Soil Nutrient Management for Yield and Quality

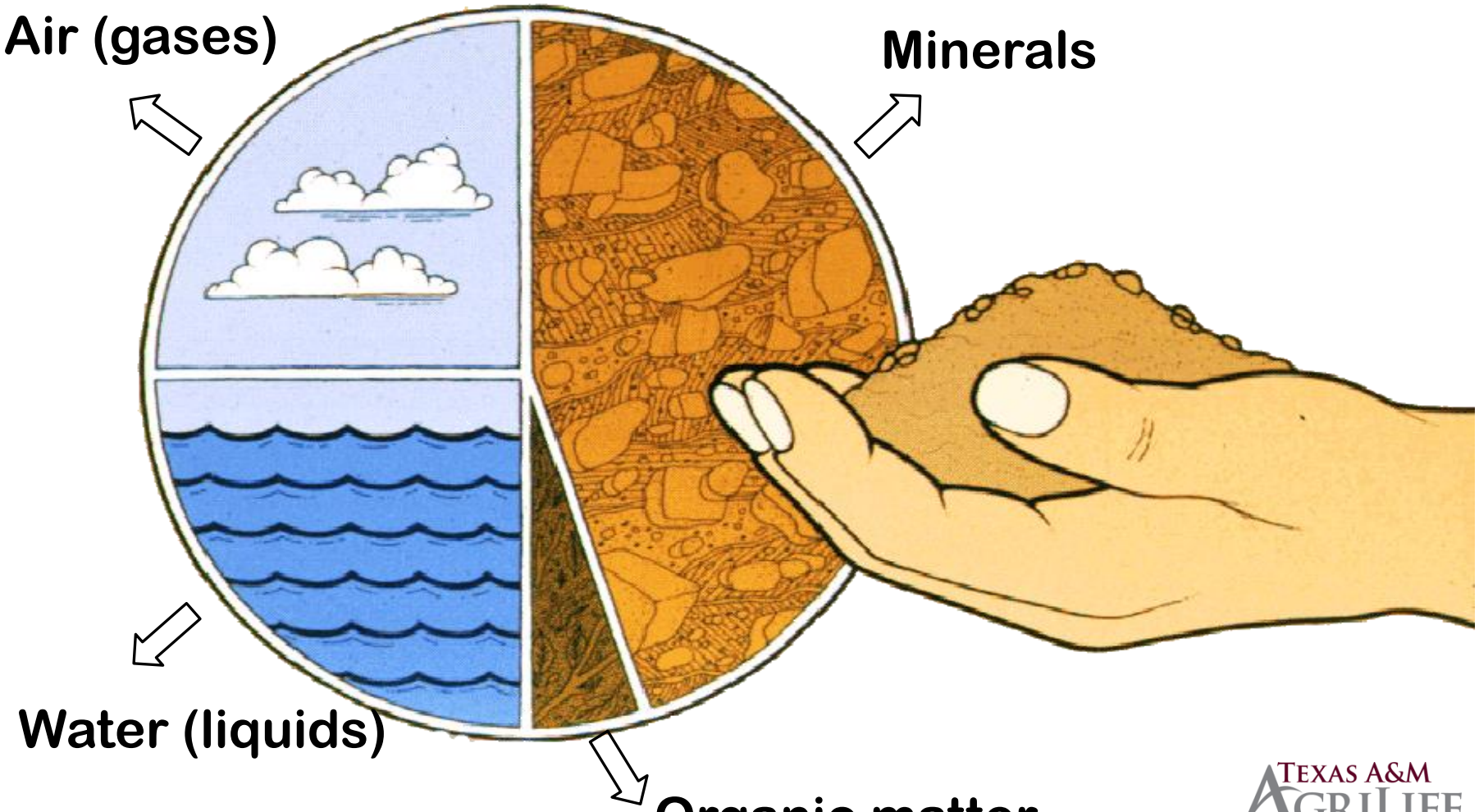
Jake Mowrer, PhD

Soil & Crop Sciences | Texas A&M AgriLife Extension

"Daddy, which is this — soil or dirt?"

