

# *Viticulture and Soil Relationships* *(Winegrowing)*

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# *Proper use of terminology*

- “Winemaker” = yeast
- “Wine chemist” = enologist
- **“Grape maker” = the sun**
- **“Grape grower” = viticulturist**

*Wine is a food product,  
which is also an “alcohol carrier”*

- Meant to be consumed with other foods (meats, cheeses and simple carbohydrates)
- Has anti-oxidant properties and aids in food digestion
- Contains most of the essential nutrients (N, P, K, Ca, Mg, S, Fe, Mn, Cu, Zn, etc.)
- Releases human inhibitions: “Conversation Juice!”

## Soil Taxonomy related to Viticulture

- Favorable soil orders: Alfisols, Andisols, Aridisols (if irr.), Entisols, Inceptisols, Mollisols, Ultisols (if limed), Vertisols (if xeric)
- Poor soil orders: Gelisols, Histosols, Oxisols, Spodosols
- Best temperature regimes: Mesic, Thermic
- Best moisture regimes: Xeric, Ustic, Aridic (if irr.), Udic

# Soil Properties Important in Viticulture

## Physical Properties

- Soil texture
- Soil structure
- Water holding capacity
- Water movement
- Drainage class

## Chemical properties

- pH: Acid-Alkaline
- Nutrients: N, P, K, Ca, Mg, S
- Micros.: Fe, Mn, Cu, Zn, Mo, Ni
- Toxics: Cl, salts, B

