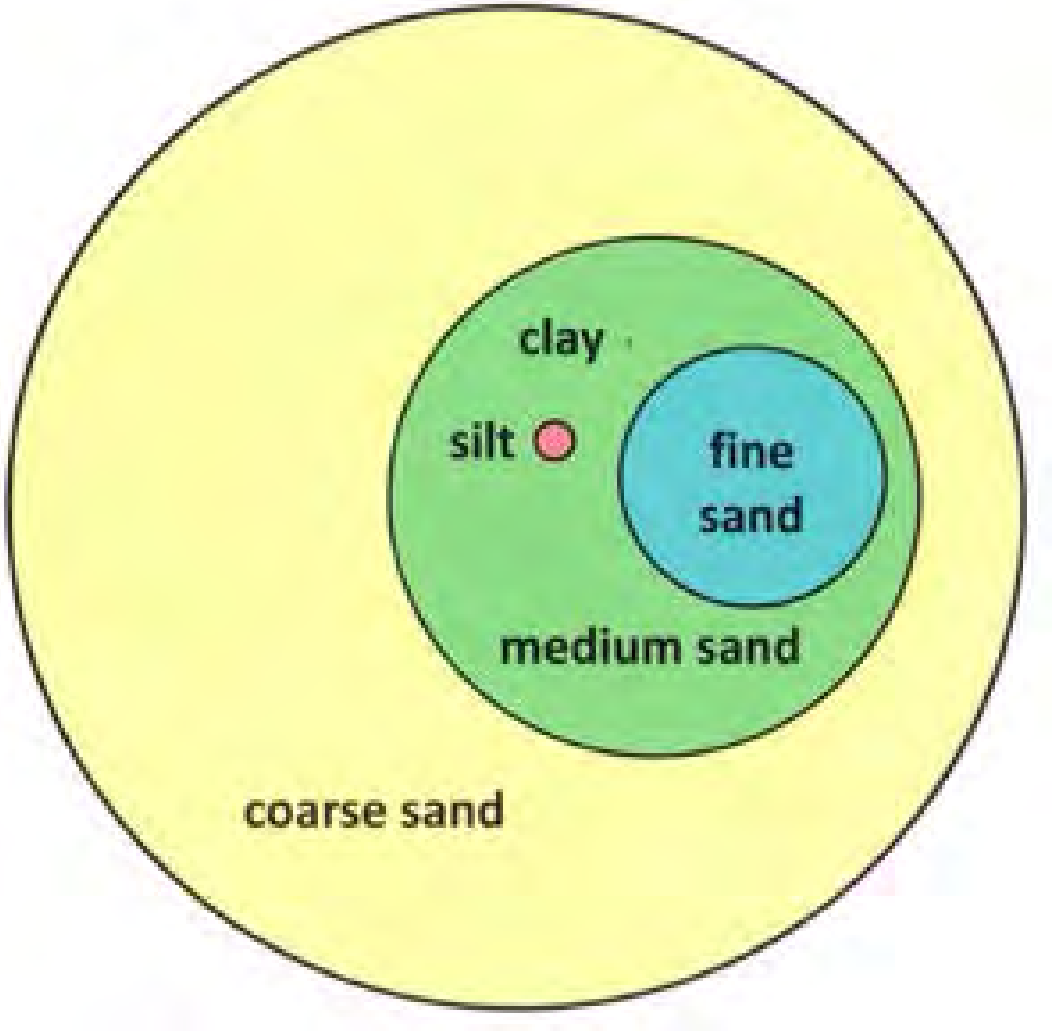
Time: allows all the preceding factors to work. Over eons rocks breakdown into clay particles and leach. Young soils tend to have less clay and are more fertile.

What does soil look like?