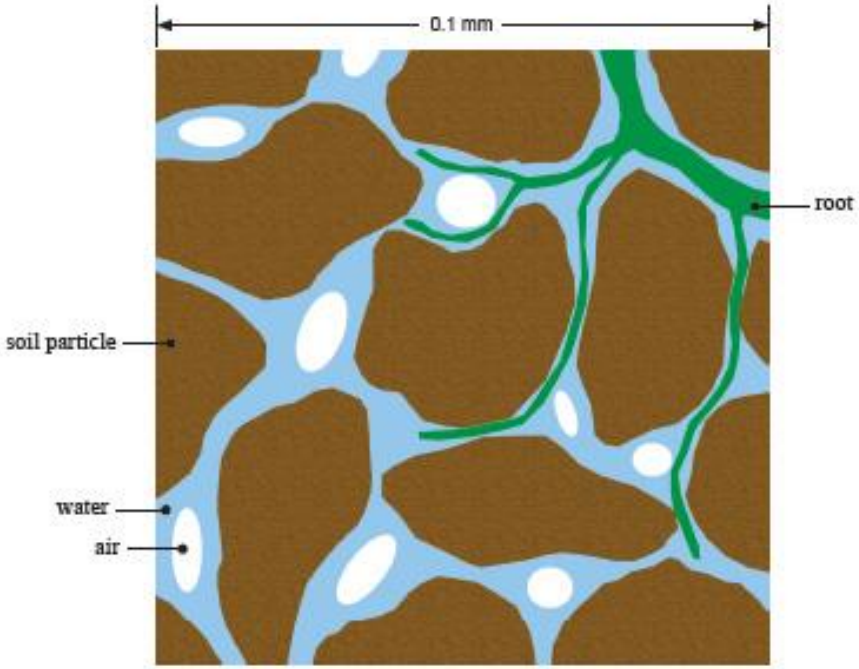
Texas A&M AgriLife Extension

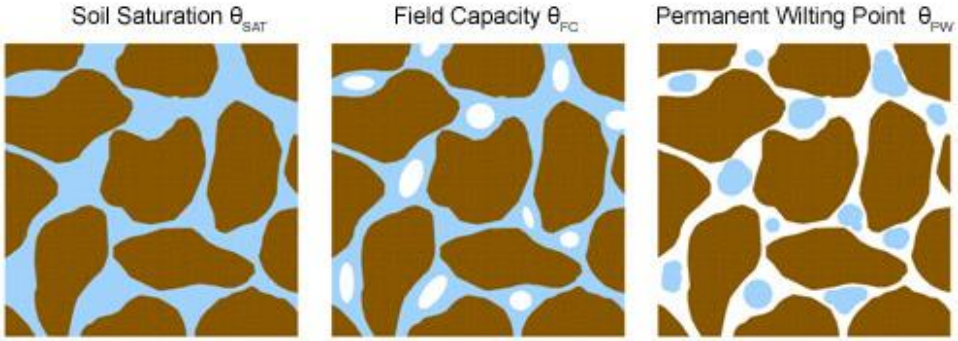
Four Principal Components of Soil



Putting it all together

Soil components create a ‘structure’





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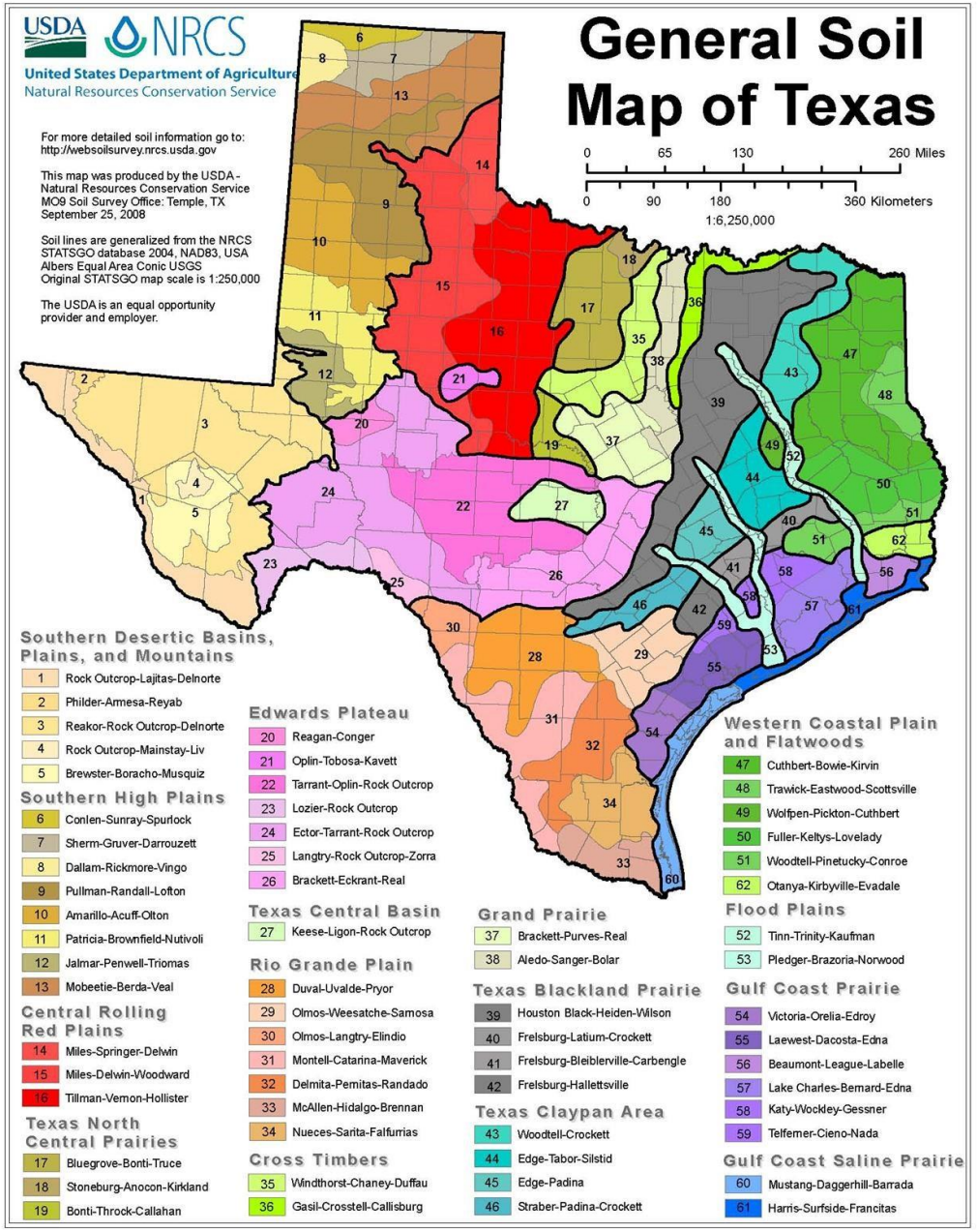
Soils in Texas vary by:

- **Type**
  - ✓ Physical properties
  - ✓ Structure
  - ✓ Chemical properties
  - ✓ Management history
- **Productivity**
- **Fertility**



Soil Fertility

- Amount of nutrients
- Balance or ratio of nutrients
- Ability to release nutrients (either already present or applied as fertilizer)
- What ***are*** you trying to grow

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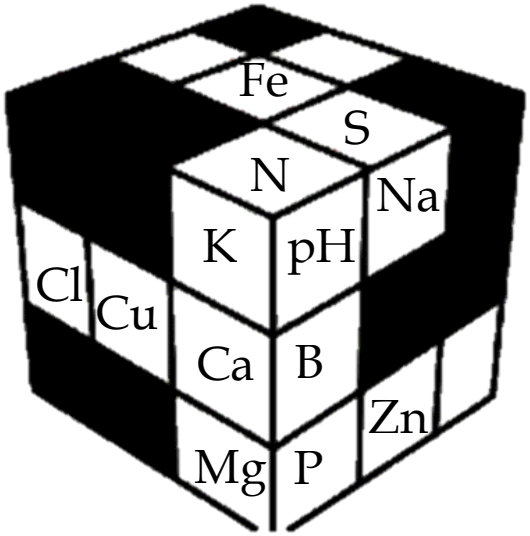
Soil Fertility

Quality, like yield, is related to soil nutrient status

However . . . .

