Soil Components:

Mineral Particles	Water	Air	Organic Particles	Organisms

1 acre-foot of soil may contain 3 tons of organisms!

Mineral Particles - We will ignore boulders, rocks, stones and pebbles

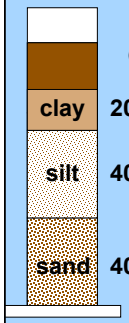
	size	drainage	air capacity	water capacity	nutrient capacity
sand	1-0.1 mm	+++	+++	-	-
silt	0.1-0.001	+	++	+	+
clay	< 0.001	-	-	+++	+++

None of these single particles is ideal for growing plants

Loam: a mixture suitable for growing plants

How Do We Know If We Have Loam?

Surfactant

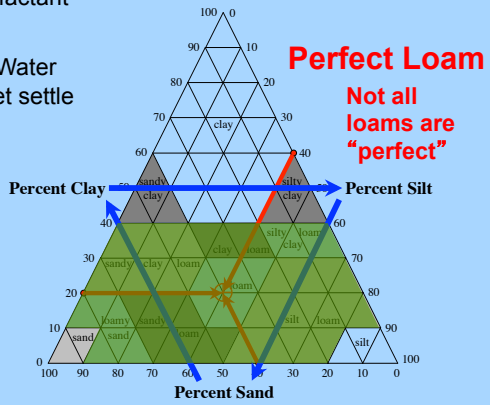


20%

40%

40%

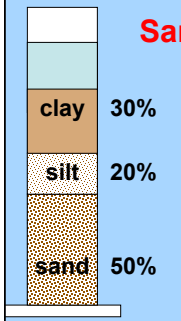
Calgon Water
mix, let settle



Perfect Loam

Not all loams are "perfect"

Let's Try Another Example (NOT ON VIP!)



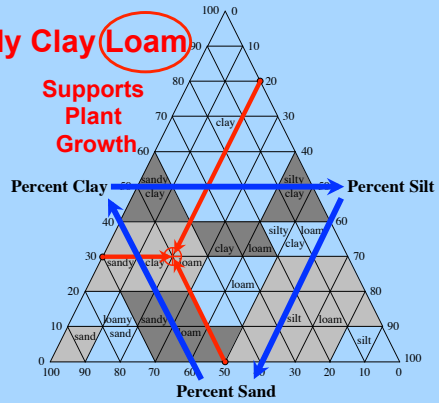
30%

20%

50%

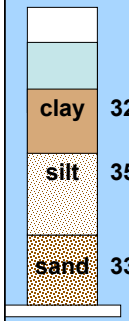
Sandy Clay Loam

Supports Plant Growth



Let's Try A More-Challenging Example

(NOT ON VIP)



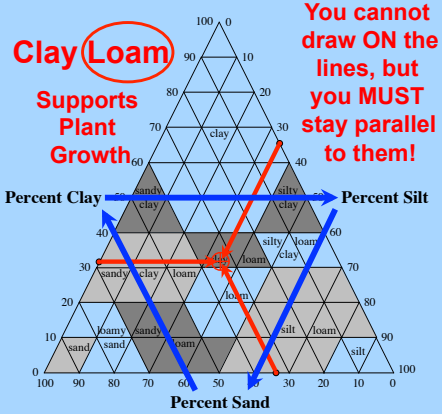
32%

35%

33%

Clay Loam

Supports Plant Growth



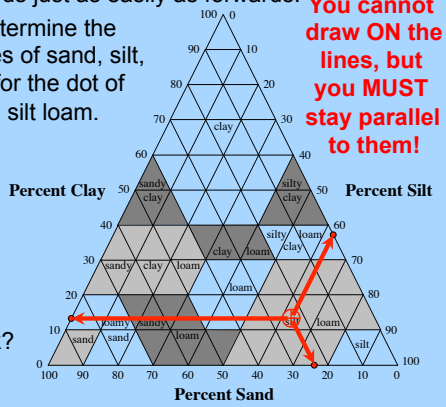
You cannot draw ON the lines, but you MUST stay parallel to them!

Do You Really Understand This? (NOT ON VIP)

If so, then you should be able to work this process backwards just as easily as forwards!

Try to determine the percentages of sand, silt, and clay for the dot of the i in silt loam.

You cannot draw ON the lines, but you MUST stay parallel to them!



clay	13%
silt	63%
sand	24%
	100%

How do you check your work?