Soil Texture

Relative amounts of sand, silt, and clay



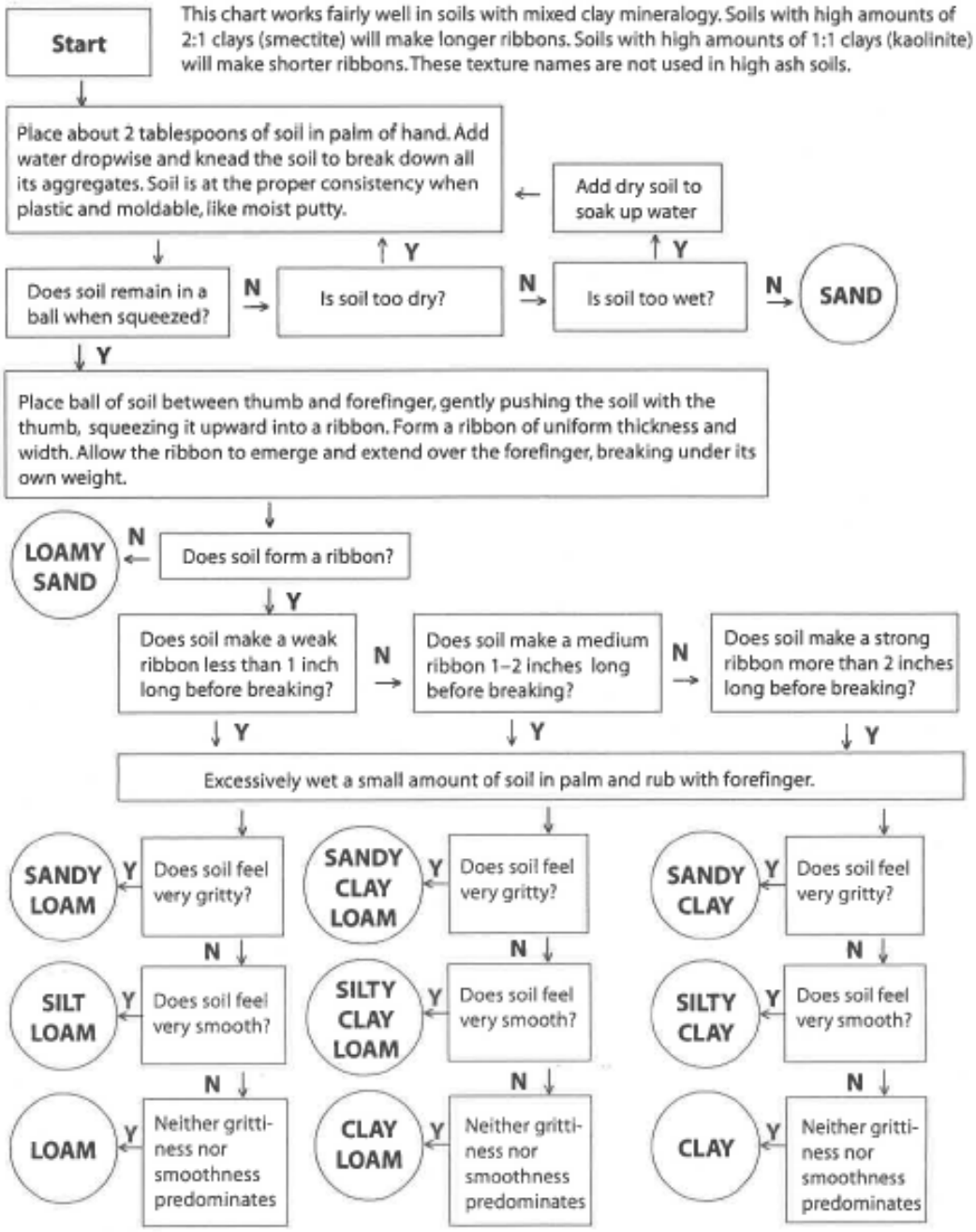
Soil texture

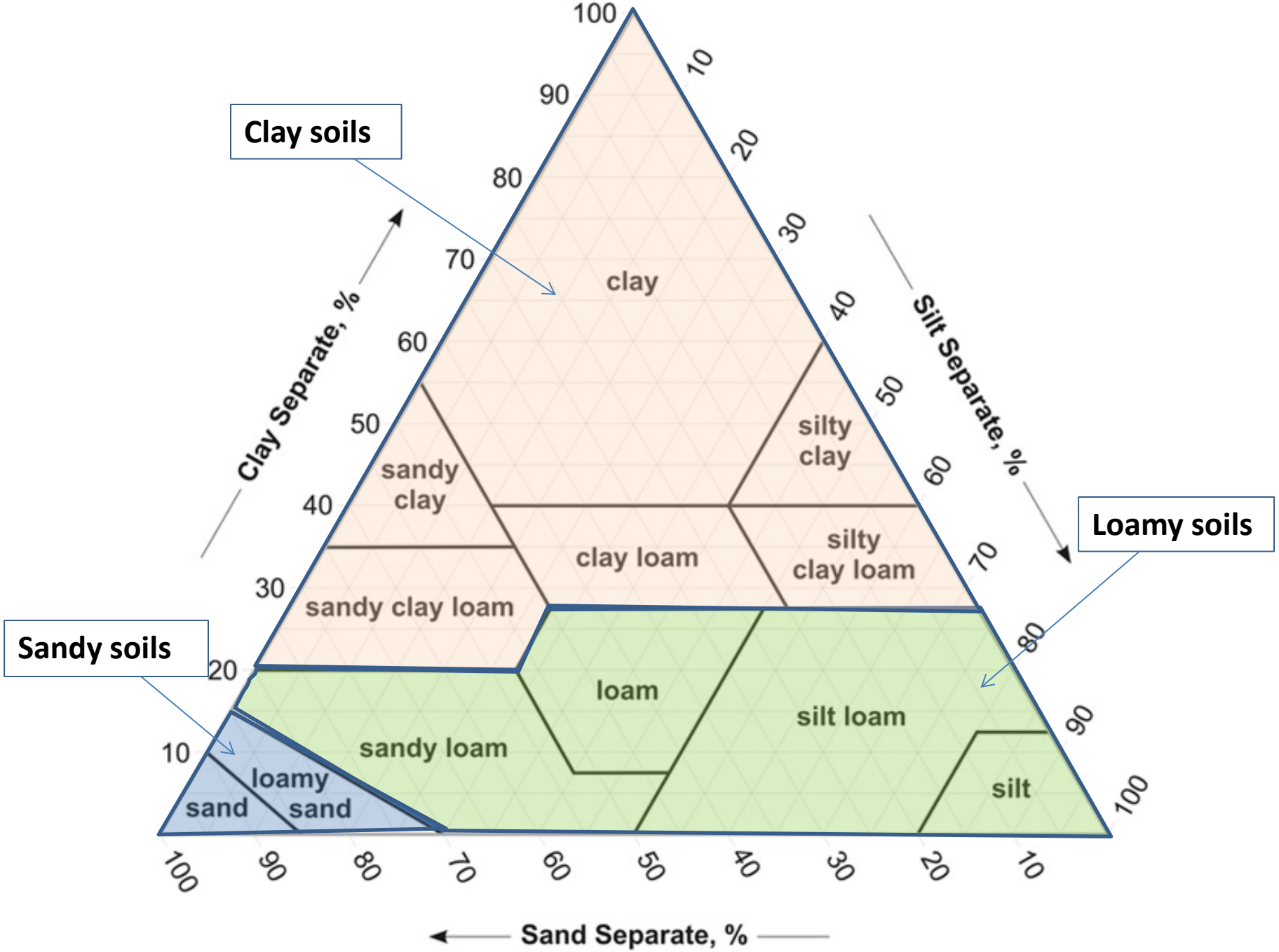
- Sand feels gritty
- Silt feels floury when dry but greasy when wet
- Clay feels sticky and is easily molded into shapes

How Texture Affects Soil Properties

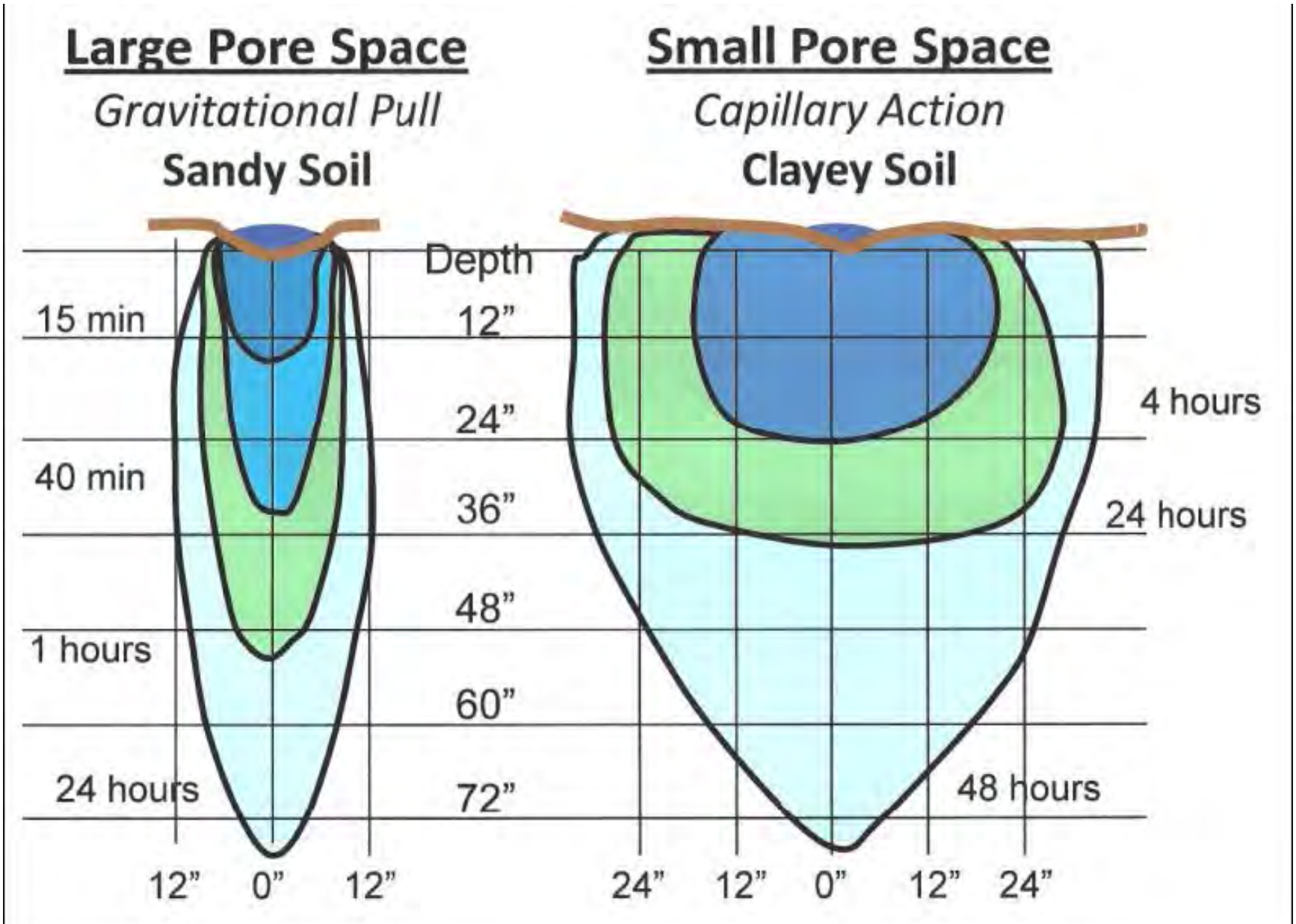
Texture	Aeration/ Porosity	Ease of Water Infiltration	Ability to Hold Nutrients	Water-Holding Capacity	Ease of Working
Loam	medium	medium	medium	medium	medium
Clay	poor	poor	excellent	good	poor
Silt	medium	medium	medium	medium	medium
Sand	excellent	good	very poor	very poor	good