Managing soil fertility for yield is less puzzling than for quality



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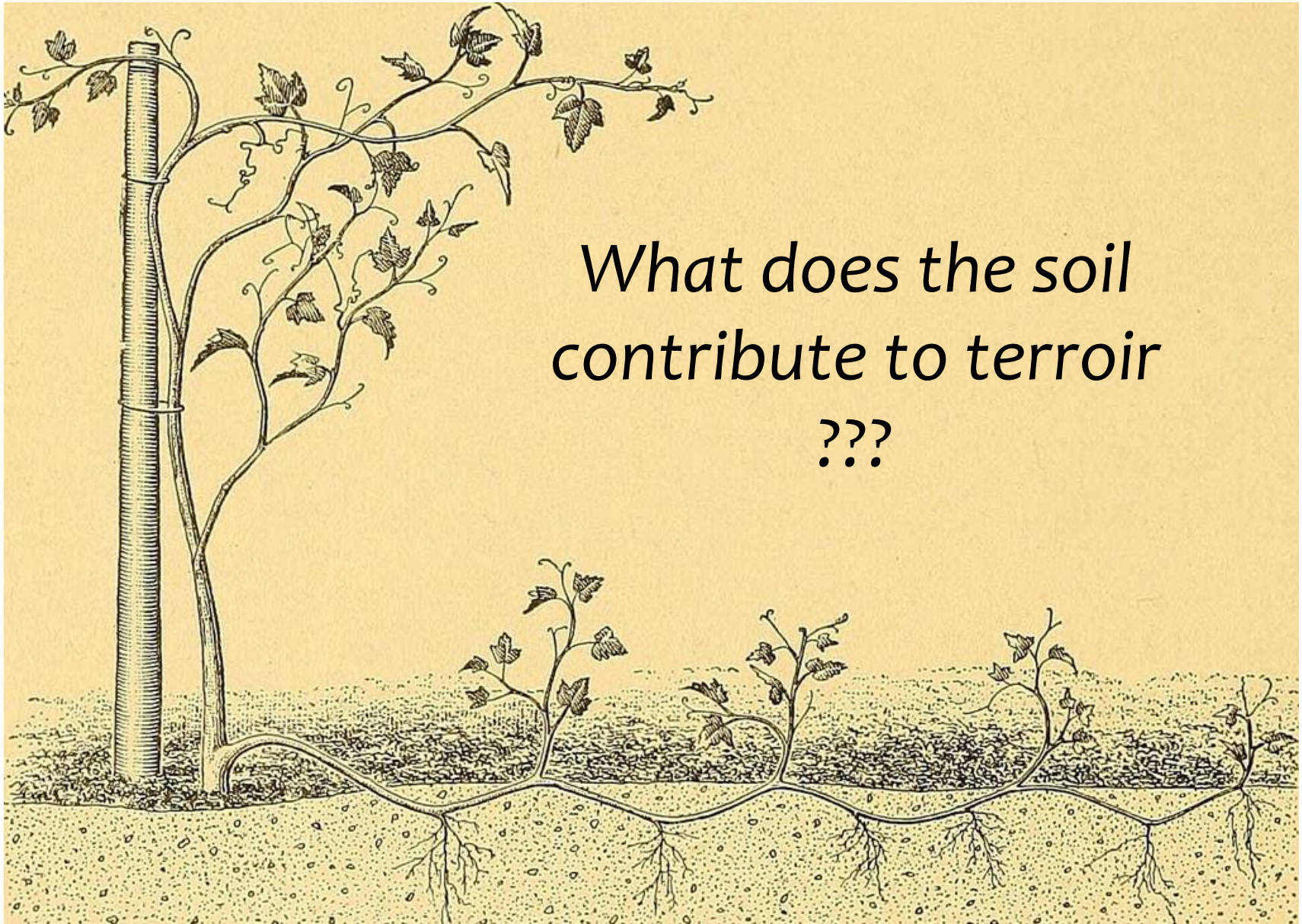
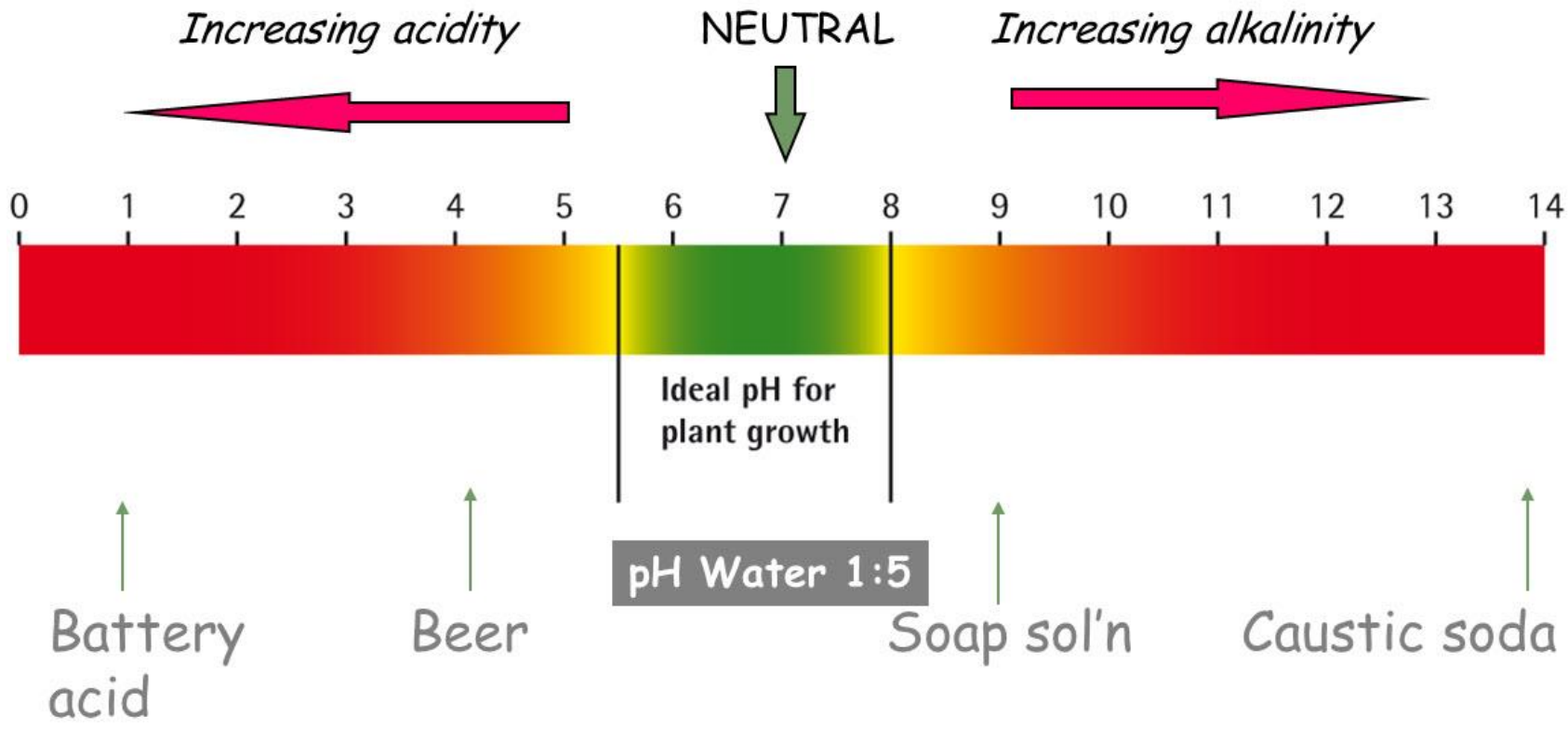
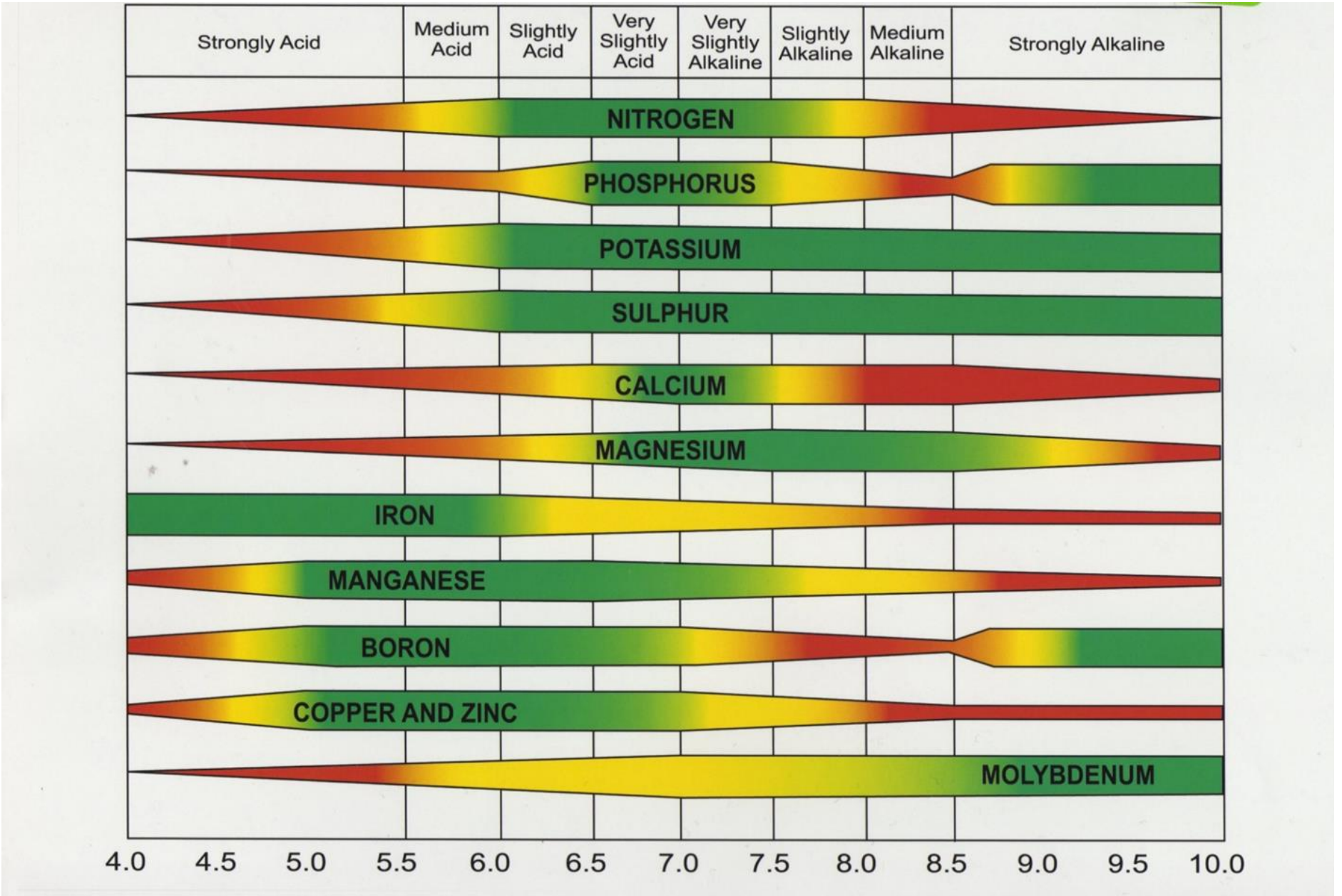
Soil Fertility