# **Contrasting Soils Relative to pH and Lime content**

Acid (pH 4);  
No CaCO<sub>3</sub>



Alkaline (pH 8);  
25% CaCO<sub>3</sub>



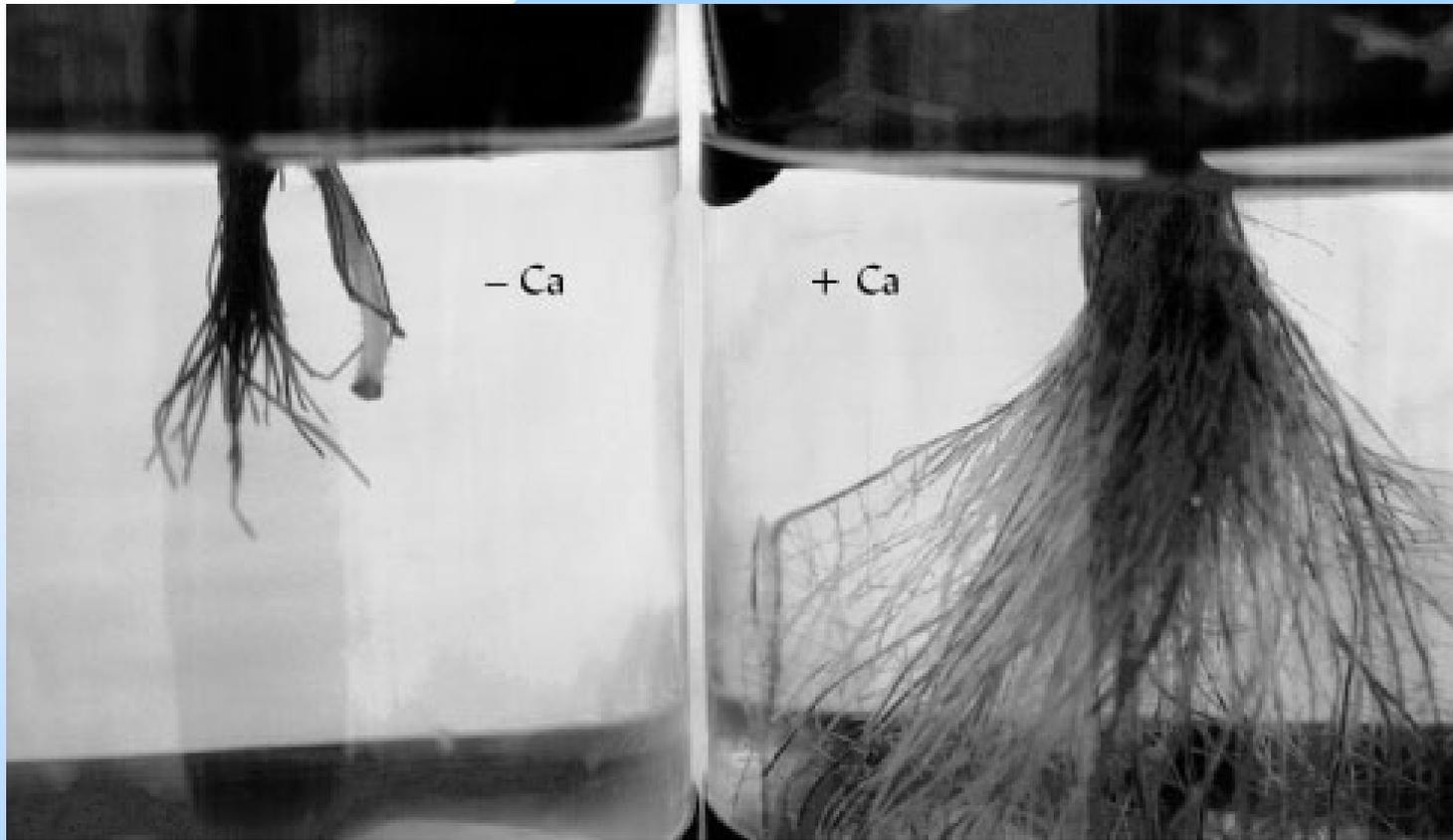


Figure 9.17: Root growth was almost completely inhibited by low calcium in the nutrient solution (left) compared to healthy roots in the same nutrient solution but with calcium added (right). If the ratio of calcium to all other cations in solution drops below 5:1, the integrity of root membranes is lost, causing many other elements (like aluminum) to become toxic to the plants.

# *Grape rootstock choices*

The *scion* (*fruit-bearing wood*) is grafted to a *rootstock* (*soil-contact wood*) chosen to be:

resistant to *phylloxera* and *nematodes* *and* to match soil physical and chemical properties.

# **Grape Rootstock Index for Calcareous (lime) Soils**

*Index of Calcium Carbonate Influence (IPC);  
French model (INRA).*

$$IPC = \frac{\text{“Free” CaCO}_3 \text{ (\%)} \times 10^4}{(\text{Available-Fe, ppm})^2}$$

*Grape Rootstock Sensitivity to  
Lime-induced Fe-chlorosis (IPC value)*

Higher IPC number =  
greater tolerance to  
higher lime & lower Fe.

<u><i>Riparia Gloire (New York origin)</i></u>	→	<u>IPC=5 (least tolerant to high lime)</u>
<u><i>riparia x rupestris (330 6C, 101-14MG, 3309C)</i></u>	→	<u>IPC=10</u>
<u><i>gravesac-rupestris du Lot</i></u>	→	<u>IPC=20</u>
<u><i>rupestris x Berlandieri (1103P, 110R)</i></u>	→	<u>IPC=30 (moderate tolerance to lime)</u>
<u><i>riparia x Berlandieri (5BB, SO4)</i></u>	→	<u>IPC=40-50</u>
<u><i>vinifera x Berlandieri (41B, 333 EM)</i></u>	→	<u>IPC=60-70</u>
<u>140 Ruggeri</u>	→	<u>IPC=90</u>
<u>Fercal (Texas origin; most tolerant of high lime)</u>	→	<u>120</u>

# Grape rootstock adaptability to soil water supply

EXCESS  
water

MEDIUM

DEFICIT  
water

*Riparia Gloire*

3306C ← *riparia x rupestris* → 3309C  
101-14 MG Gravesac

41B ← *vinifera x Berlandieri* → 333EM

5BB ← *riparia x Berlandieri* → SO4  
161-49C 420A

← *(rupestris x Berlandieri)* →  
1103P 110R 140 Ru

# Soil Forming Factors Influence Soil Changes

## Soil Forming Factors

- Parent material
- Climate
- Topography
- Biotic factors
- Age

Each soil is unique based on the inter-relationships of these soil forming factors.