Soil Texture Decision Chart




Clay soils
Loamy soils
Sandy soils
Clay Separate, %
Silt Separate, %
Sand Separate, %
clay
silty clay
sandy clay
clay loam
silty clay loam
sandy clay loam
loam
silt loam
sandy loam
silt
loamy sand
sand
100
90
80
70
60
50
40
30
20
10

How texture affects drainage



Drainage and water holding capacity

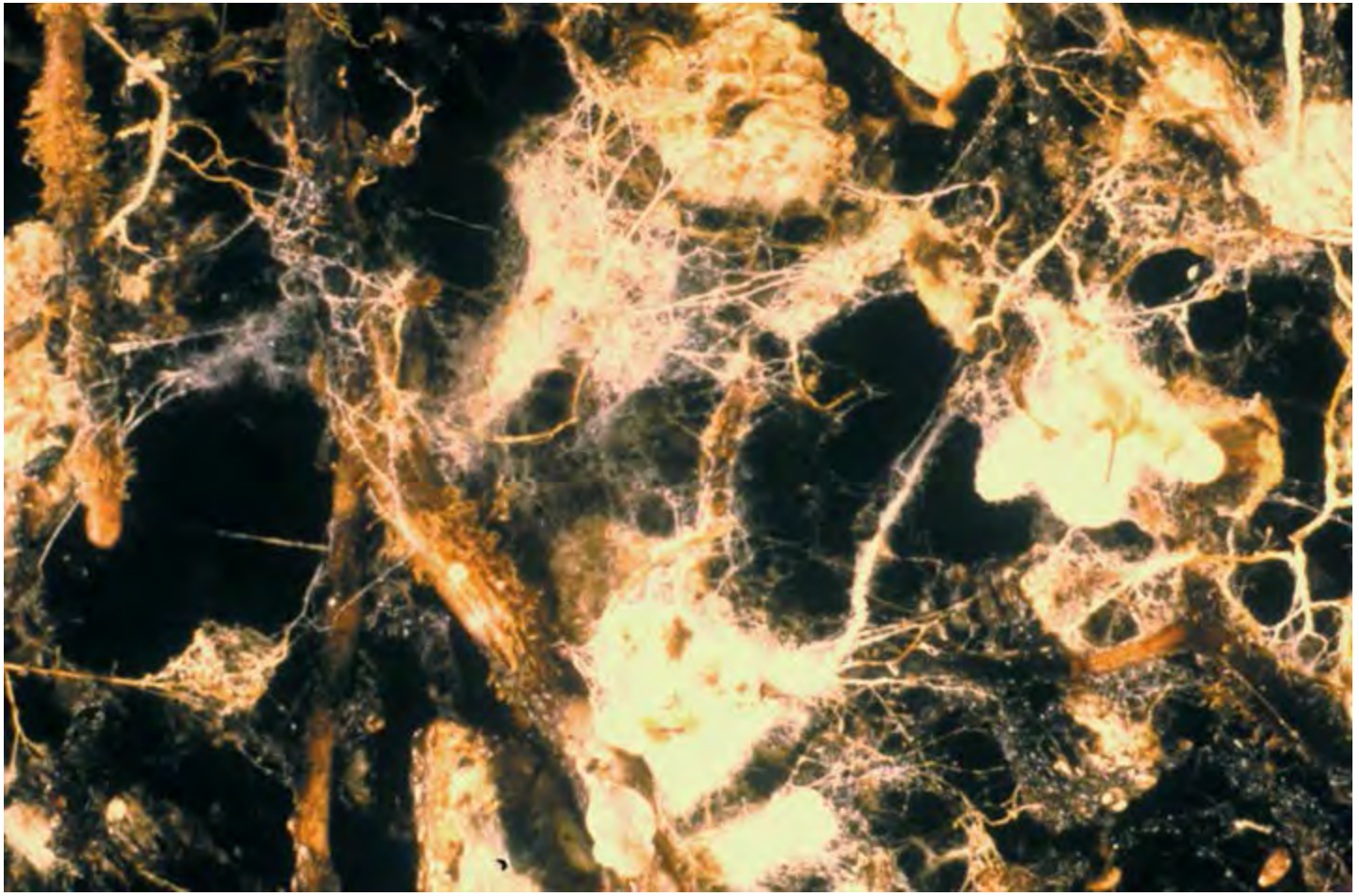
- Macropores control infiltration and drainage
- Small pores control water holding capacity
- Tiniest of pores hold water unavailable to plants

Soil structure: crumbs, clods, or mud pies?
(under cultivation)

Compaction and how to ruin your soil's structure

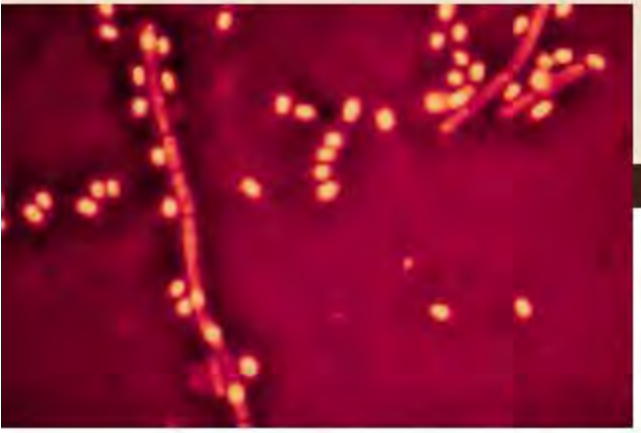
Improve soil structure

Organic Matter and Soil Microbes



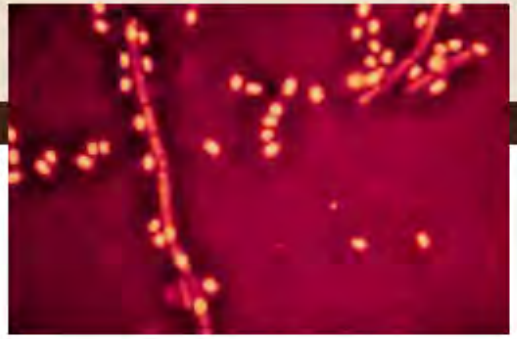
Helps soil structure by tangling and gluing soil particles together

