Artal
SMART AGRICULTURE | 1895-2020
125 years

Technical information

TRACE ELEMENTS

Properties & benefits

Trace elements

Microelements are required elements for plant metabolism in very small amounts.

They are found in proportions between 5-200 ppm to 0,02% of plant dry matter.

These elements are considered microelements:

Chloride (Cl), Iron (Fe), Boron (B), Manganese (Mn), Magnesium (Mg), Zinc (Zn), Copper (Cu), Molybdenum (Mo) and Nickel (Ni).

Trace elements

The roles for these microelements in plants are two:

Enzymatic cofactor

Cofactors are microelements attached to proteic structures. Microelement gives protein the ability to make its function. They usually are part of the catalytic center, the place where metabolic reaction occurs.

Homeostasis regulator

Homeostasis is the equilibrium between plant and its environment and allows the plant to adapt itself to it. Osmoregulation, transpiration... are processes regulated by microelements.

Free

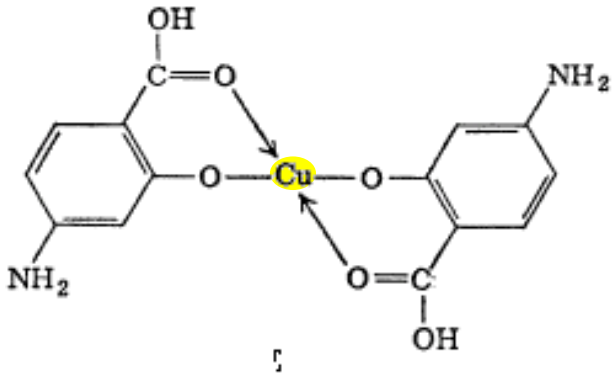
Microelementos, once absorbed foliar or radicular, have to be transported where they are required. Absorption can be in two forms:

Free

Simple microelements are found in this form, the inorganic form. Depending on soil pH they will have one ionic valence or another, its **ionic state**. Plants can only absorb specific ionic states, so soil pH limits plant availability for some micronutrients.

Attached

Microelements can be combined with a chelate/complex agent that improves significantly plants absorption capacity for microelements. Amino acids, vitamins, phytosiderophores... have this ability to chelate/complex.