Soils forming under conditions with similar soil forming factors will have similar properties.

# Cropley clay (Vertisols)



- Formed from clayey alluvium from igneous and sedimentary rocks
- High water-holding capacity; expansive “cracking” soils
- High grape yields; vegetal flavor wines

# Arbuckle clay (Alfisols)



- Located on East side stream terraces & alluvial fans
- Formed from mixed alluvium (water deposited) from Coast Ranges rocks
- Subsoil claypans; moderate water-holding capacity
- Moderate to high yields; vegetal to fruity wines

# Linne clay loam (Mollisols)

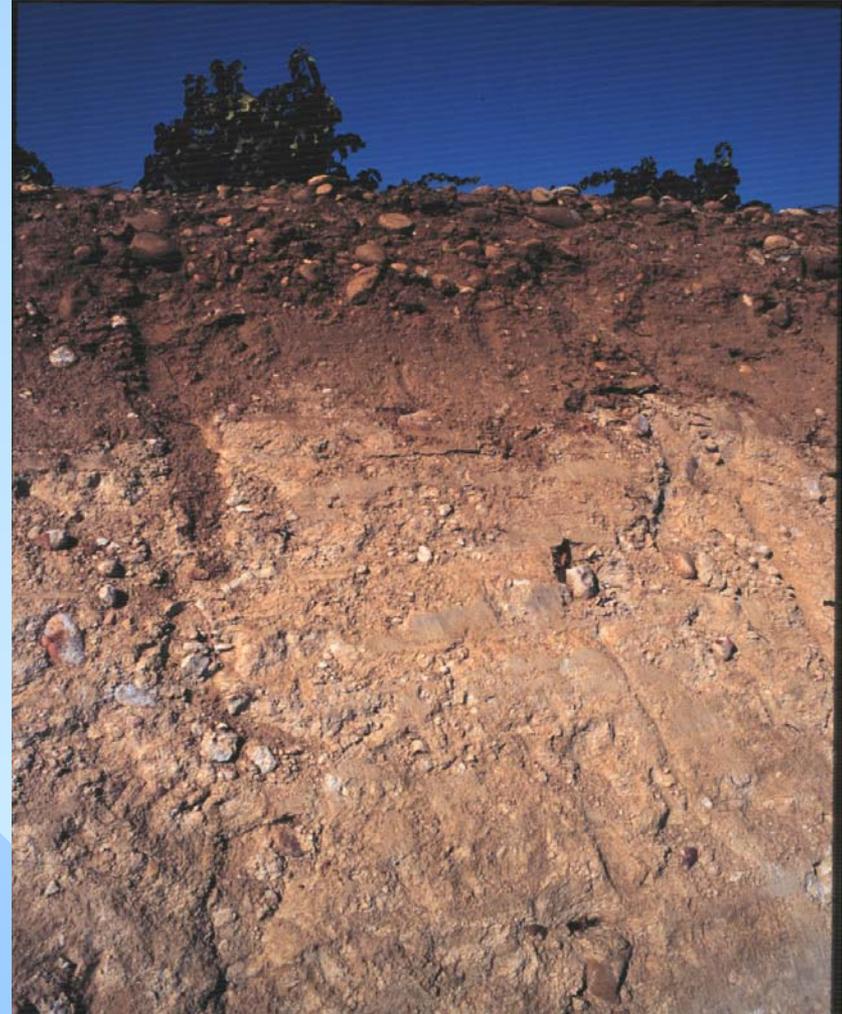


- Formed from calcareous sedimentary rock residuum
- Moderately deep; medium vigor
- Moderate yields; medium-size grape clusters; well balanced flavor wines