Soil Organisms



Bacteria, fungi, actinomycetes, protozoa, nematodes, arthropods, earthworms

Roles of Soil Organisms

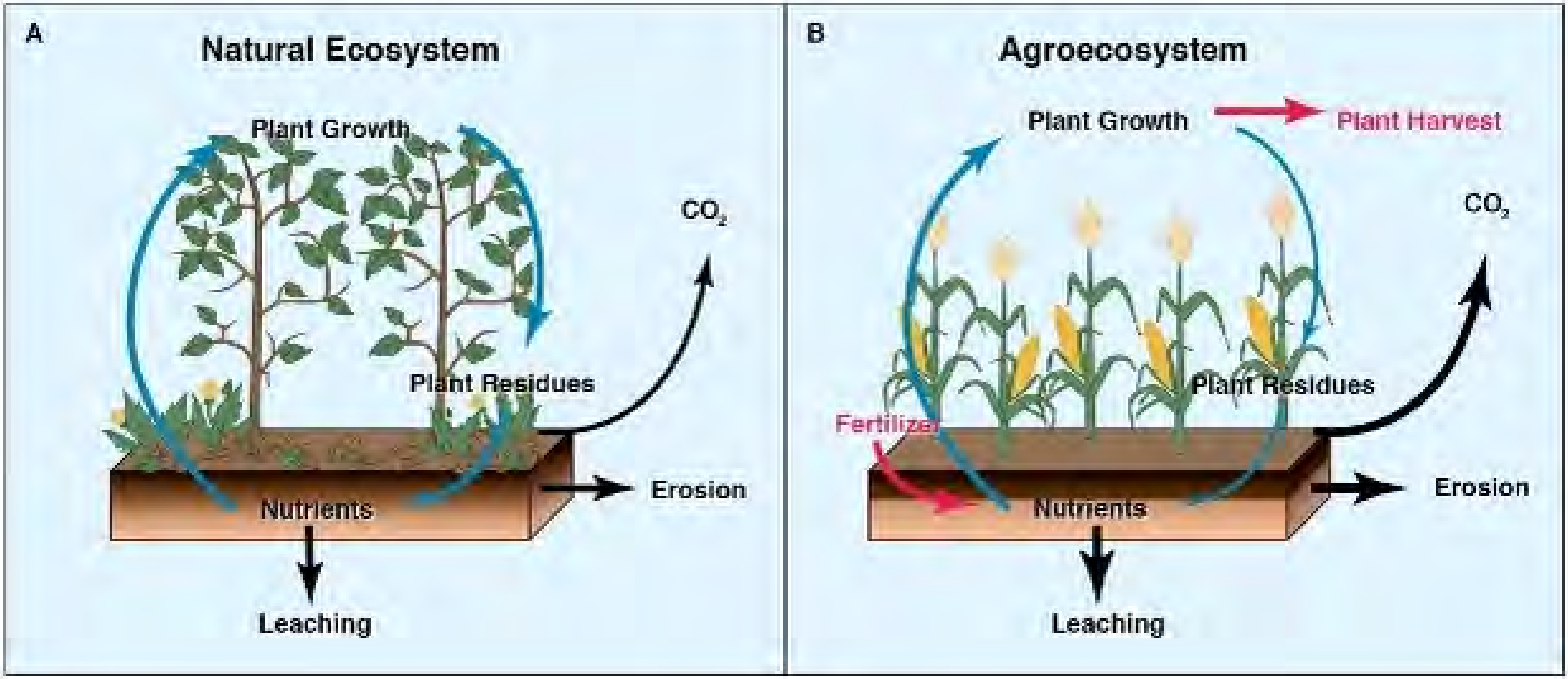


- Residue decomposition
- Nutrient cycling
- Aggregation and porosity
- Contaminant breakdown
- Nitrogen fixation
- Enhance root function
- Pathogens
- Predators

