

Chelated Nutrients

something stupid

Chelated Roots

- The word chelated comes from the Greek word 'chele' meaning claw
- Slovenian translation: kelatirani
- Different chelates are named after the metals they contain.
examples: iron chelate, magnesium chelate, chelated zinc

What is a Chelate?

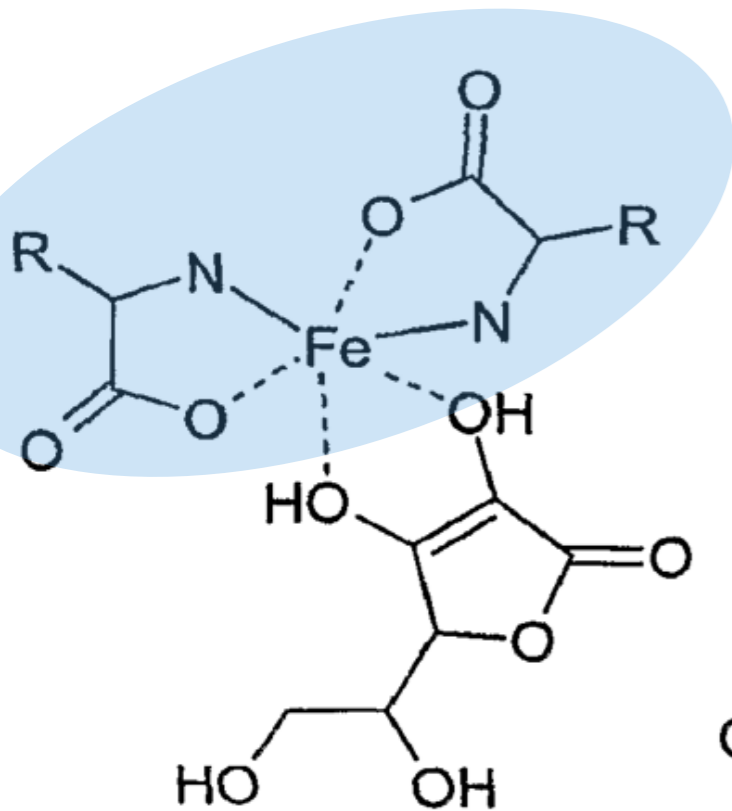
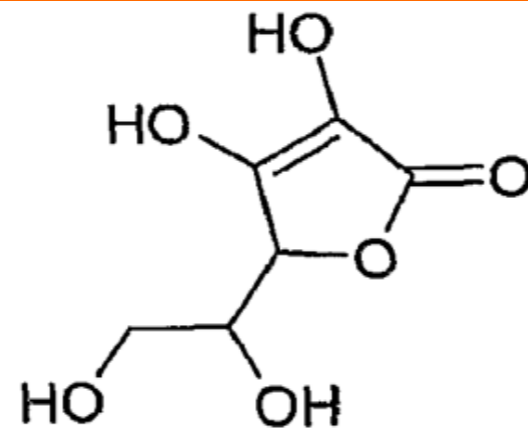
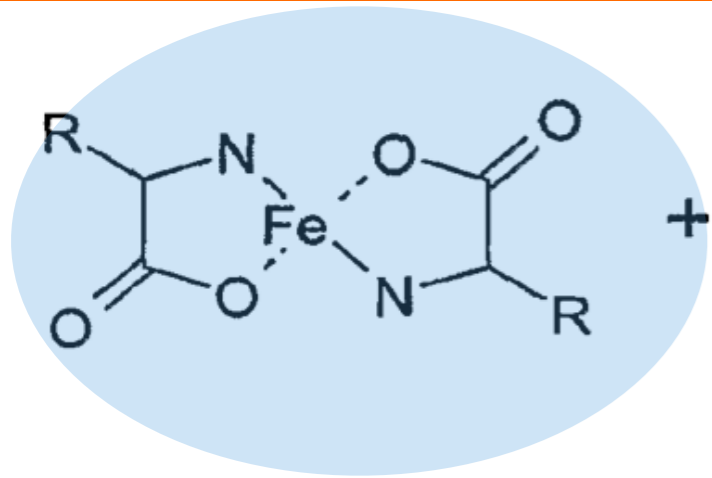
- Chelate- a compound containing a ligand (typically organic) bonded to a central metal atom at two or more points. (Google definitions)

