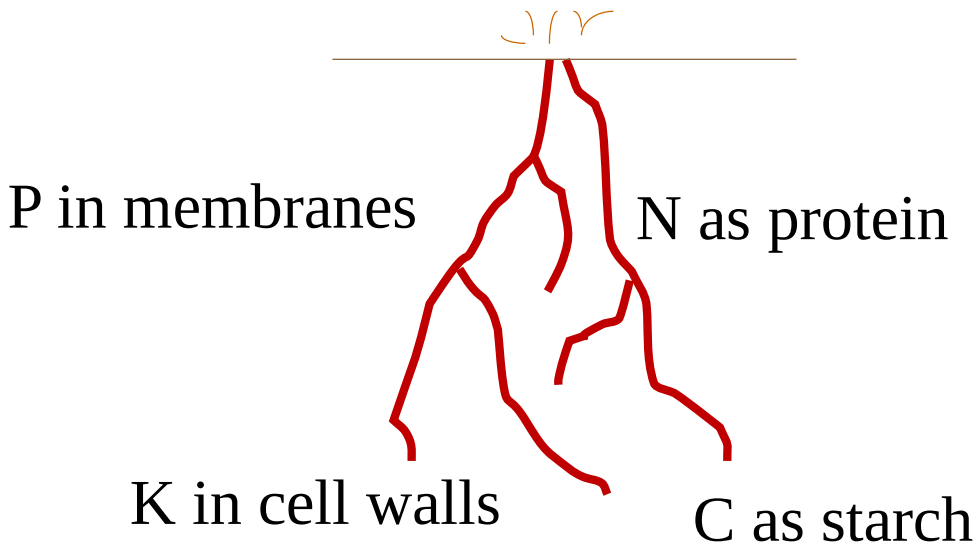
Chapter 1
Understanding Soil

Lecture 4 – Plant Physiology and Biochemistry

The Annual Growing Cycle: Winter



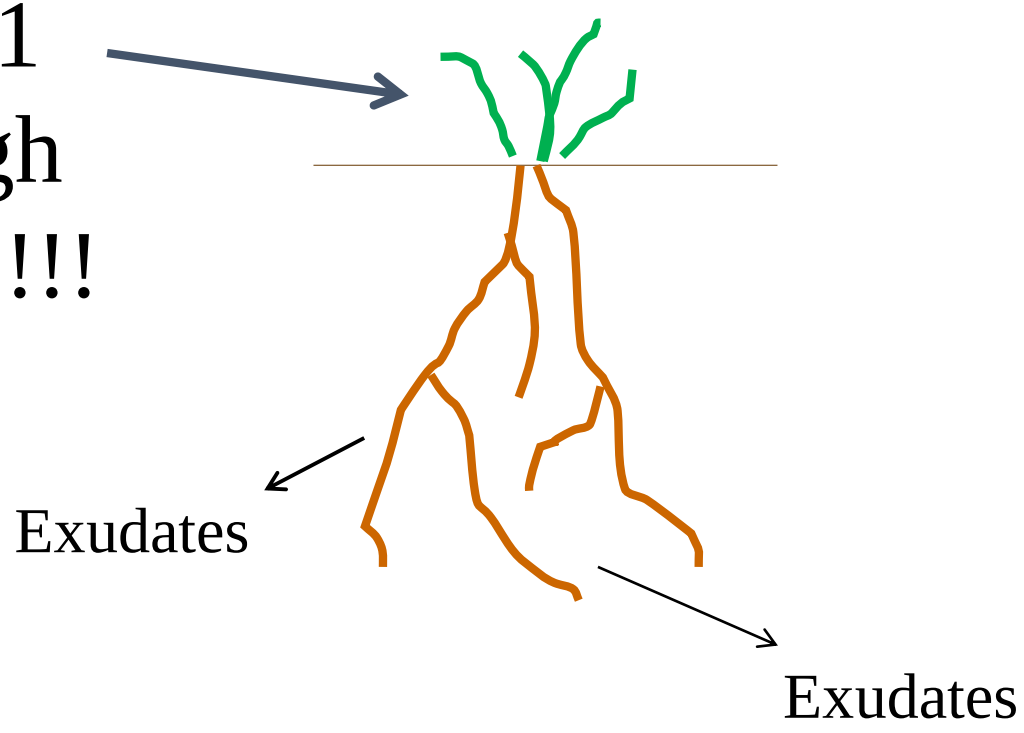
Winter (Dormant Period):
All nutrients stored in roots.