Improving drainage

Improving drainage

Fertility/nutrients



Plant Nutrients

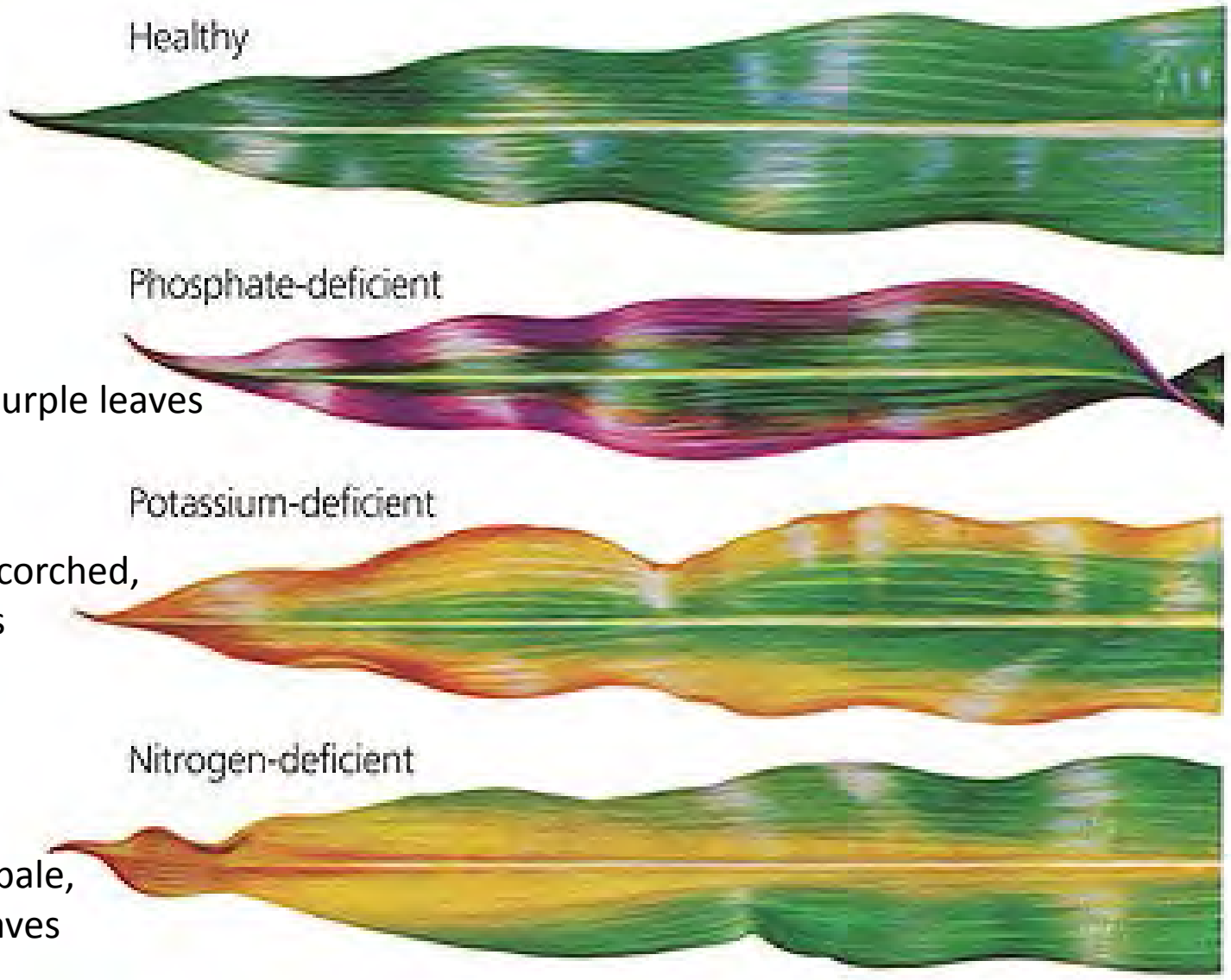
Macronutrients

- Nitrogen
- Phosphorus
- Potassium
- Calcium
- Magnesium
- Sulfur

Micronutrients

- Boron
- Iron
- Manganese
- Zinc
- Copper
- Chloride
- Molybdenum

Nutrient deficiency symptoms



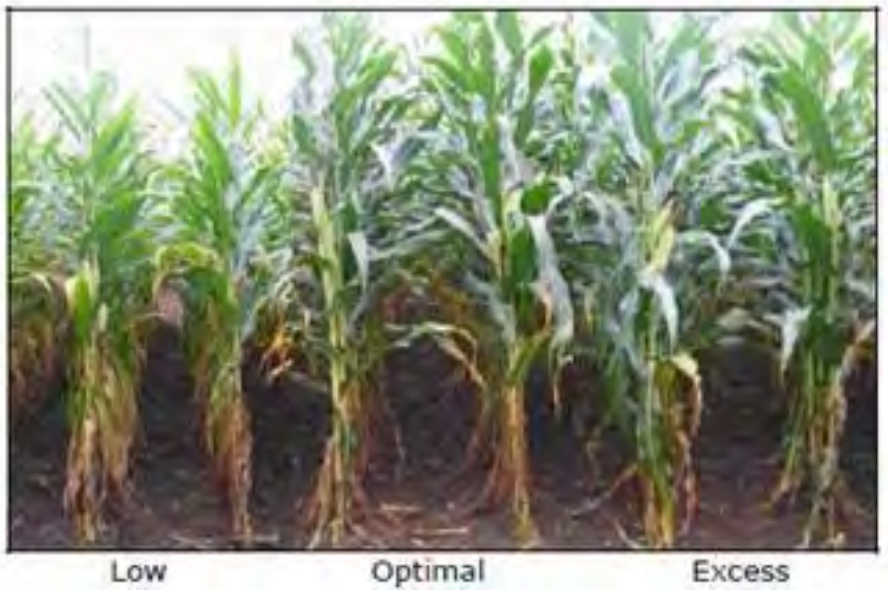
P-deficient:
usually see purple leaves

K-deficient:
usually see scorched, curled leaves

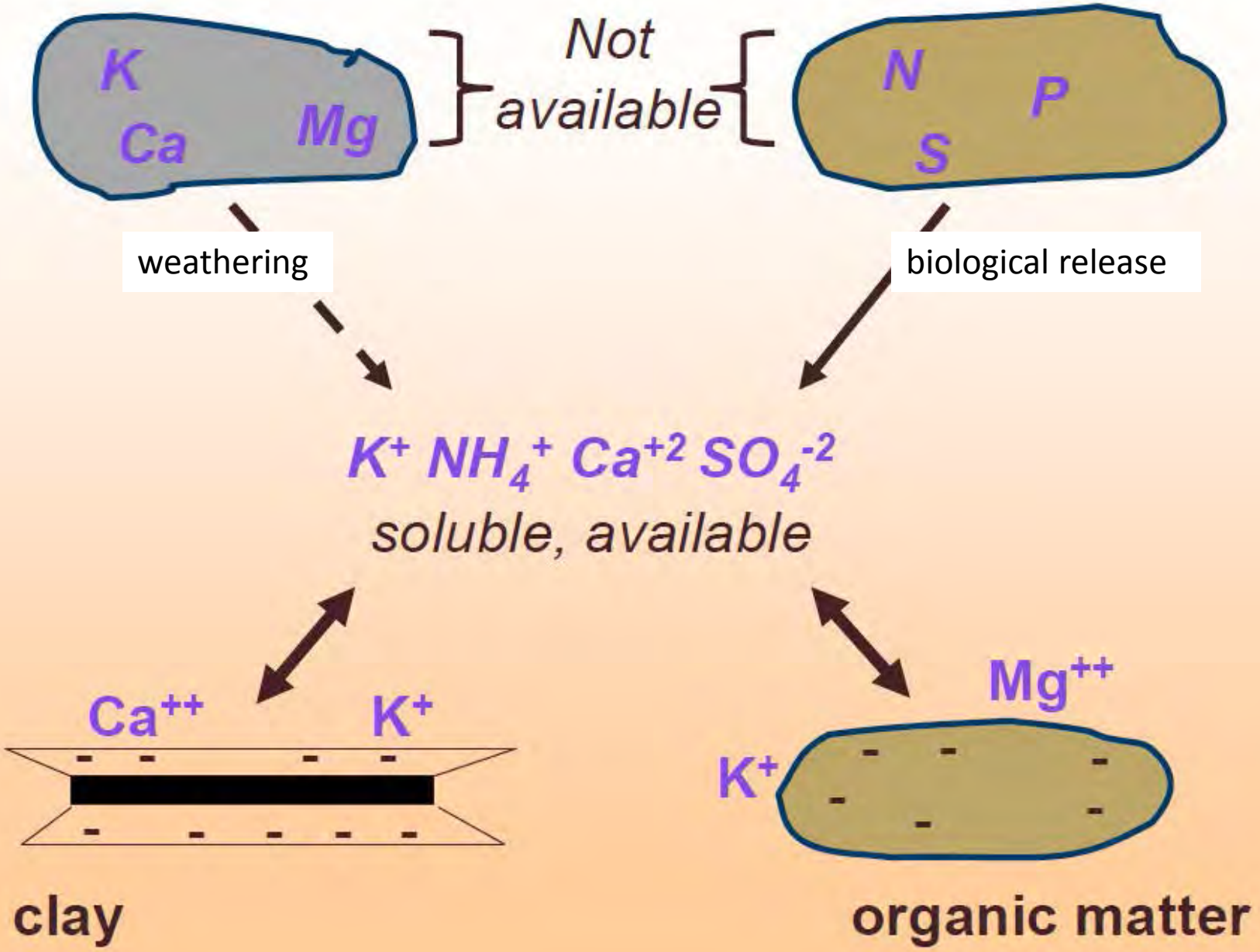
N-deficient:
usually see pale, chlorotic leaves

Excess nutrients

- Nitrogen:
  - Groundwater contamination
  - Plant health, fruit yield and quality
    - All leaves no fruit
- Phosphorus:
  - Surface water contamination
- Boron
  - Toxicity
- Too much of everything
  - Reduced yield and vigor
  - Problems taking up water



How do nutrients become available?