Soil pH – what is it?

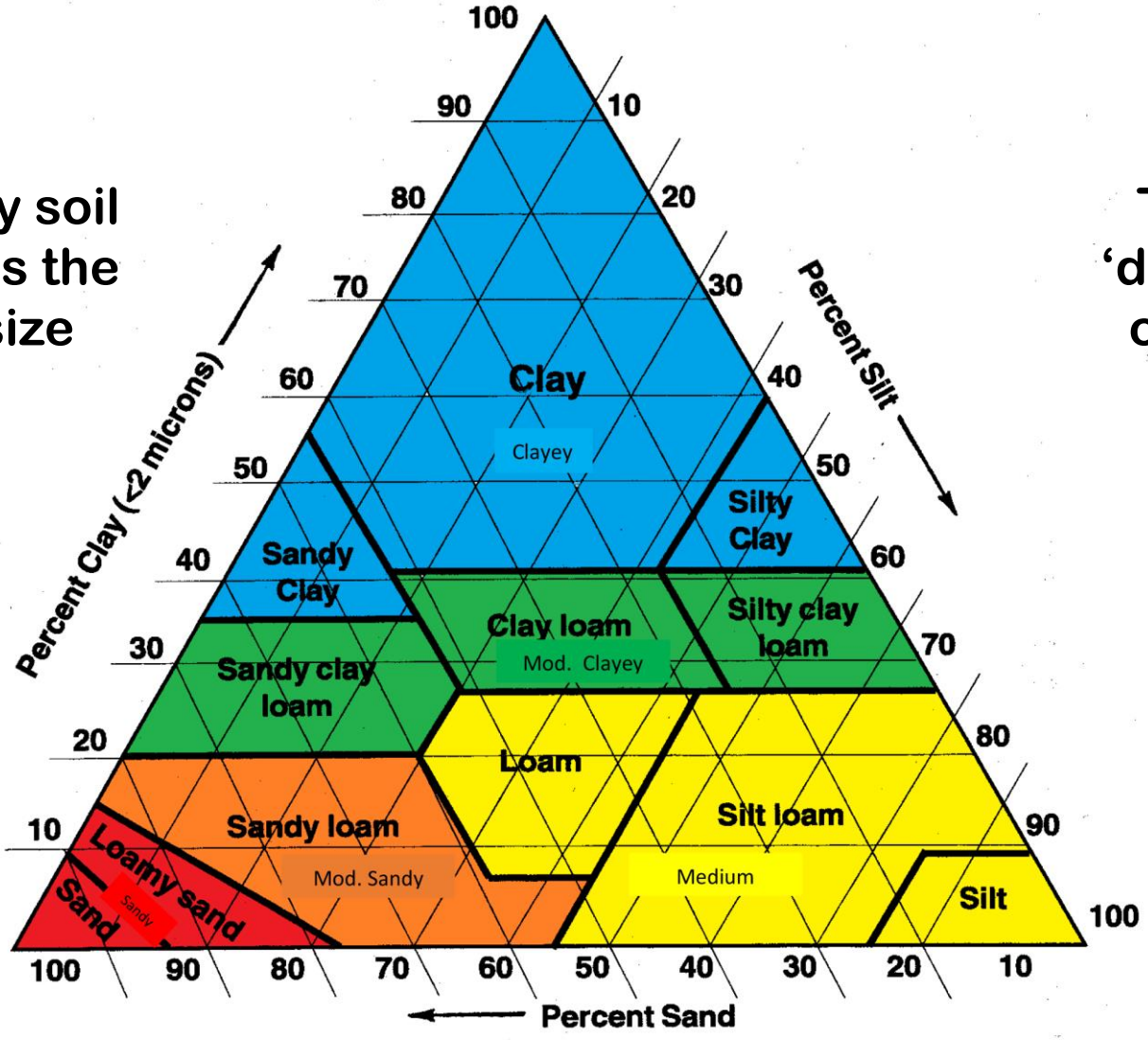
- measure of the acidity or alkalinity of a soil
- concentration of hydrogen ions (H+) in the soil solution




Strongly Acid
Medium Acid
Slightly Acid
Very Slightly Acid
Very Slightly Alkaline
Slightly Alkaline
Medium Alkaline
Strongly Alkaline
NITROGEN
PHOSPHORUS
POTASSIUM
SULPHUR
CALCIUM
MAGNESIUM
IRON
MANGANESE
BORON
COPPER AND ZINC
MOLYBDENUM
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5
9.0
9.5
10.0

Soil Physical Properties

Not every soil particle is the same size



There is a 'distribution' of particle sizes

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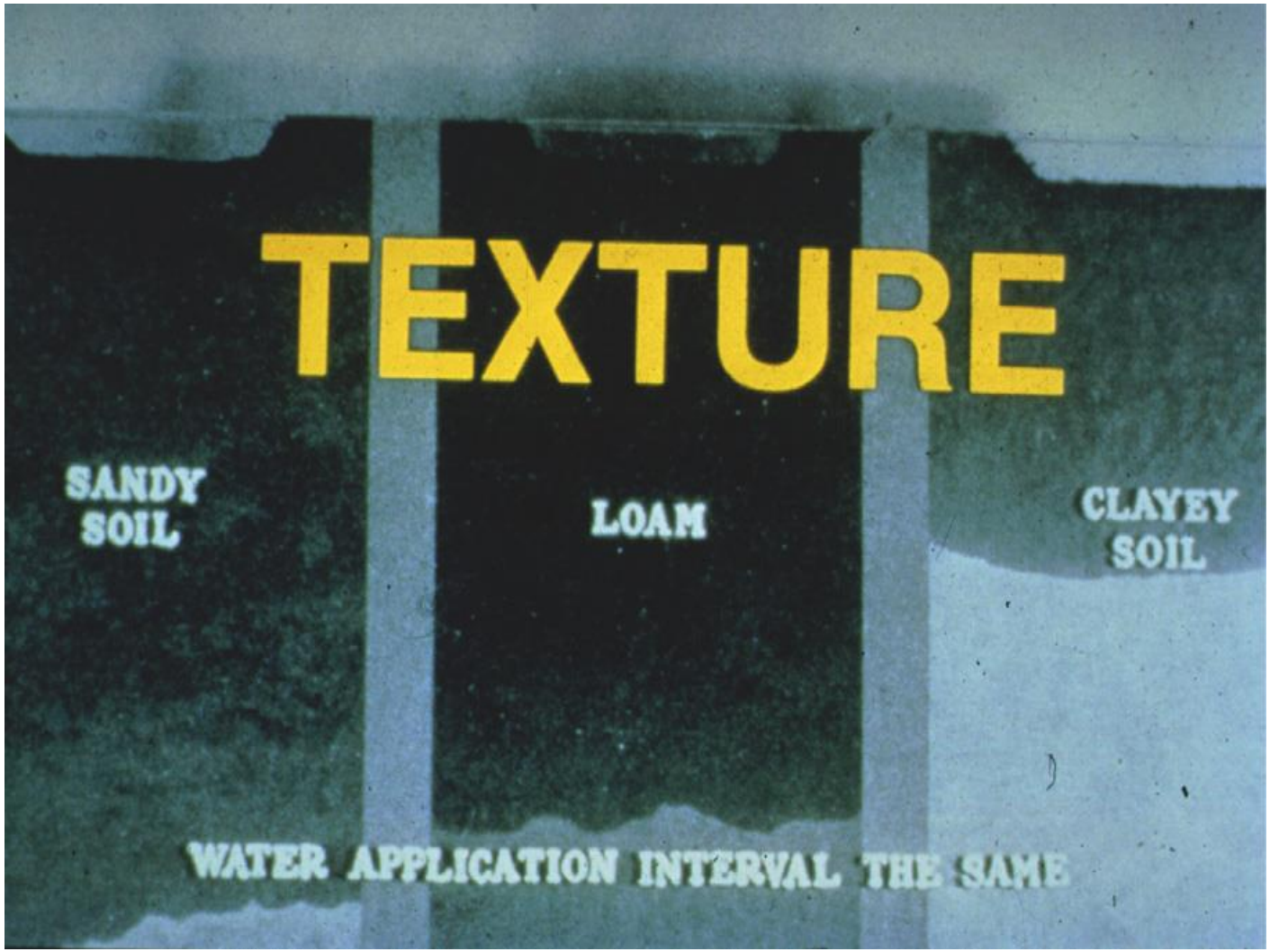
Soil Physical Properties