As temperature, moisture become optimal, nutrients are mobilized into new growth

The Annual Growing Cycle: Spring

C:N ratio

10:1
High
N!!!!!



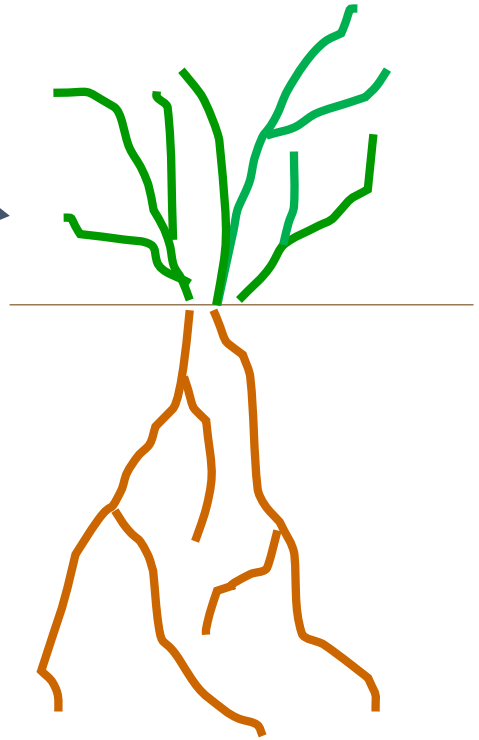
Spring:
First flush of new growth is concentrated with nutrients that were stored in roots.

The Annual Growing Cycle: Late Spring

C:N ratio

30: 1

Normal leaf N



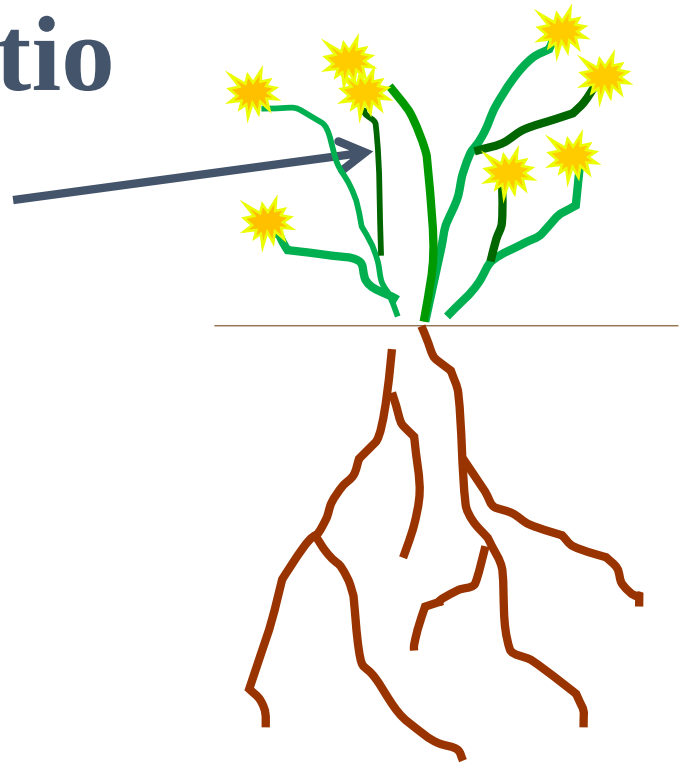
Late Spring:
High initial nutrient concentration diluted as plant photosynthesizes and adds carbon

The Annual Growing Cycle: Summer

C:N ratio

Shoots
60:1

Flowers
30:1



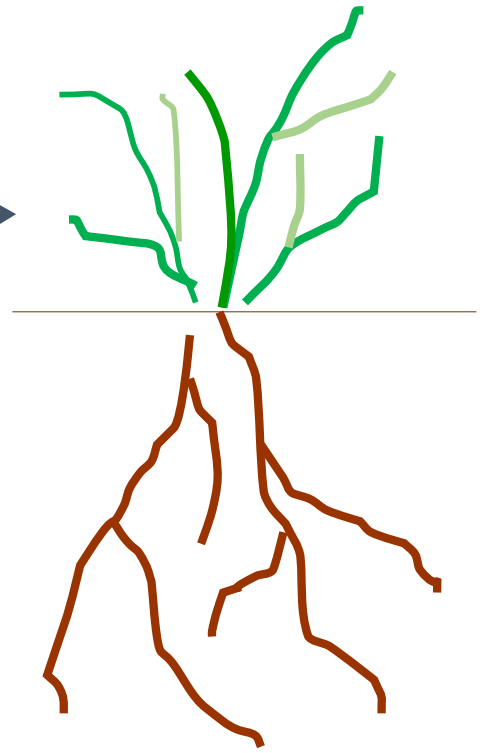
Flowering, seed set:
Seeds require high nutrient concentration.