Comparing Fertilizer Sources

Organic

- Little or no processing
- Low nutrient analysis
- Usually slow release
- Often unknown concentrations
- Usually a source of organic matter

Synthetic

- Industrial process with potentially major environmental impacts (huge carbon emissions, water contamination)
- Usually fast release
- Known concentrations
- No organic matter

Comparing fertilizer Sources

Organic

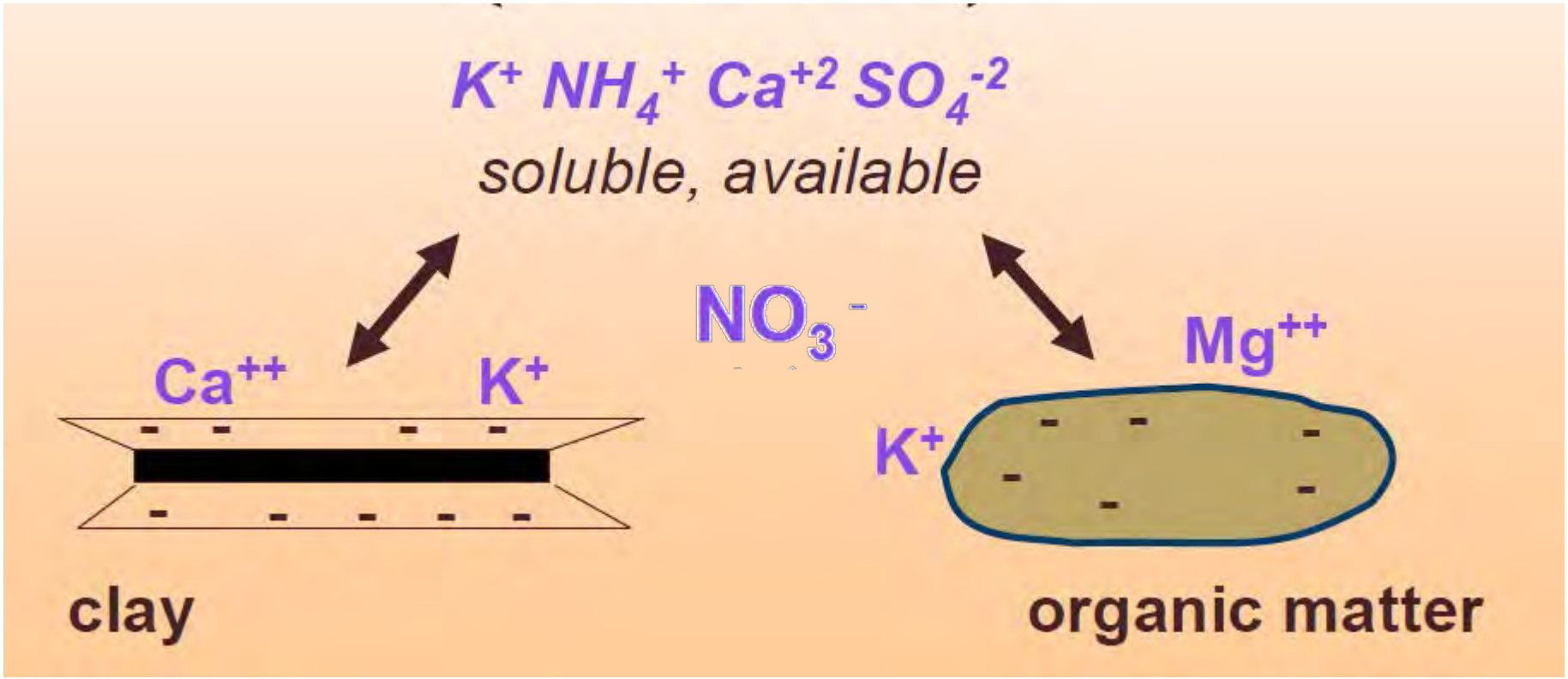
- Manure
- Biosolids
- Bone meal
- Wood ash
- Blood meal
- Seed meal

Synthetic

- N – air
- P – mined
- K - mined

Nutrient Uptake

The forms of nutrients taken up by plants are the same regardless of the nutrient source.



Fertilizer Labels

5 – 10 – 10

% Nitrogen – % Phosphate – % Potash

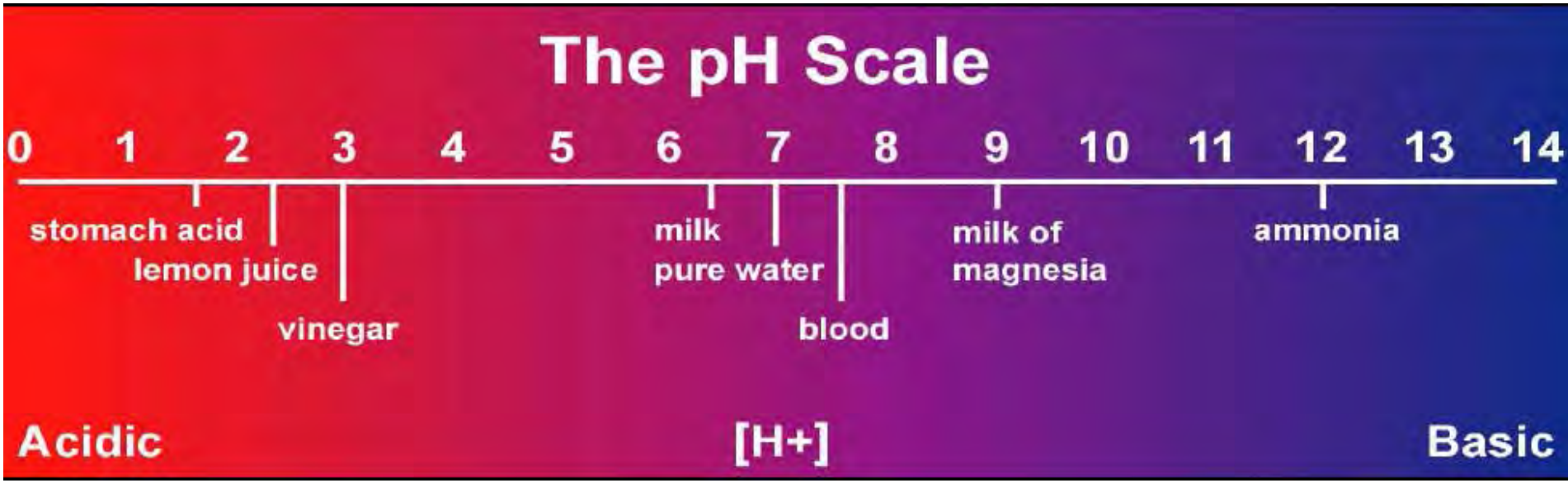
Phosphate = units of P

1 lb P = 2.3 lb phosphate (P_2O_5)

Potash = units of K

1 lb K = 1.2 lb potash (K_2O)