- **Clays affect**
  - Retention and availability of water
  - Nutrient availability
  - Compaction and resistance to rooting

Soil Physical Properties



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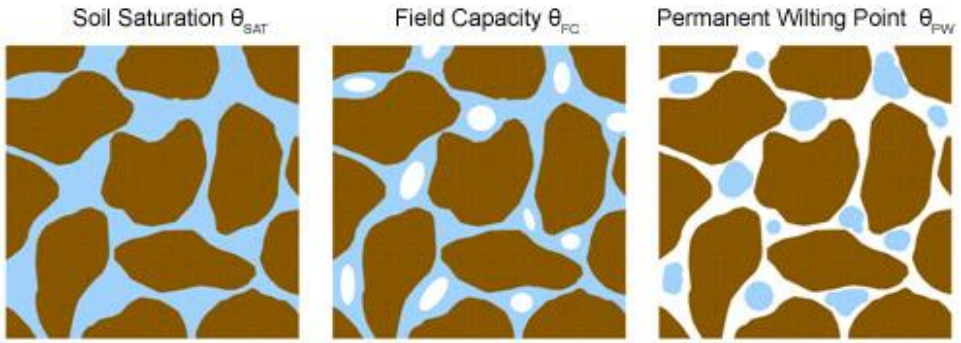
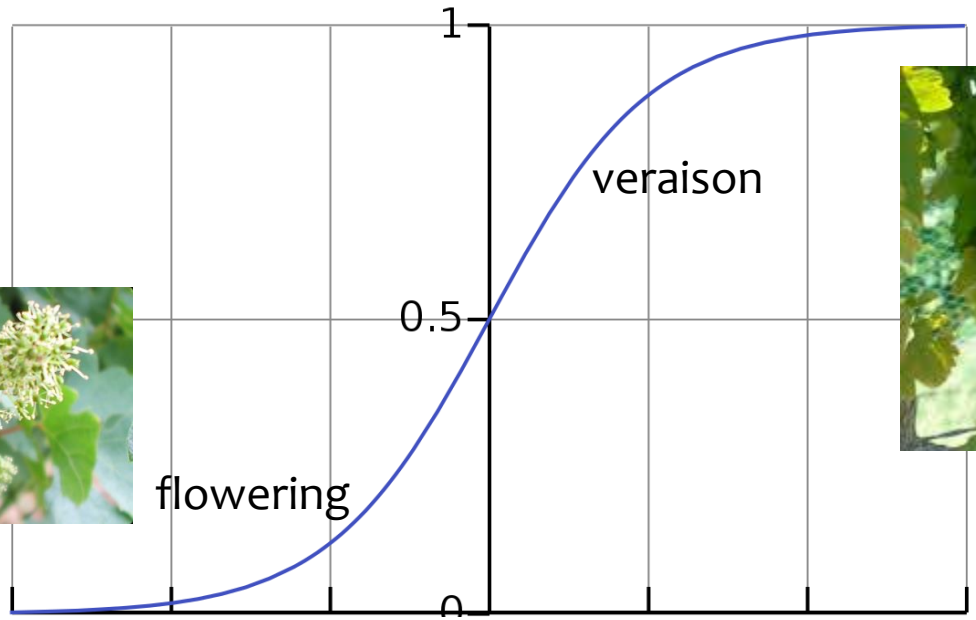
Soil Water

- **Optimization is key**
  - Vigor increases in swells or clays where water accumulates
  - Nitrogen uptake increases with available water
  - ‘a little’ stress is recommended
  - Regulated deficit irrigation related to accumulation of phenolic compounds



Nitrogen

- **Should be optimized as plant needs change with time**
  - Early growth relies on N reserves in woody tissue
  - Post-flowering uptake from soil increases to a maximum at veraison
  - ‘A little’ stress recommended