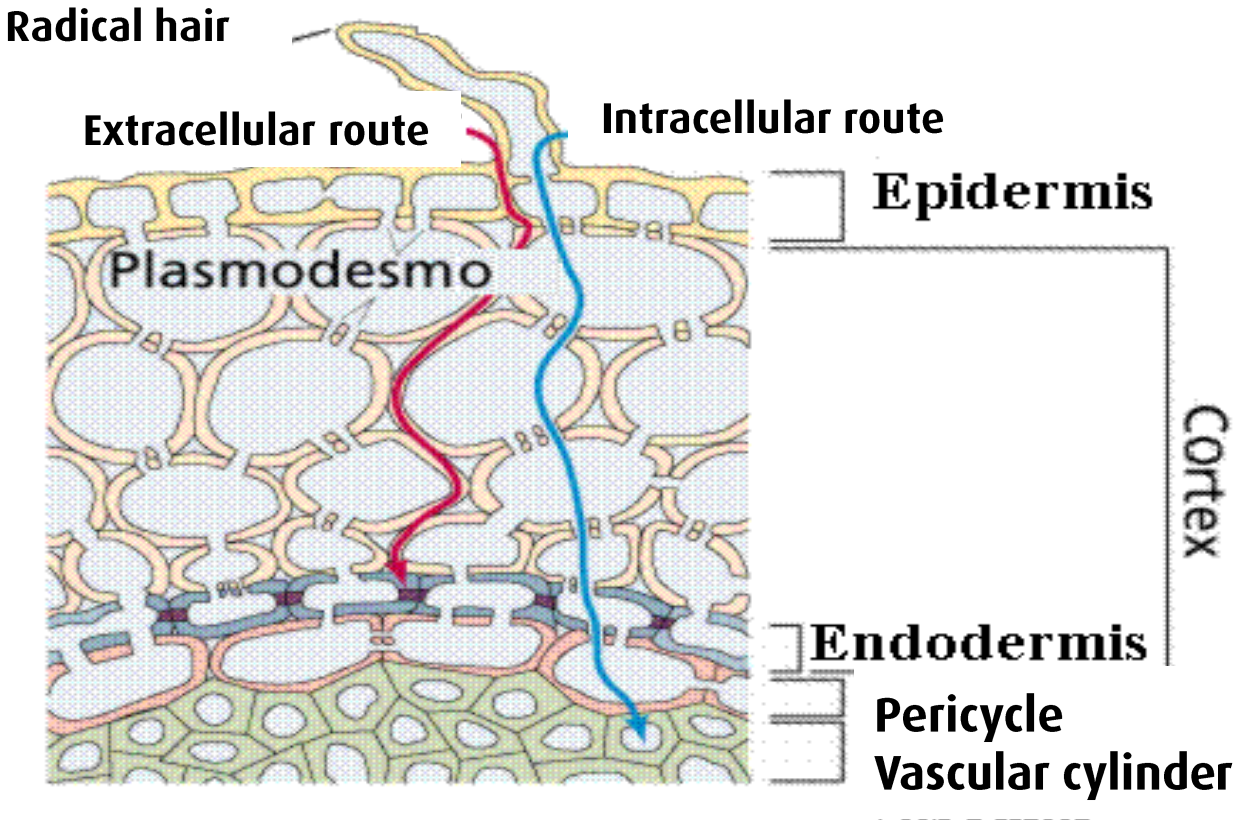


Example of a Copper (Cu) chelate attached with two chelating agents.

Once assimilated, microelements go into the conductive tissue of the plant. Arrival to this conductive tissue can be done in two ways:

a) **Symplastic pathway**: Transport of the element goes from cell to cell intracellulary until conductive tissue is reached.

b) **Apoplastic pathway**: Transport goes through the spaces found in the extracellular matrix. The element doesn't enter cells.



Scheme of both ways of entry into the plant

Assimilated elements enter now **xylem**. This is a kind of conductive tissue composed by dead and hollow tubular cells from where water and nutrients are conducted.