Not all Chelates are Created Equal

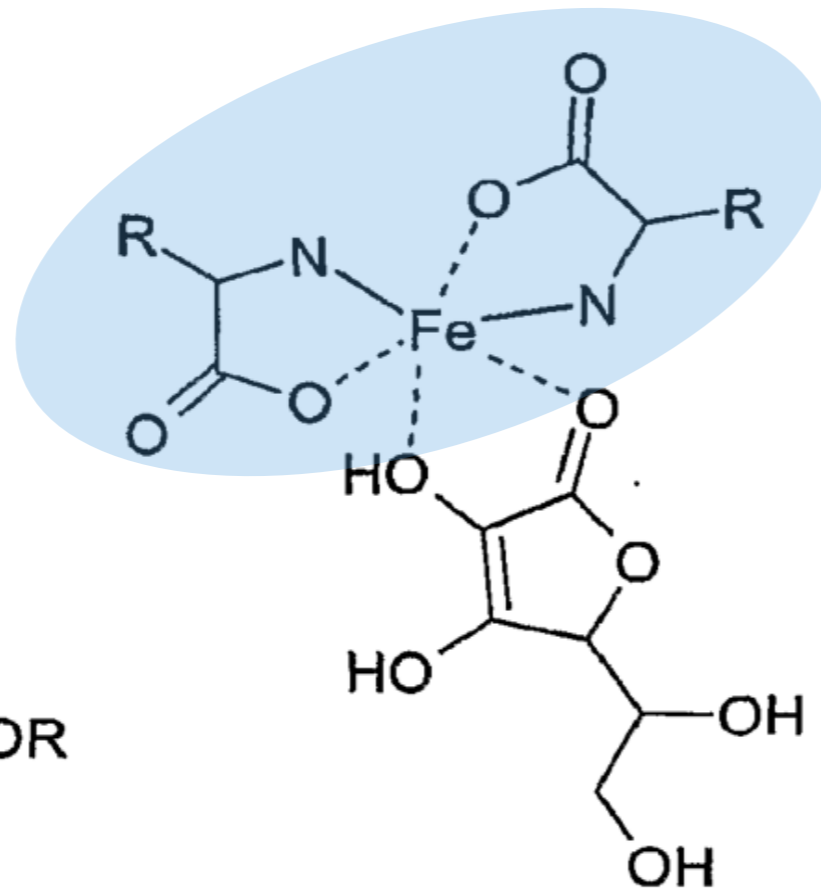
- Because the name only describes the central metal atom, totally different compounds will have the same name.
- Compounds with the exact same chemical formula will arrange themselves differently