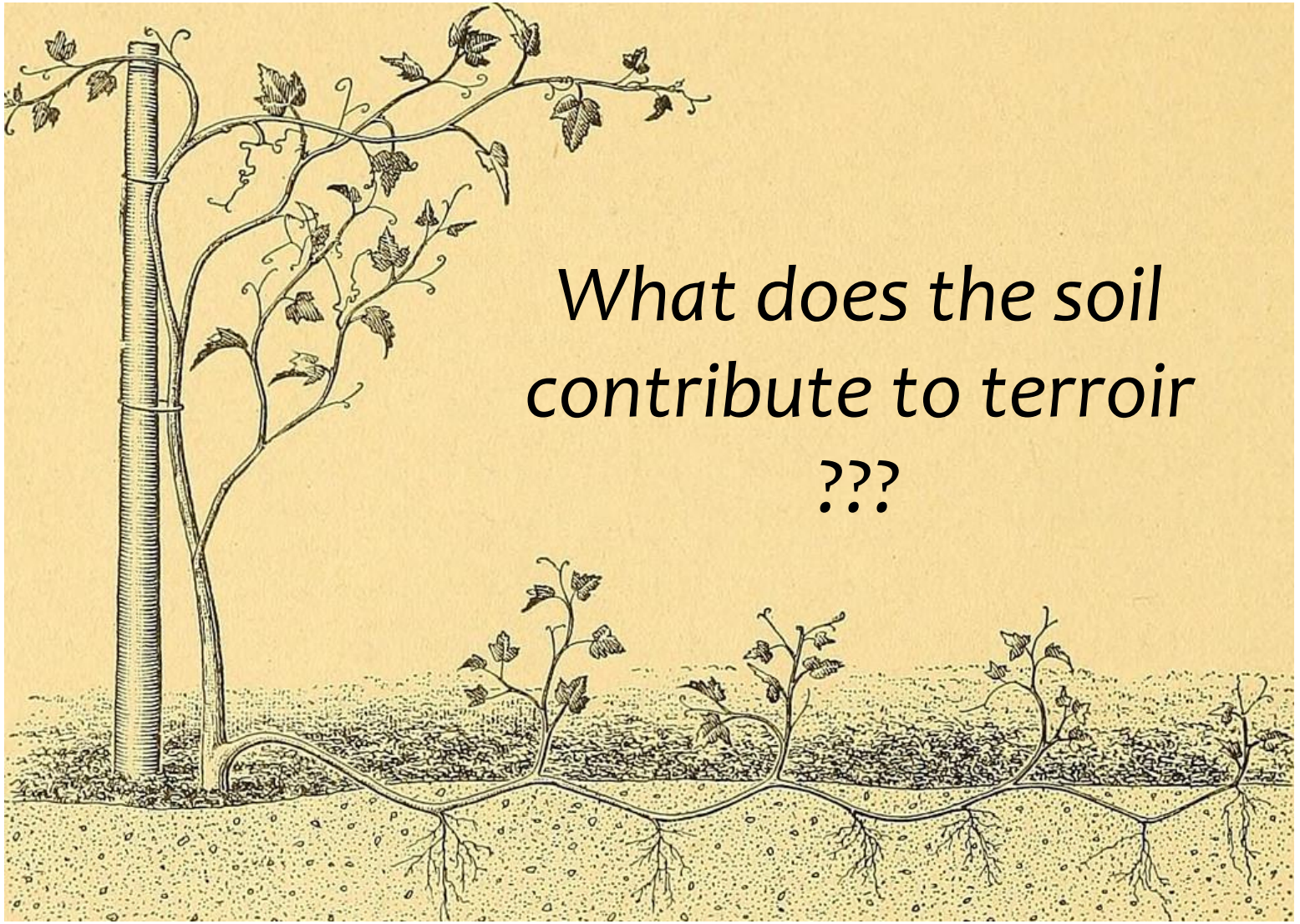
Nitrogen

- **If applied in excess. . .**
  - Vines can produce too much vegetation (leafing out)
  - Photosynthates used to produce more shoots and leaves at the expense of fruit
  - Shading hinders ripening
  - Potential for undesirable rapid fermentation
- **If applied in deficit. . .**
  - Stuck fermentation (too little yeast assimilable nitrogen)

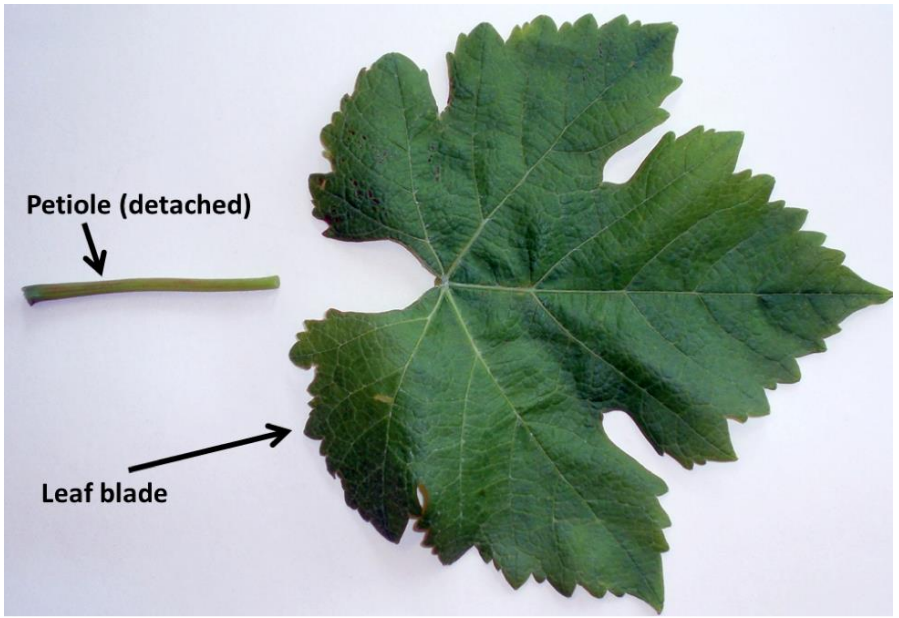
Potassium

- **High K linked to high grape pH**
  - Poor color
  - May lower arginine
  - K accumulation delayed by water stress

- **May have a disease fighting effect!!!**



Nutrient Management Program



Soil + Tissue gives the whole picture

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Bloom or Veraison?

<u>Bloom</u> - Petioles for micronutrient status Allows more time for program adjustment

Patty Skinkis, Oregon State University

<u>Veraison</u> - Better for N, P, & K (Macros)Too late to make corrections

Why not both?

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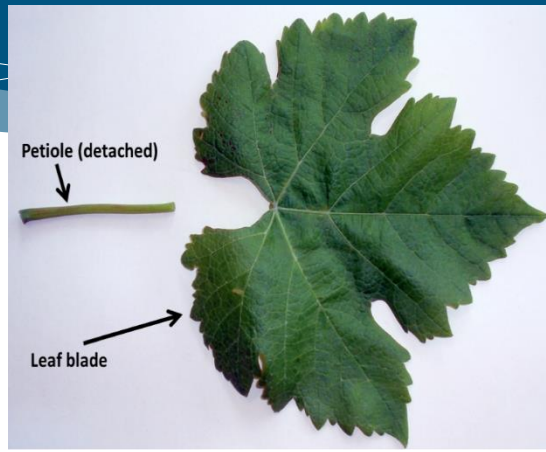
Petiole or Leaf Blade?