# French Vineyard Soil “Analog”

Chateauneuf du Pape, France

Calcareous gravelly loam



# *Carmody McKnight Vineyards*

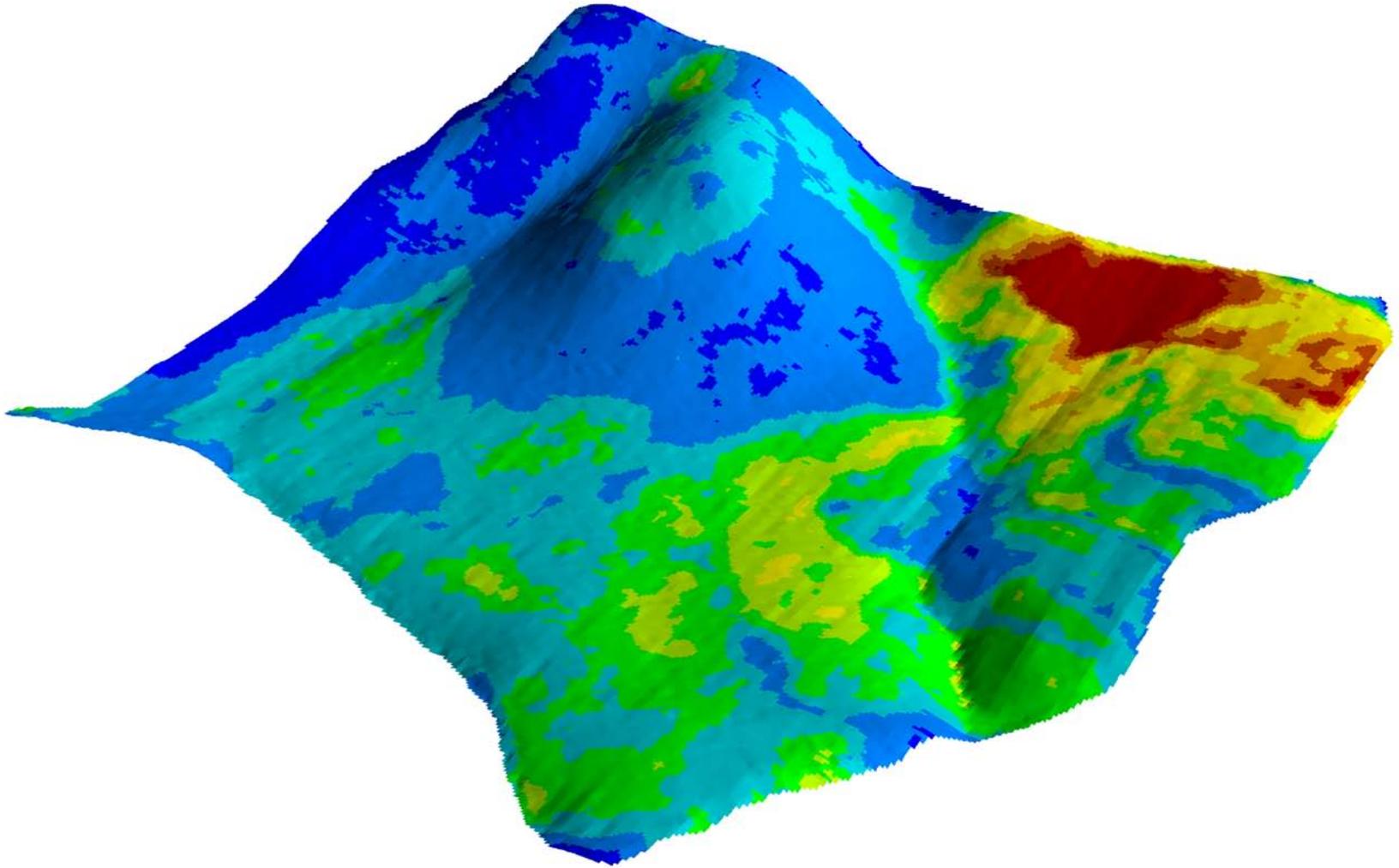
*(Vineyard soil mapping site)*



# ***Electromagnetic Sensors***



# *Digital Elevation Model & EM* *(Carmody McKnight Vineyards)*



# *Carmody McKnight Vineyards*

*(Soil mapping site)*



# Use of Soils Information in World Viticulture

- Rootstock Selection
- Irrigation System Design
- Soil-borne pest identification and control
- Cover Crop Selection
- Erosion Control Plans
- Vineyard and Trellis System Design

# *Fiddlin' with soil survey maps*



# *Questions?*