Same Chemicals Different Arrangement

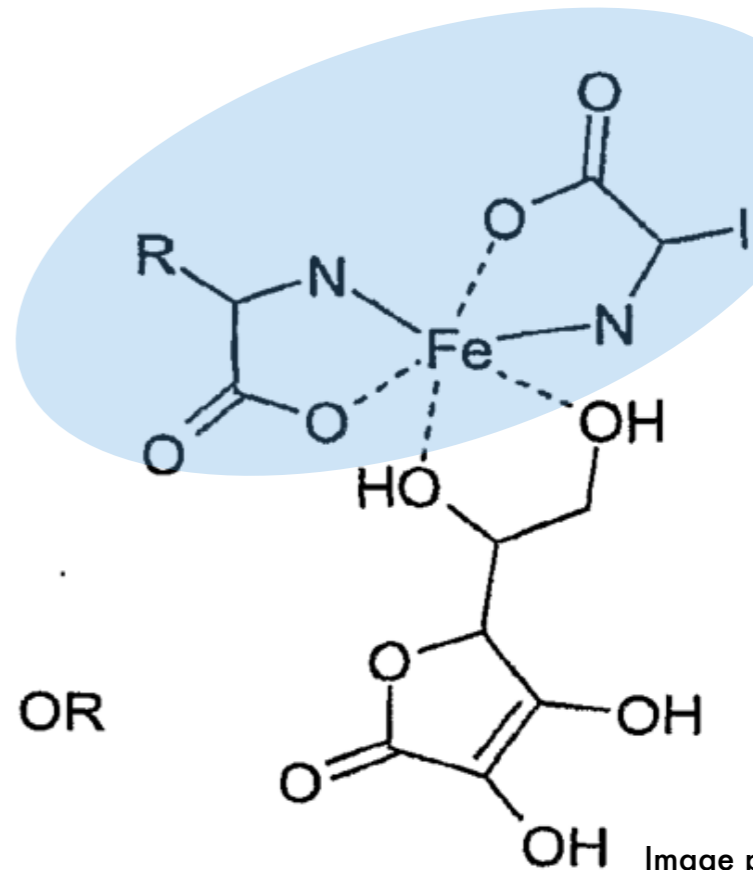
Amino Acid Chelate with Reducing Agents



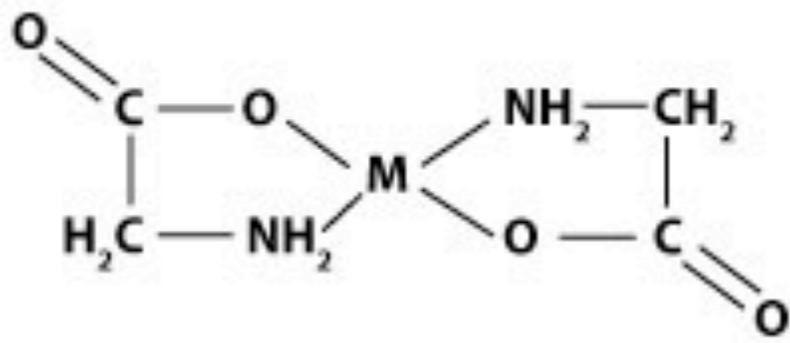
OR



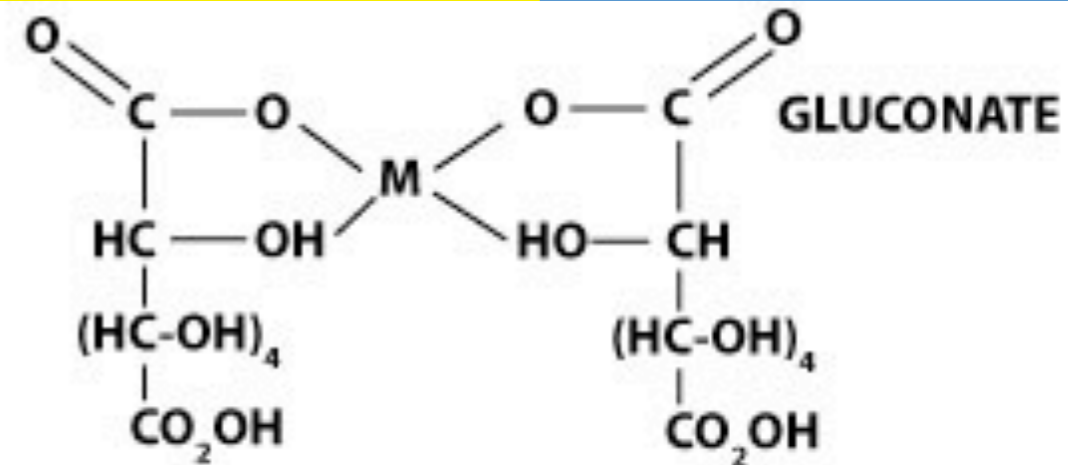