Nutrients are taken from other plant parts to satisfy this need

The Annual Growing Cycle: Autumn

C:N ratio

150:1 to 200:1 as standing dead



After seed produced: Plants get ready for dormant season, pull all nutrients possible back into roots

Root Depth

If you cut the top, do the roots fall off?

Hendrikus Schraven holding ryegrass planted July 15, 2002

Harvested Nov 6, 2002
Mowed twice to ½ inch

70% Essential Soil,
30% BioComplete™ Compost/organic fertilizer
BioComplete™ Tea once

No weeds, no disease

www.soildynamics.com

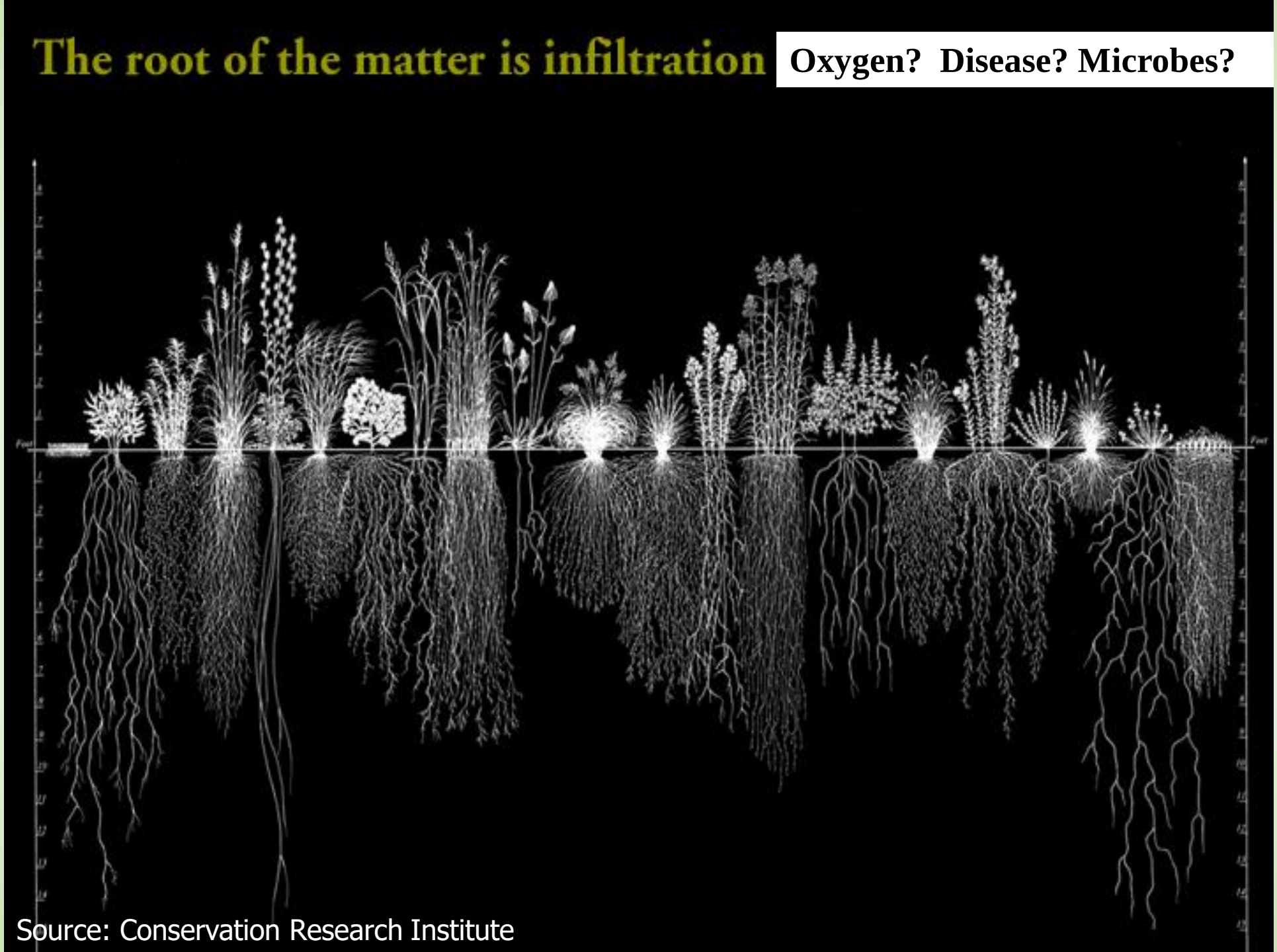
Size of Root System of a Rye Plant (*Secale cereale*)