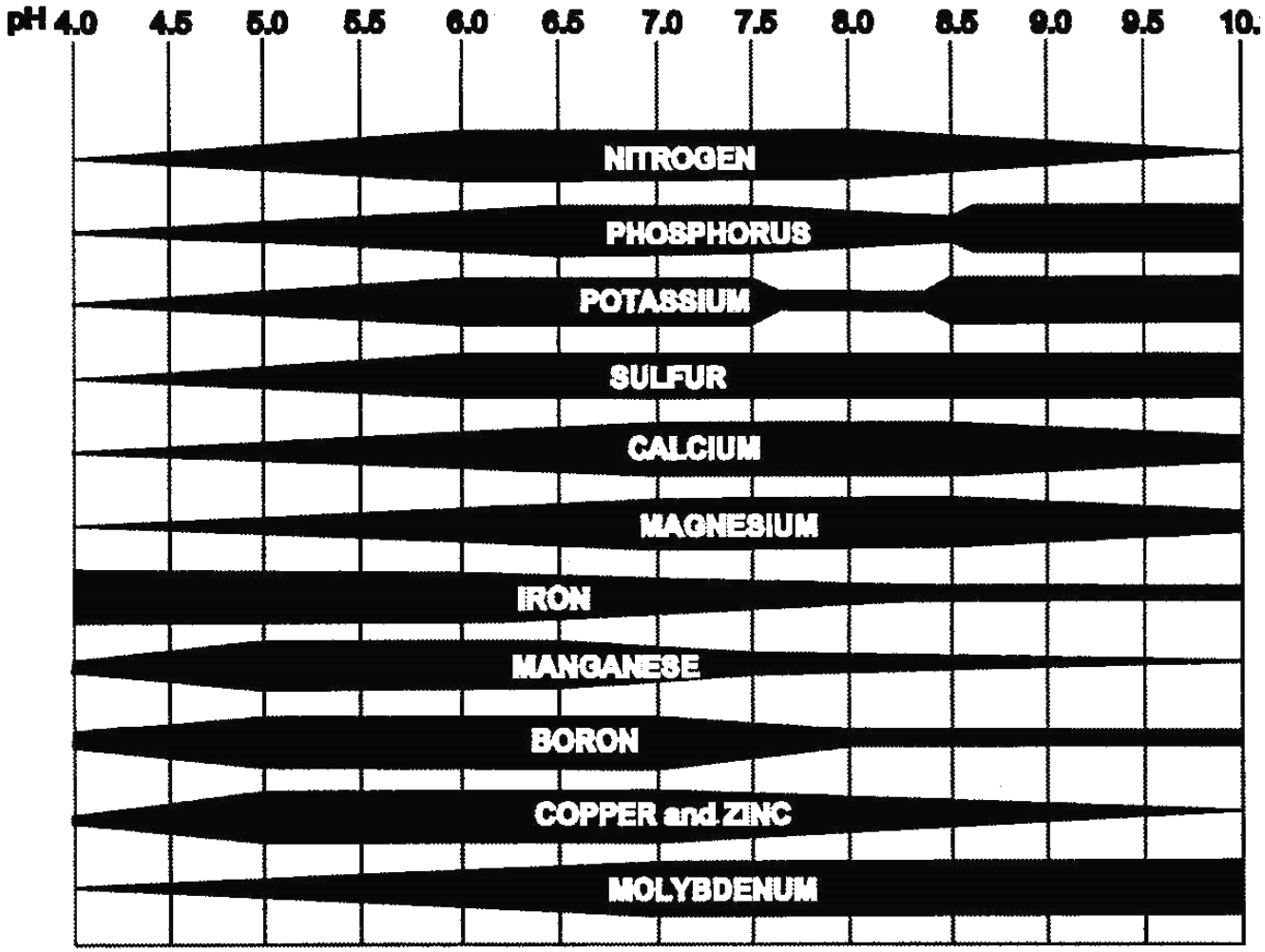
Soil pH



- Indicated relative acidity or alkalinity
- pH 7 = neutral
- pH less than 7 = acid
- pH more than 7 = alkaline (basic)
- Logarithmic scale

Soil pH

NUTRIENT AVAILABILITY AT DIFFERENT pH VALUES. MAXIMUM AVAILABILITY IS INDICATED BY WIDEST PART OF BAR



6 - 7.5 is a sweet spot for most plants

Adjusting pH

- Orgnic matter tends to buffer pH around neutral
- To lower pH add sulfur
- To raise pH add lime

Testing soil

- Sample defined area
- Take 10 or more subsamples (0-8” deep)

- Dry and mix <u>well</u>

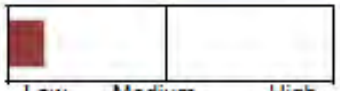
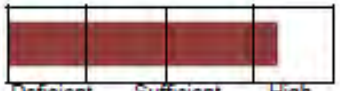
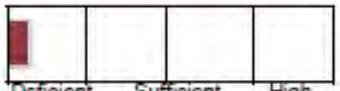
- Subsample mixture and fill sample bag

soiltest
farm consultants, inc.

PAP-Accredited
NAPT
2014

Name: KRISTIN COVEY
Date Received: 1/9/2017

Sample ID: GARDEN
Kit Number:

Test Results		Interpretation	Fertility Recommendations
pH	6.5		
Salts	0.44		
Organic Matter (%)	5.1		
Ammonium-N (ppm)	4.2		0.0 lbs of N per 1,000 ft²
Nitrate-N (ppm)	12.2	Ammonium + Nitrate + OM	
Phosphorus	271		0.0 lbs of P_2O_5 per 1,000 ft²
Potassium	52		2.5 lbs of K_2O per 1,000 ft²

What does this test mean Need more assistance? Visit www.soiltestlab.com

pH: The pH scale is from 0-14 with 7 being neutral. If your pH is less than 7 the soil is acidic, if greater than 7 it is basic. To lower pH elemental sulfur can be added, to raise pH lime can be added. Most plants can grow in a wide range of soil pH, however, optimal pH is plant dependent.

soiltest farm consultants, inc.

SOILTEST FARM CONSULTANTS - 11
2925 DRIGGS DR

Moses Lake , WA 98837
Laboratory #: S17-00161

Date Received: 1/9/2017
Grower: KRISTIN COVEY
Sampled By:
Field: GARDEN
Customer Account #:
Customer Sample ID:

Phosphorus	Bray	mg/kg	271
Potassium	NH4OAc	mg/kg	44
Boron	DTPA	mg/kg	0.17
Zinc	DTPA	mg/kg	11.5
Calcium	NH4OAc	meq/100g	6.1
Magnesium	NH4OAc	meq/100g	2.2
Sodium	NH4OAc	meq/100g	0.33
Lime Req		Tons/Acre	0.0
Buffer pH	SMP		6.7
Total Bases	NH4OAc	meq/100g	8.7

Soil Test Results

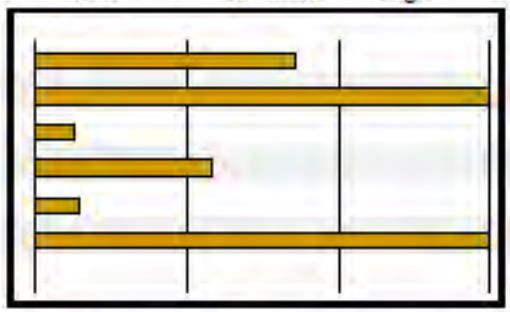
pH 1:1		6.5	CaCl2 pH 5.8
E.C. 1:1	m.mhos/cm	0.17	
Est Sat Paste E.C.	m.mhos/cm	0.44	
Effervescence			
			Lbs/Acre
Ammonium - N	mg/kg	4.2	13
Organic Matter W.B.	%	5.1	ENR: 102

Depth inches	Nitrate-N mg/kg	Nitrate-N lbs/acre	Sulfate-S mg/kg	Moisture Inches
0 - 12	12.2	39	13	
Totals	**12.2**	**39**	**13**	