OR



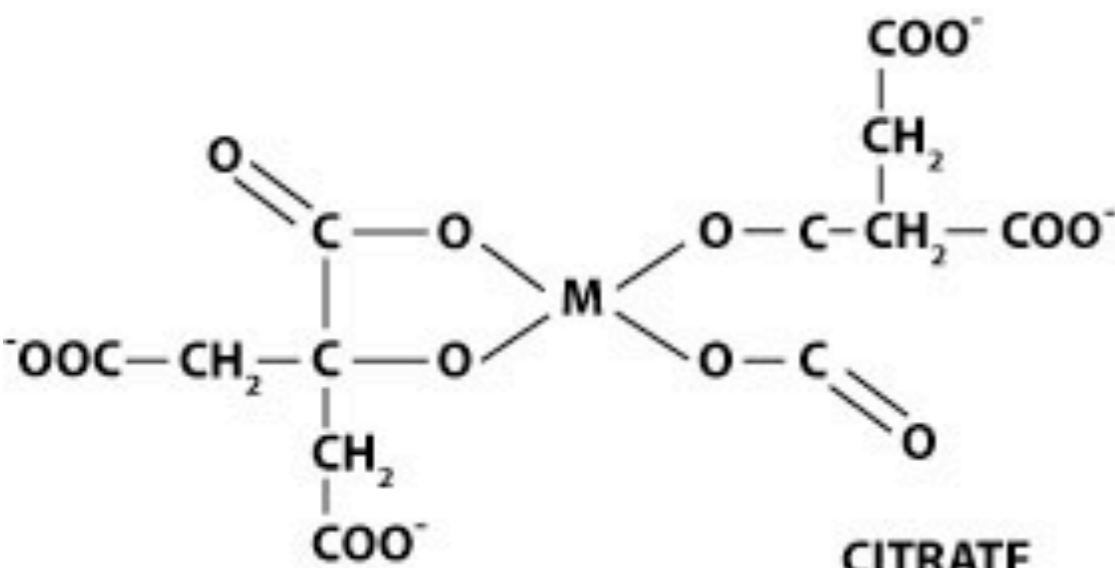
Different Chemical Composition



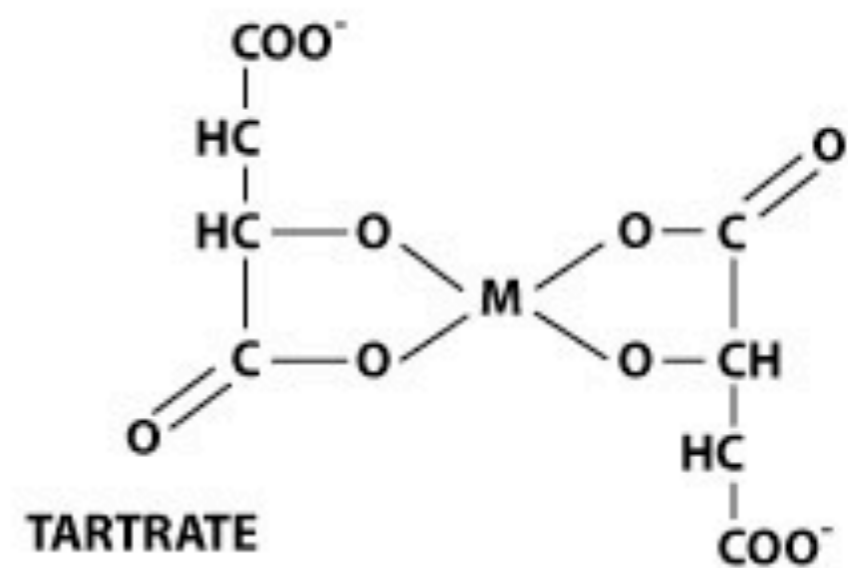
GLYCINE



GLUCONATE



CITRATE



TARTRATE

So what?