Kind of Root	Number	Length	
		Meters	Feet
Main Roots	143	65	214
Secondary Roots	35,600	5,181	17,000
Tertiary Roots	2,300,000	174,947	574,000
Quarternary Roots	11,500,000	441.938	1,450,000
Total Root	14,000,000	609,570	2,041,214 (380 miles)

From Al Knauf

The root of the matter is infiltration

Oxygen? Disease? Microbes?



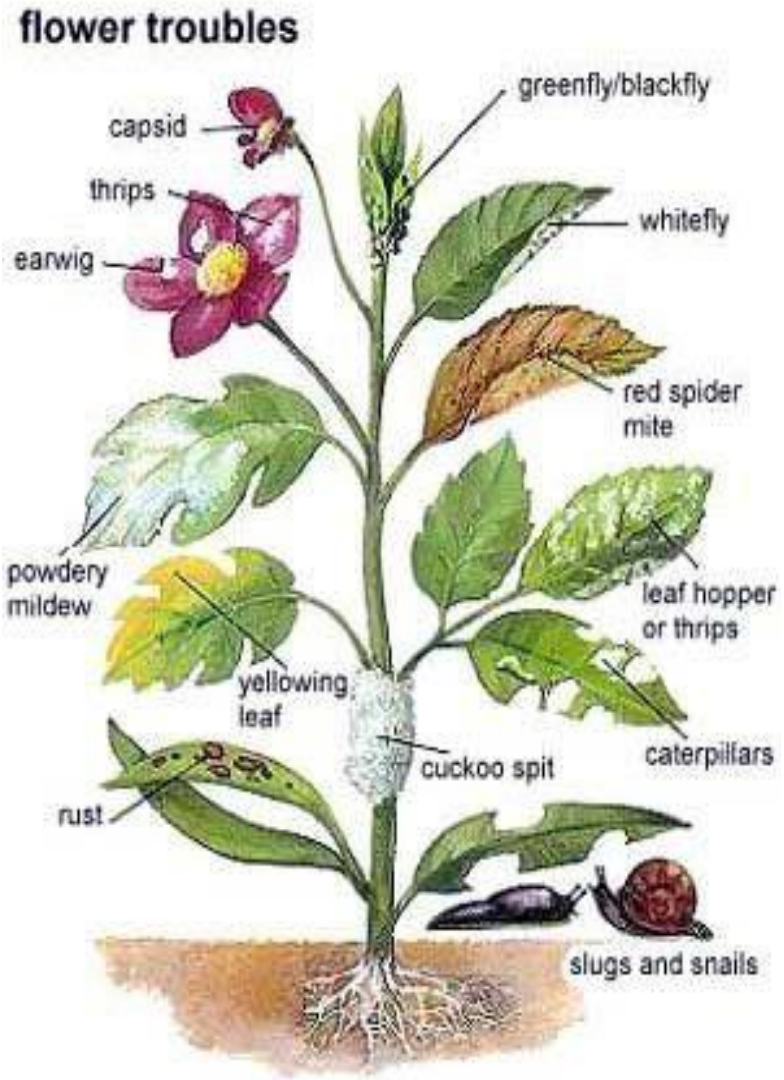
Source: Conservation Research Institute

Diseases and Pests

Why are diseases and pests attacking this plant?

How do nutrients get into a plant?