Petiole - Better for K, Cl, & Na
Easier to handle and collect in large amounts

Leaf Blade - Better for N, Mg, Zn, B, Ca, Cu, & Mb. More related to whole plant physiology

Why not both?

Nutrient Guidelines

			Petiole		Leaf Blade	
Nutrient	Sample timing	Units	Deficient	Excessive	Deficient	Excessive
$NO_3 - N$	bloom	ppm	300 - 400	2500		
N total	bloom	%			2.2 - 2.5[a]	4.25
	véraison	%	0.40		1.5 - 1.8[a]	
P	bloom	%	0.15 - 0.20		0.20 - 0.23	
	véraison	%	0.10		0.12	
K[b]	bloom	%	0.75 - 1.0	3.25	0.80 - 0.90	1.5
	véraison	%	0.50 – 0.80		0.50 - 0.70	1.25
Ca	bloom	%	1.0		1.0	
Mg	bloom	%	0.20		0.20	
Mn	bloom	ppm	20		20	
Zn	bloom	ppm	20 - 25		15 - 20	
B	bloom	ppm	<25	125	20	250
Cu	bloom	ppm	3 - 5	25 - 50	3 - 5	

R. Paul Schreiner, USDA-ARS, Hort Crops Research Lab, Corvallis, OR.

EXTENSION

2009 West Texas Nutrition Survey

Bloom Petiole of 26 Vineyard Blocks

	2009 Petiole	Petiole Standard
Nitrogen (%)	1.891	1.5 – 2.7
Potassium (%)	2.634	1.6 - 2
Magnesium (%)	0.746	0.31 – 1.5
Zinc (ppm)	64.987	26 - 100
Iron (ppm)	40.222	41 - 300

Ed Hellman Texas A&M AgriLife.

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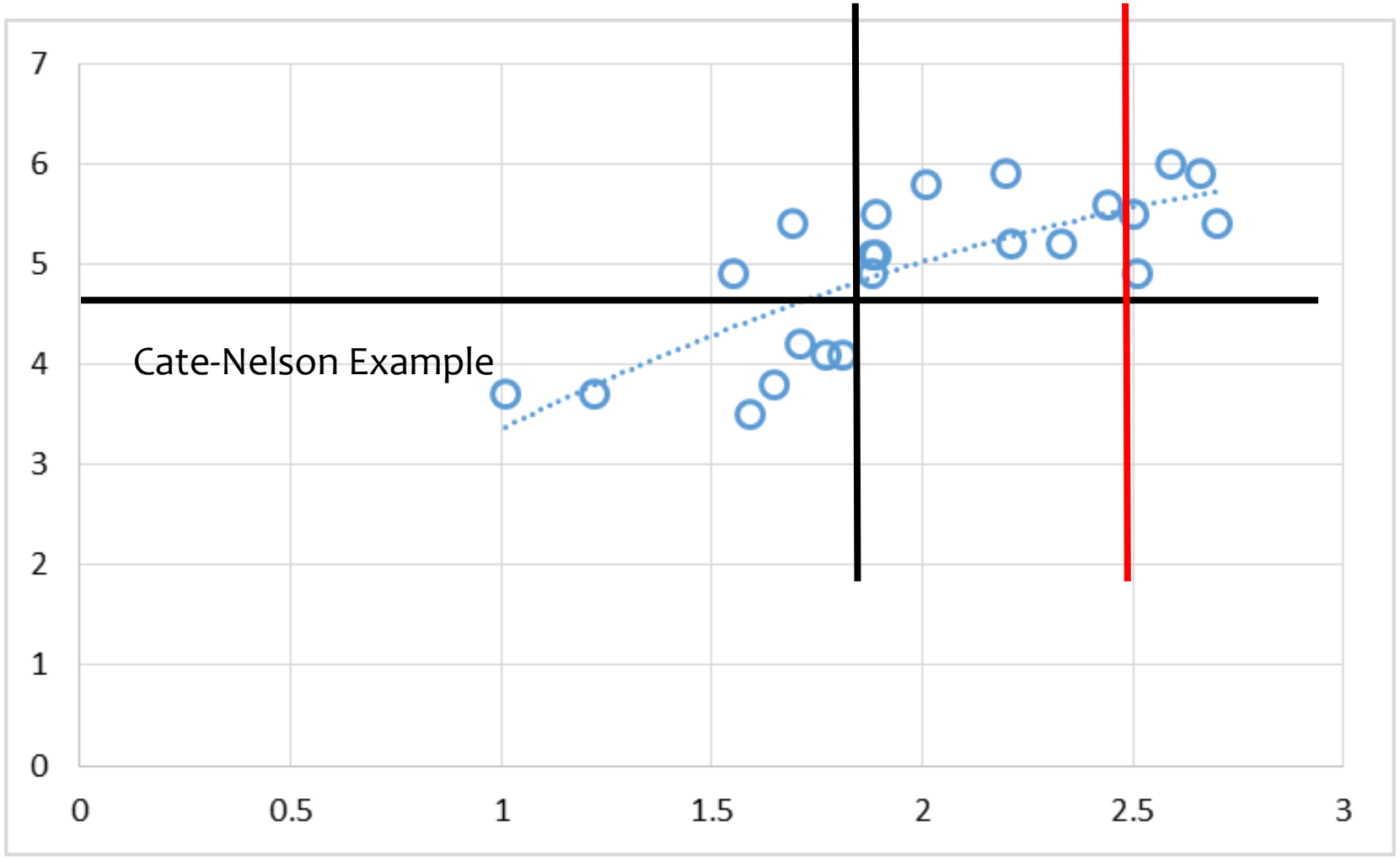
Fun with Excel

Year	Tartaric Acid	pH	Brix	Soil Nutrient	Petiole Status
2019	4.8	2.01	15	29	0.04
2019	4.7	1.99	14	28	0.08
2019	4.9	1.98	17	28	0.07
2020	4.5	2.01	15	31	0.05
2020	5.2	2.09	12	31	0.08
2020	5.1	1.99	19	25	0.07

Be the expert of your own terroir



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