The point is that a chelated form of a mineral is a broad description and actually describes very little about it's chemical composition



Let's Break-it-on-Down

- Central Metal Atom
- polydentate
(multiple bonded)
ligand
- usually these
ligands are organic
compounds



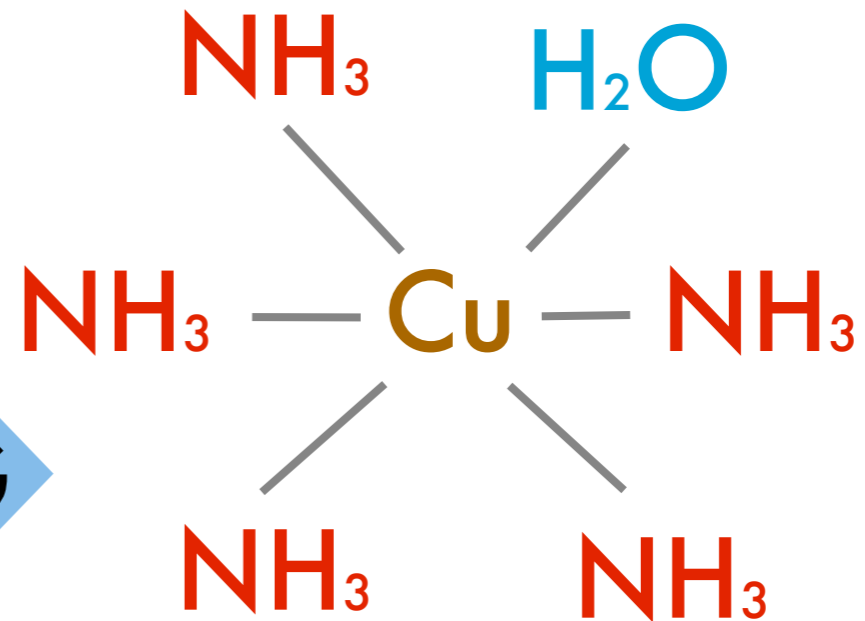
Ligands

- Latin root 'ligare' meaning 'to bind'
- An ion or molecule that bonds with a central metal atom
- These are known as chelants, chelators, chelating agents or sequestering agents.

Ligand Lore

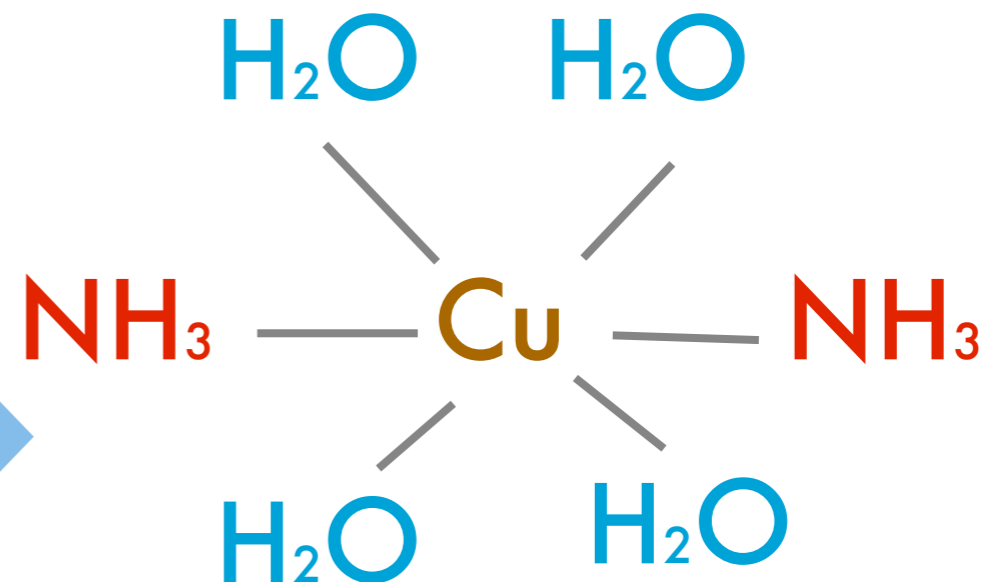
- Larger, more complex ligands result in stronger bonds with a give metal.