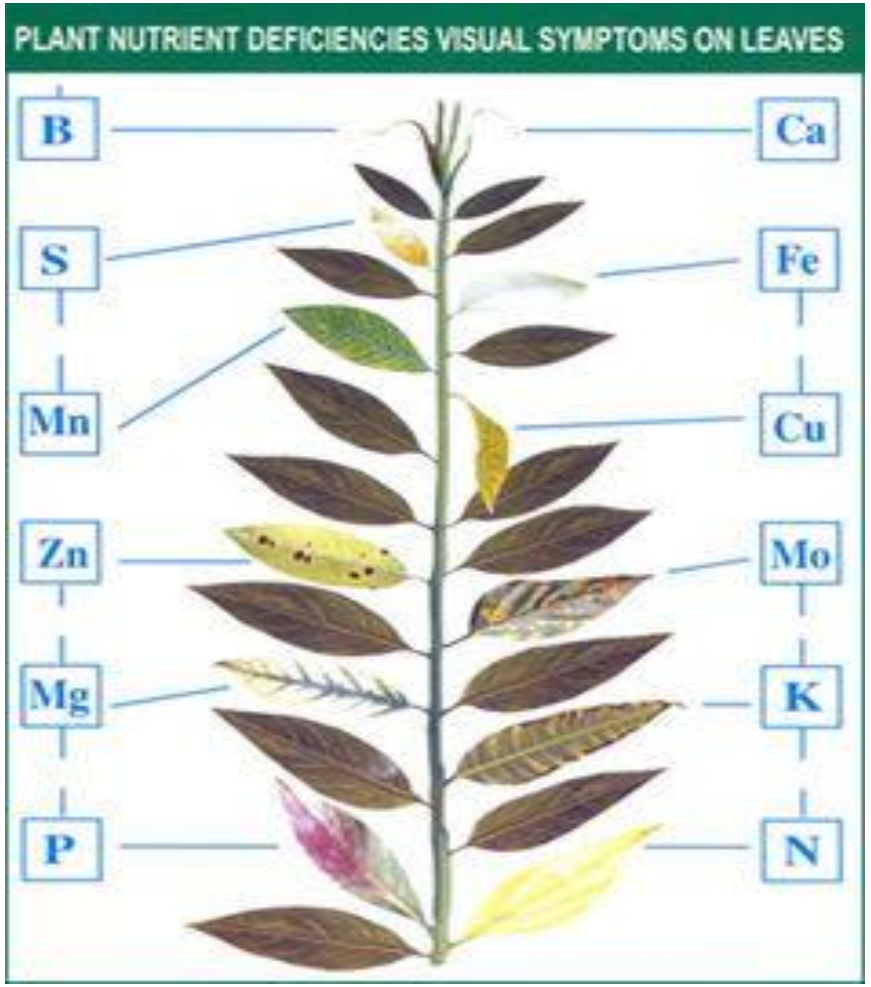
Roots?



Nutrient Deficiency

Why would nutrients be lacking?

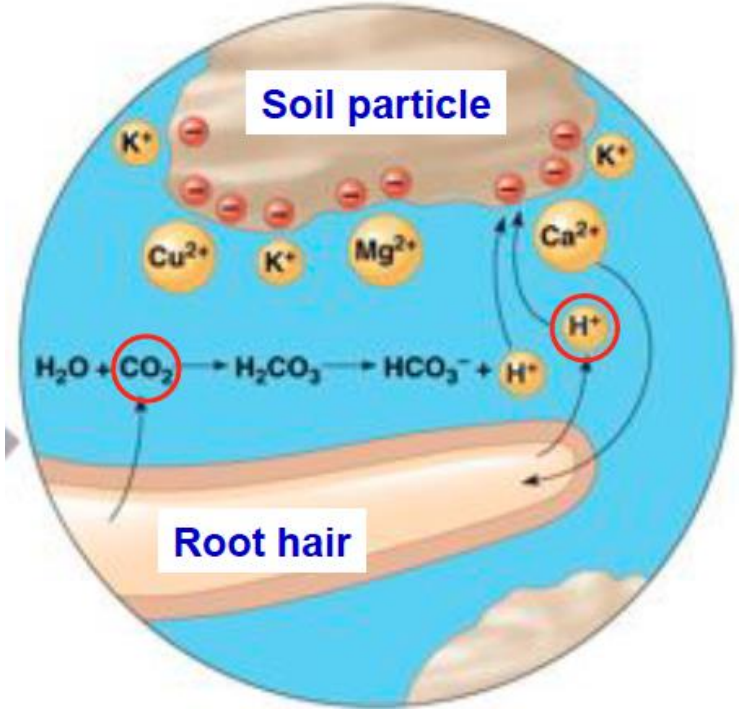
How do nutrients get into a plant?