Sum of Tested N: 154 lbs/acre N

Interpretation Guide

Fertilizer recommendations for of GARDEN after



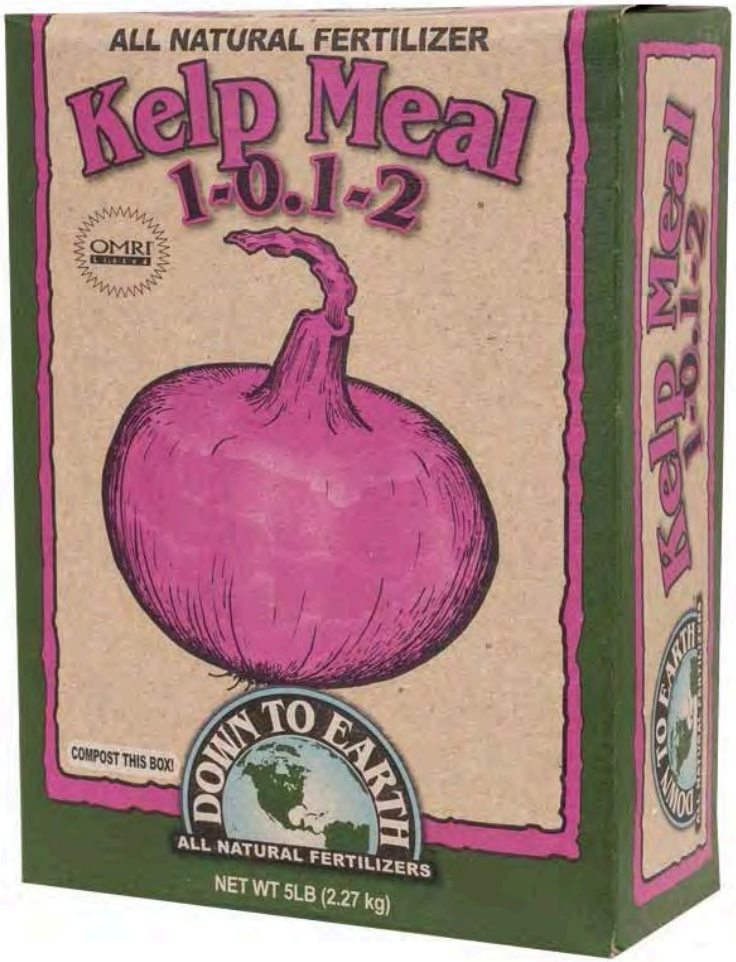
Nitrogen	154	lbs/acre
Phosphorus	271	mg/kg
Potassium	44	mg/kg
Sulfur	13	mg/kg
Boron	0.17	mg/kg
Zinc	11.5	mg/kg
Manganese		mg/kg

0 lbs/acre of Nitrogen
0 lbs/acre of P2O5
115 lbs/acre of K2O
0 lbs/acre of Sulfur
1 lbs/acre of Boron
0 lbs/acre of Zinc
0 lbs/acre of Mn

We make every effort to provide an accurate analysis of your sample. For reasonable cause we will repeat tests, but because of factors beyond our control in sampling procedures and the inherent variability of soil, our liability is limited to the price of the tests. Recommendations are to be used as general guides and should be modified for specific field conditions and situations. Note: "u" indicates that the element was analyzed for but not detected

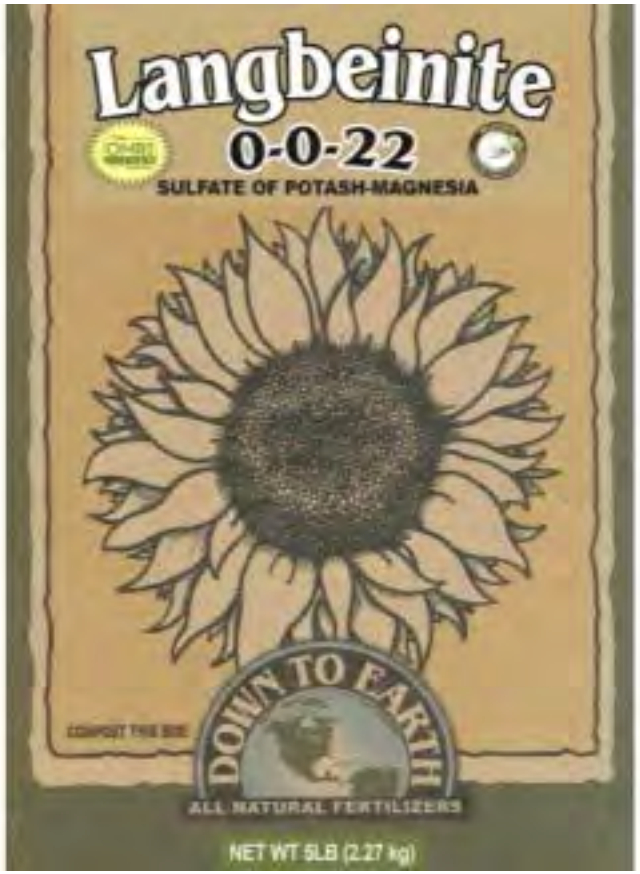
This is your Invoice #: S17-00161 Account # 101100 Reviewed by: KEB List Cost: $30.00

Recommendation:
2.5 lbs K_2O / 1000 ft^2



- This fertilizer is 2% K_2O
- 0.02*X = 2.5lbs
- X =125lbs of fertilizer / 1000 ft^2
  - (that would be 25 5lb boxes)
- She has approximately 200 ft^2 of garden space (1/5 of 1000)
- So she needs 25lbs of this fertilizer for her garden. That's the same as 5, 5lb boxes of this fertilizer spread evenly across her garden area.

Recommendation:
2.5 lbs K_2O / 1000 ft^2



- This fertilizer is 22% K_2O
- 0.22*X = 2.5lbs
- X =11.4 lbs of fertilizer / 1000 ft^2
  - (that would be a little more than 2 boxes)
- She has approximately 200 ft^2 of garden space (1/5 of 1000)
- So she needs 2.3lbs of this fertilizer for her garden. That's the same as about half of 1 5lb box of this fertilizer spread evenly across her garden area.

Carbon:Nitrogen Ratio

- Ranges from <5:1 to >500:1 in organic materials
- Low C:N supplies N to plants
- High C:N ties up N by biological immobilization

Types of Organic Amendments

Hot stuff – C:N <10:1

Cool stuff – C:N 15:1 to 25:1

Woody stuff – C:N > 30:1

Hot Stuff

- Poultry manure
- Seed meals
- Fish and feather meals
- Fresh grass clippings
- Fresh rabbit manure
- Dewatered or dried biosolids

Hot Stuff C:N < 10:1

- Rapid N availability
- Use as a fertilizer
- Over application leads to excess nutrient levels in soil -- potentially harming crop and water quality.

Cool stuff

- Compost (yard debris, most manures, biosolids)
- Fresh materials:
  - Yard debris
  - Cover crop residues
  - Dairy manure solids
  - Coffee grounds

Cool stuff, C:N 15:1 to 25:1

- Slow N availability
- Can add large amounts without risk of over-fertilization
- Use as a soil amendment
- N immobilization (tie-up) likely with fresh materials in first few weeks after application
- Compost organic matter lasts a long time in soil

Woody stuff

- Straw
- Sawdust
- Paper waste
- Horse manure rich in bedding

Woody stuff, C:N > 30:1

- N immobilization
- Need to add N along with organic amendment
- Use as mulch or bulking agent for compost

Organic Application Guidelines
(middle-of-the road estimates)

- Poultry manure: 3-5 gal/100 sq. ft.
- Rabbit manure: 20-40 gal/100 sq. ft.
- Horse manure, dairy solids: 1 inch
- Compost: 1 inch per year in annual bed
- Compost: Up to 30 to 50% by volume when making raised beds.
- Seed and animal by-product meals: Use like inorganic fertilizers

Green Manure or Cover Crops

- Grow your own OM
- Legumes will provide N
- Cover crop during the winter
- Early planting is best
- Soil incorporation takes work

Common Winter Cover Crops

Cereal Rye

Annual Ryegrass

Hairy Vetch

Crimson Clover

Compost

- Home or municipal
- Good source of OM
- Nutrient value depends on compost type

Kate Kurtz
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