STRONG



- Example: A copper ion chelated with 5 ammonium ions will not be as strongly bonded as a copper ion chelated with 2 ammonium ions

WEAK



The Frog Says:

Often, one metal ion will replace another in a chelate. This depends on the ligands present, strength of bonds and pH of the nutrient solution. Plants and microbes can influence this exchange



Still don't make no sense!

- All biochemical compounds can dissolve(bond to) metal cations.
- proteins, polysaccharides, amino acids, and polypeptides are all excellent chelating agents
- Plants and micro-organisms produce custom biomolecules to chelate specific metals

Chelate this!

- The complex carbon chains in humus are excellent chelators. This is part of the reason that humus is so well known for improving nutrient retention.
- When a metal atom is chelated it is bonded into a much larger compound which helps to prevent it from washing away.

Chemical Weathering

- When an acid strips a metal ion from a mineral, it forms a chelated compound.
- Forming chelates is the primary form of chemical weathering in the environment.



The Frog Says:

“Chelates play important
roles in all of our lives.
From food and medicine to
dangerous government
contrails.
CHELATES RULE.”



How do Chelates Effect Plants?

- Plants require certain macro and micro nutrients that are often 'stored' as chelates
- When a plant wants a certain type of nutrient it will produce a specific exudate in order to attract those elements or microbes that can 'fix' the element for it.

Chelation is a 2 Way Street

- Plants and microbes also use chelating agents to remove toxic buildup from the soils
- Chelates are often used to treat water
- Chelates are used in heavy metal detox to remove poisonous particles like lead and mercury from humans

The Frog Says:

“Don’t get ahead of yourself. While chelates can be very beneficial, taking the wrong ones can kill you. DON’T BE A FOOL.”



Stay Focused!

- Synthetic chelates are very effective at providing nutrients to plants
- They are also very expensive to manufacture so generally they are only applied when plants are deficient of a specific nutrient