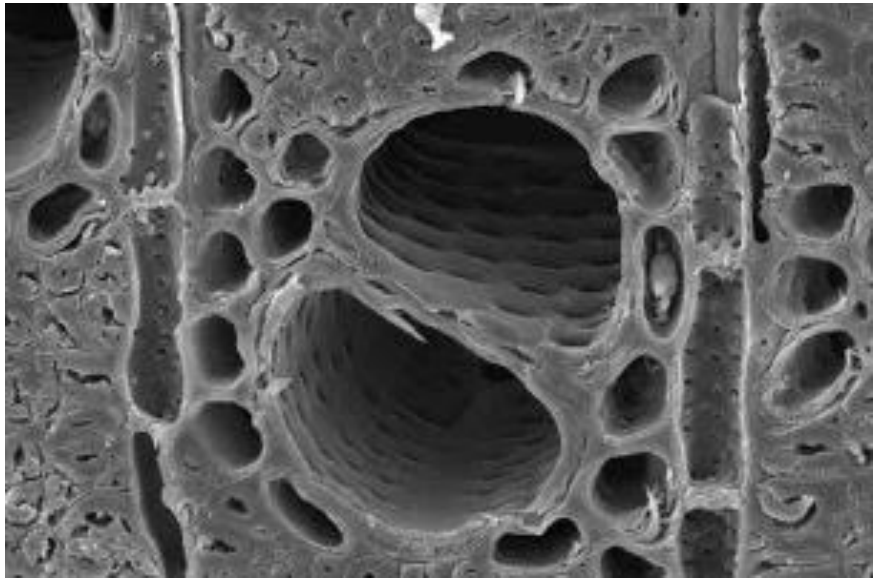


Image of the xylematic tubes

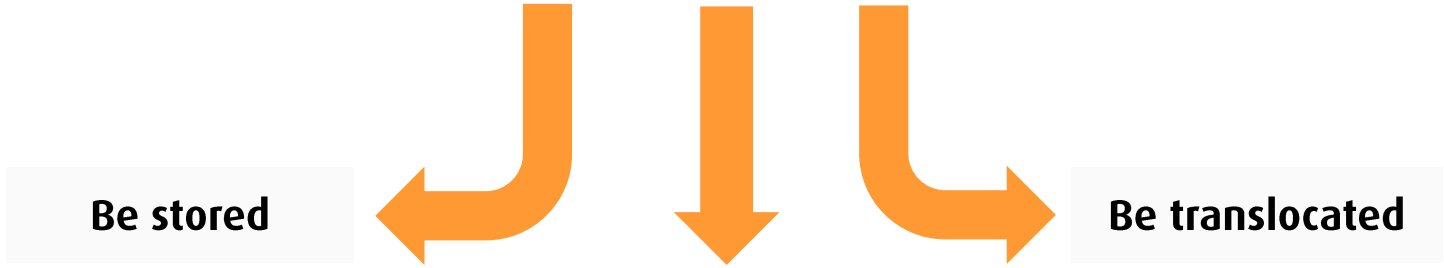
Movement through xylem works due to the **cohesion** between water molecules and the **evapotranspiration.**

Evapotranspiration is the evaporation of the water within foliar surface that leaves plant as vapor.

This creates a negative pressure in the leaves that sucks the whole xylematic water column (and microelements in it) upwards.

Upward movement in the xylematic column makes microelements arrive to the leaves where evapotranspiration occurs.

Microelements can follow now thre ways



TRACE ELEMENTS

Depending on the pathway that microelement goes through, it will stay in leaves or it will go to the **phloem**, the other conductive tissue