Nutrient Availability – Conventional Theory

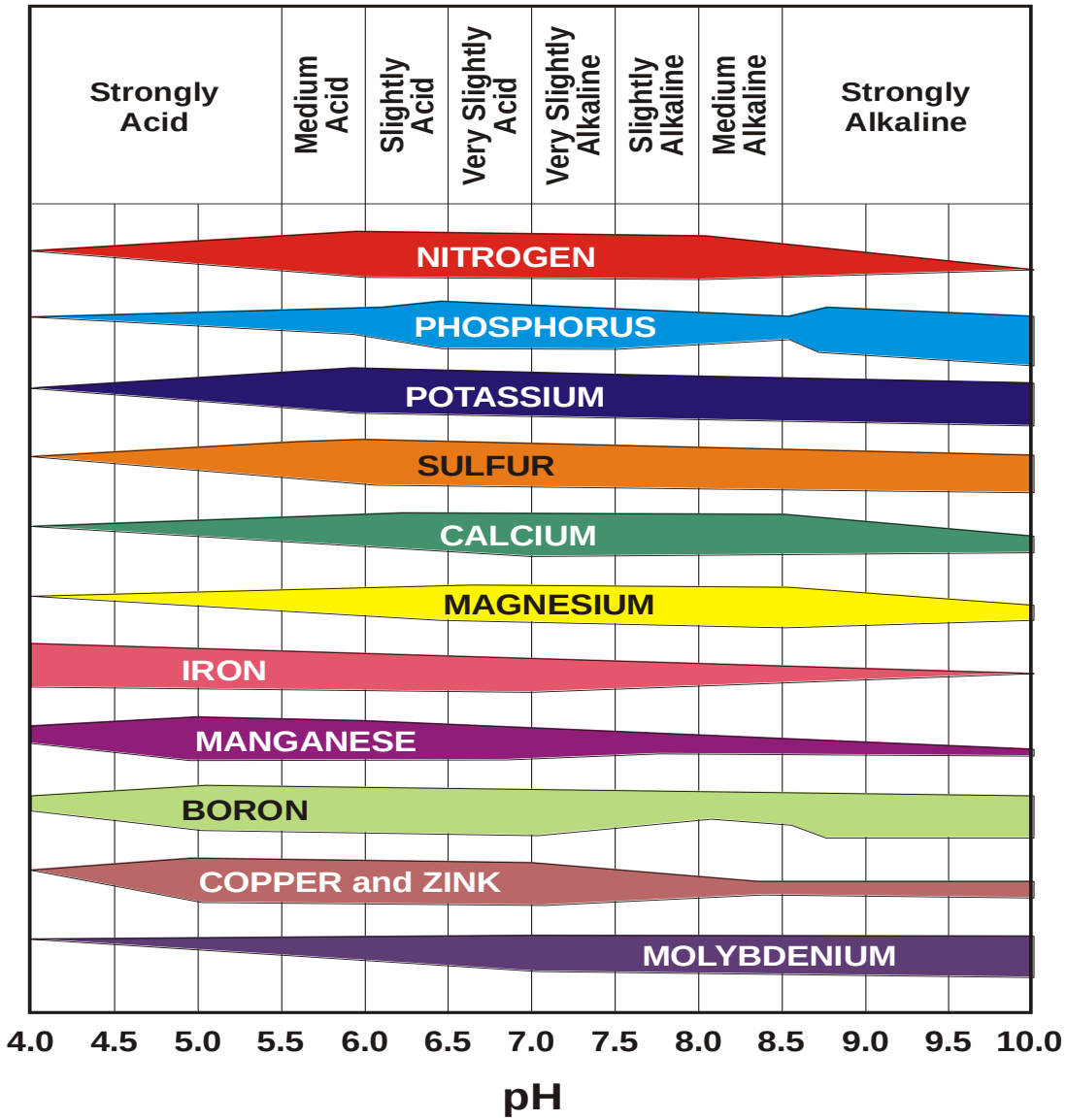
Roots release H^+ and CO_2. The CO_2 interacts with water to make H_2CO_3, which then disassociates into HCO_3^- and H^+. The release of H^+ ions knock cations from negative sites on the surface of soil particles into the soil solution, providing nutrients for plants to take up.

But, nutrients taken up by plants can't be renewed. Wouldn't bacteria and fungi get the nutrients released long before the plant does?



Why do plants release exudates? Where do more nutrients come from? Floods, landslides or fertilizer? No other choices?

Availability of Minerals Relative to pH



Without biology, you are stuck with pH as the sole arbiter of what is available to plant roots, as indicated to the left. But add organisms, and plant nutrition is no longer ruled by chemistry alone.