In the Solution

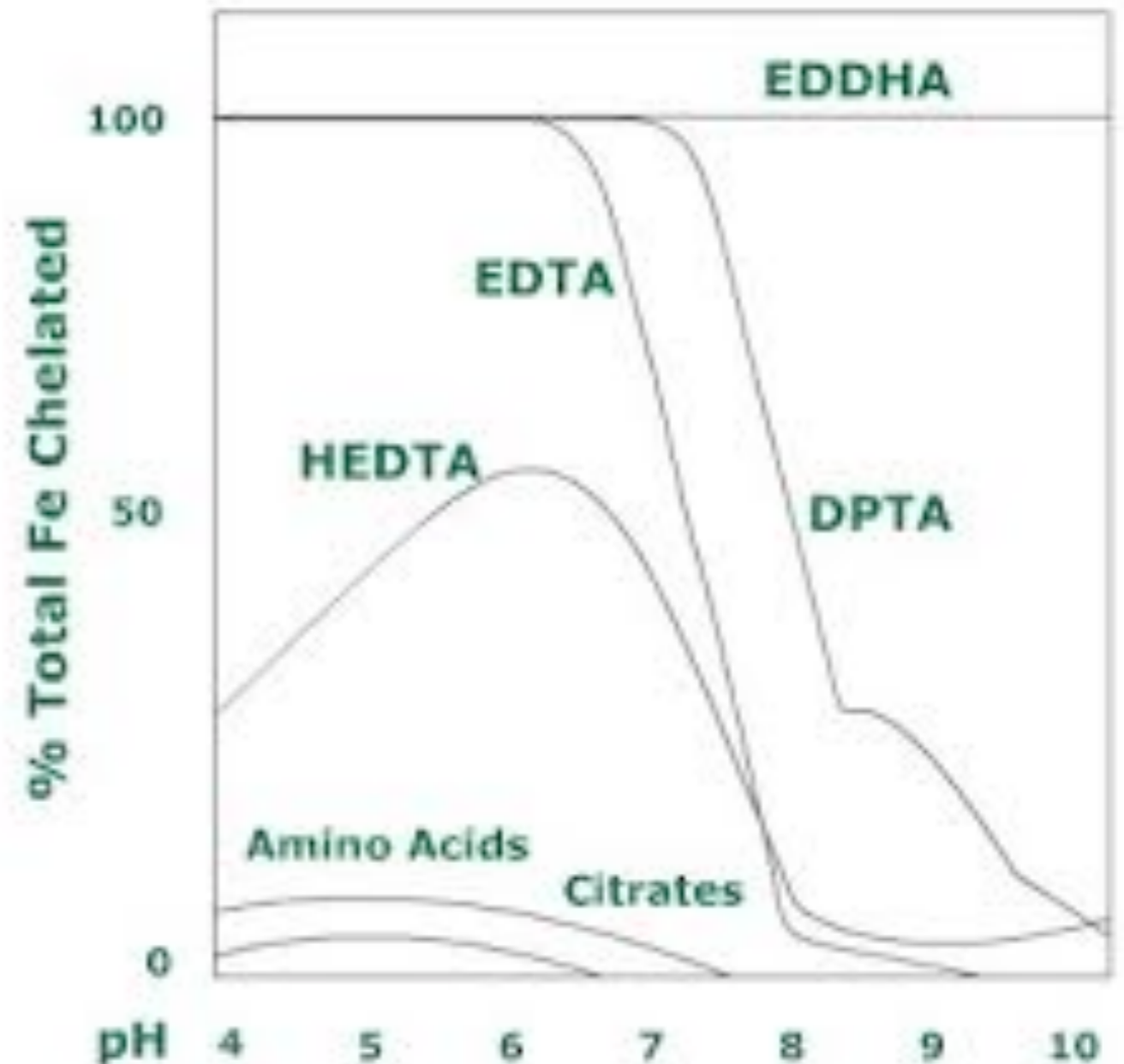
- Chemical Fertilizers use chelated forms of micronutrients in unison with phosphate salts. Without the chelating agents, the micro nutrients would bond with the phosphates and become unavailable to the plant.
- EDTA is the most commonly used chelator in fertilizers

EDTA

- Ethylenediaminetetraacetic Acid
- Most commonly used to suspend Ca and Fe in Nutrient solutions
- Used in many industries as a 'chemical buffer'
- photography chemicals, paper bleaching, shampoos, medicines, and more.

What Chelate is the Best?

- Chelates are susceptible to chemical factors such as pH and bond strength.
- Different Chelating agents work better in different conditions



In Short...

- Chelated nutrients are held in the active portion of the soil because they are bonded into larger multi charged compounds like humic and amino acids.



In the Long Run

Chelates are very important to the balance of a soil's chemical cycles. They primarily act as chemical buffers, but also help in complex processes such as soil detoxification and nutrient selection



The Frog Says:



Thank you
for watching
the
presentation.
If you have
any
questions,
ask Dan!

References

“Chelation” Wikipedia.com. Wikimedia Foundation Inc.. n.d. Web. 10 Dec. 2014.

Lancashire, Robert J. “Stability, Chelation, and the Chelate Effect.” *The Department of Chemistry, University of the West Indies, Mona Campus, Kingston 7, Jamaica Lecture 5 (1995)*: n. pag. Web. 10 Dec. 2014.

References

Brady, Nyle C., and Ray R. Weil. *Element of the Nature and Properties of Soils*. New Jersey: Prentice Hall, Pearson, 2010. Print

“Chelate definition.” Web. Google.com. n.d. Web. 10 Dec. 2014.

“Iron Chelate.” Images. Google.com. n.d. Web. 10 Dec. 2014.