If they are stored/consumed

↓

They stay in leaves

If they are translocated

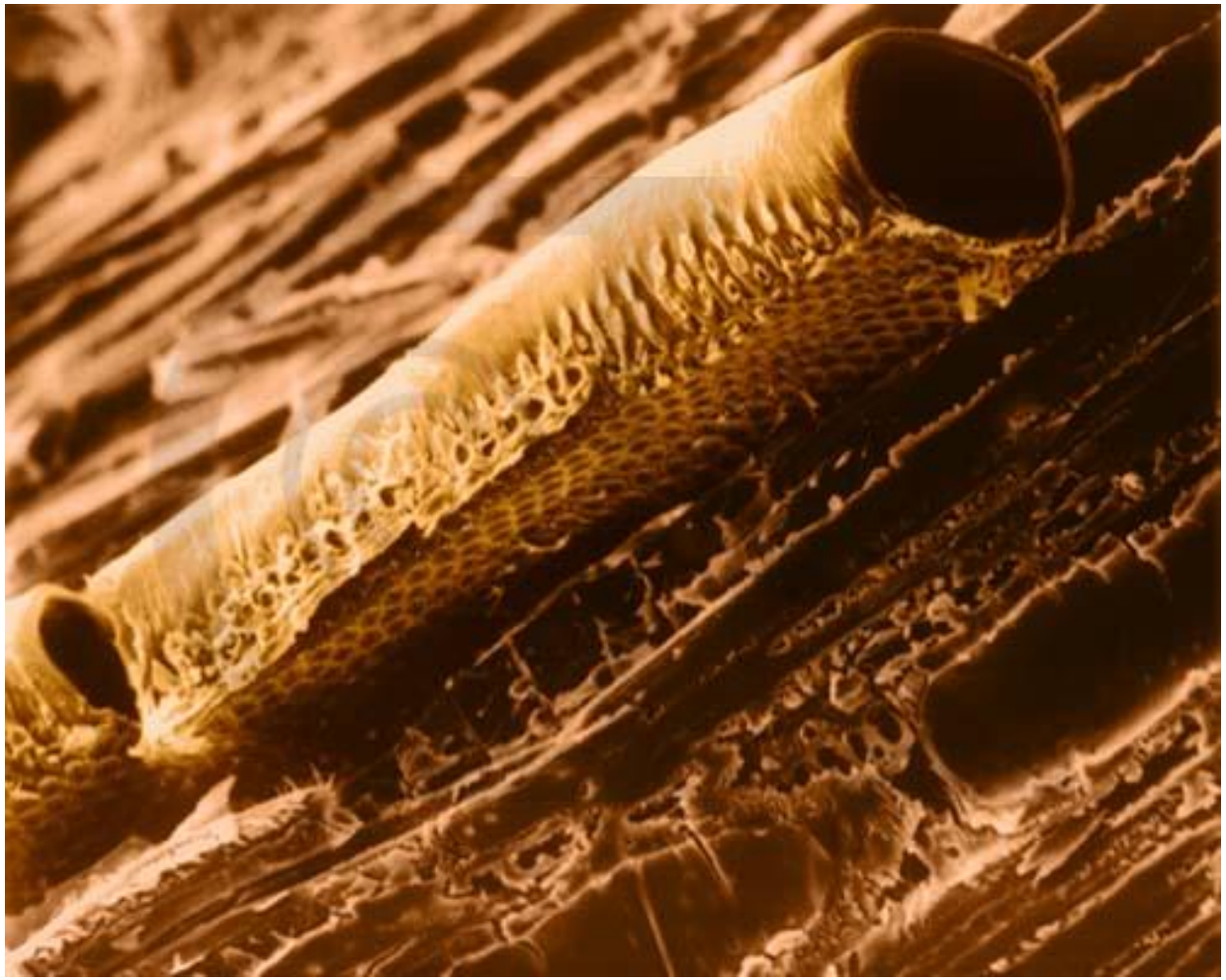
↓

They go to the phloem

TRACE ELEMENTS

Plant movement

- **Translocation** is the transfer of microelements from xylem to phloem.
- **Phloem** is the part of the conductive system composed by **living cells**.
- **With energy,** this system can transport nutrients wherever they are required
- This is the system that **transports nutrients** to fruits, roots and developing tissues, where there is no evapotranspiration.



Tubular element of the phloem

Depending on the microelement, translocation is not always possible or easy. Because of this, microelements are classified into three groups:

Mobiles ➡ They can be easily translocated. **Magnesium**, **Chlorine** and **Sodium**, besides macroelements (**NPK**) are included here.

Partially Mobiles ➡ These microelements present a conditioned mobility. **Zinc**, **Copper**, **Manganese**, **Iron**, **Molybdenum** and **Zinc** are included in here.

Immobile ➡ These elements show a really low translocation rate. **Boron** and **Calcium** are included here.

The possibility of microelements being translocable or not has certain implications :

- Deficiencies will be first noticed in the **young tissues** in the case of the partially and immobile ones.
- The **application** of the partially mobile and immobile must be in the form of **complexes** with organic compounds to enable their translocation.

TRACE ELEMENTS

Summary

Microelements play a key role in the plant:

- **Metabolism** and **homeostasis** processes (relation of the plant with its environment) are influenced by microelements.
- Microelements deficiency is **not mortal** for the plant but **delays** its growth and fruit production.
- Microelement transport through the plant depends on their ability to be translocated or not.

Trace Elements

Microponic

MICROPONIC is a mix of chelated trace elements with boron, copper, iron, manganese, molybdenum and zinc, chelated with HEEDTA

It acts as a **deficiency corrector** due to its wide microelements variety.

Its application is recommended during **active metabolism** period, like sprouting or fruit production.

FLOWAL

FLOWAL products are **chelates** and **simple complexes** (of calcium, zinc, magnesium, manganese and iron) chelated with **heptagluconic acid** or with **HEEDTA**.

They are **nutrients** and/or **deficiency correctors** that work in wide ranges of soils pH.

TRACE ELEMENTS

NUTRIARTAL

NUTRIARTAL is a range of products based on complexed double and triple trace elements, containing manganese and zinc with gluconic acid as complexing agent. They can also contain iron (**NUTRIARTAL Fe**) or magnesium (**NUTRIARTAL Mg**).

They act as **zinc** and **manganese** sources to prevent and/or correct deficiencies that delay and reduce production.