Macronutrients C. Hopkins Café: Mighty Good

C	H	O	P	K	N	S	Ca	Fe	Mg

CO_2 H_2O limited in most soils the three parts of normal fertilizer

limited in CT soils due to acid rain… dolomitic limestone

Fertilizer Guaranteed Analysis: **N-P-K**

Example Analysis: **5-10-15** Balanced Fertilizer: Good for flower garden

%phosphorus = **10%** %potassium = **15%** %nitrogen = **5%**

Another Example: **25-0-0** Single Fertilizer: Nitrogen good for lawn

%phosphorus = **0%** %potassium = **0%** %nitrogen = **25%**

Micronutrients Come on cousin, see Mo by Al and Cleo

Co	Mn	Cu	Zn	Si	Mo	B	Al	Cl

- Micronutrients are just as important but are needed in smaller amount
- These metal ions serve as cofactors for many enzymes
- Leached out of soils by acid rain
- Added to some blended fertilizers
- Recommended for Connecticut

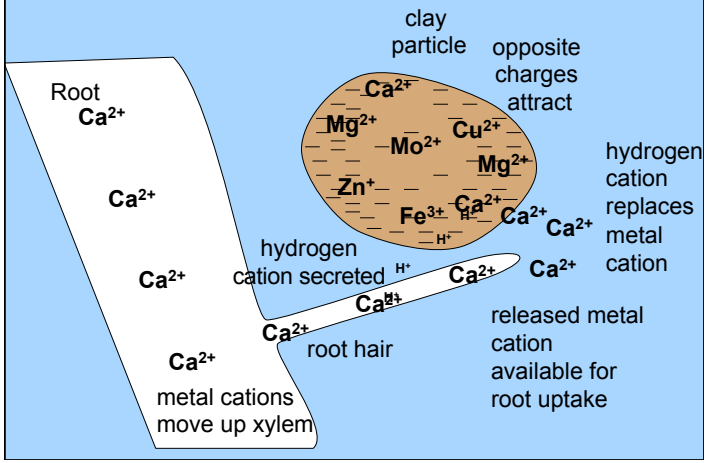
Nutrients Available to Plants Via Soil Water

Water dissociates: $H_2O \longrightarrow H^+ + OH^-$ **$[H^+] = 10^{-7}M$ pH 7**

$[H^+]$:	10^0	10^{-7}	10^{-14}
pH Scale:	0	7	14
	acid sour	neutral sweet	alkaline bitter
		vinegar dH_2O	soap
		cranberry bean grass	

Pioneer farmers tasted the soil to decide where to homestead

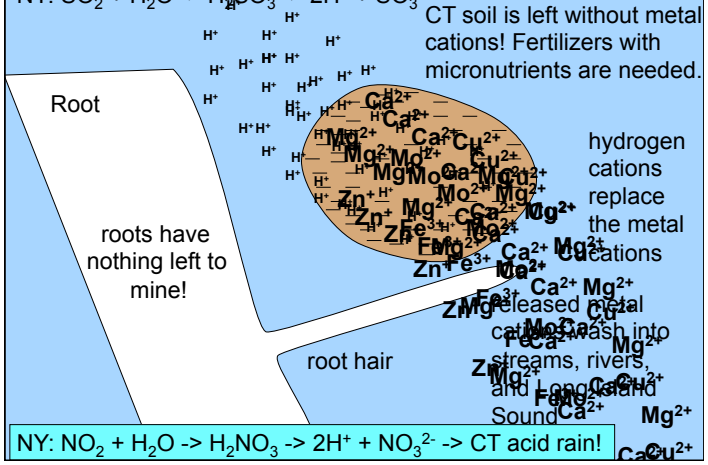
Cation Exchange - how plants "mine" soils



Cation Exchange - how acid rain depletes soil

NY: $SO_2 + H_2O \rightarrow H_2SO_3 \rightarrow 2H^+ + SO_3^{2-}$

CT soil is left without metal cations! Fertilizers with micronutrients are needed.



NY: $NO_2 + H_2O \rightarrow H_2NO_3 \rightarrow 2H^+ + NO_3^{2-}$ -> CT acid rain!

Soil Horizons

A	black	Leaching zone: roots here (topsoil)
B	"red"	Accumulating zone: nutrients (subsoil)
C	rocky	Weathered bedrock
D	solid	Bedrock

Horizons subject to erosion

Black color is caused by organic particles

Rotting material makes humus particles

- **Improve drainage (air capacity)**
- **Increase water holding capacity**
- **Increase nutrient holding capacity**

Prevented by:

- **Mulching**
- **Proper cultivation**
- **Perennial planting**

leaves, grass clippings, compost, green manure, horse manure