PLANTMETALS has six workgroups

Workgroup 1 - Trace Metal (TM) Transport from soil to plant.
Identifies the pathway of metals from the soil into and within the plant, their genetic underpinning and how these are modified in rare plants with exceptional accumulation of metals.

Workgroup 2 – Metalloproteins
Studies metal-binding proteins. Proteins carry out all biochemical reactions in living organisms. Of all plant proteins, as much as thirty percent require metals as cofactors, which accomplish the diverse biochemical function of these proteins.

Workgroup 3 - Environmental impact on plant metabolism
Studies deficiency, toxicity, and metabolic interactions of TM with beneficial microorganisms and pathogens. Such interactions may, for example, involve changes in the uptake and intra-plant distribution of metals, enhanced or diminished expression or activity of metalloproteins.

Workgroup 4 - Agronomy - how to apply science practically
Studies how to achieve better nutritional quality of food crops with respect to essential metal nutrients and TM toxins in the context of EU regulations. Studies how specific green plants can be used to clean up contaminated soil and water (phytoremediation).

Workgroup 5 - Dissemination
Spreads the results of the Action to the different stakeholders and the general public.

Workgroup 6 - Intellectual property protection.
Facilitates the transfer of the scientific results of PLANTMETALS into applications for the benefit of people in the EU and worldwide.

COST (European Cooperation in Science and Technology) is a funding organisation for research and innovation networks throughout Europe and beyond. COST is supported by the EU Framework Programme Horizon 2020.

By enabling researchers from academia, industry and the public and private sector to work together in networks that transcend borders, COST helps to advance science, stimulates knowledge sharing and pools resources to address scientific, technological, and societal challenges.

PLANTMETALS is an EU COST Action started in October 2020 and running for four years. Currently 171 participants from 36 countries participate in the Action.

PLANTMETALS tackles basic and applied issues related to trace metal (TM) deficiency or excess levels in plant physiology and crop production by the combined expertise of physiologists, (bio)physicists, (bio)(geo)chemists, molecular geneticists, ecologists, agronomists and soil scientists. Knowledge will be translated to the needs of farmers and consumers, with inputs from companies.

www.plantmetals.eu

Contacts:
Grant Manager: Drs. Robert Dulfer.
robert.dulfer@umbr.cas.cz
Science Communication Officer: Prof. Ute Krämer
ute.kraemer@ruhr-uni-bochum.de
Chair of the Action: Prof. Hendrik Küpper
hendrik.kuepper@umbr.cas.cz

The Biology Centre of the Czech Academy of Sciences, České Budějovice, Czech Republic, is the COST Grant Holder.

This Action is financially supported by the COST Association, grant CA 19116 "Trace metal metabolism in plants – PLANTMETALS"

cost EUROPEAN COOPERATION

Funded by the Horizon 2020 Framework Programme of the European Union

PLANTMETALS

When too little ....

Variations of metal content in soils, water and plants from deficiency to toxicity, a global problem for agriculture and human health

Trace metal metabolism in plants

CA19116 Plant Metals

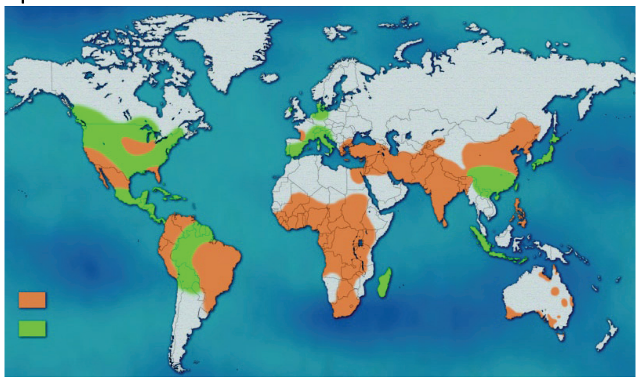
Not all heavy metals are always bad….

→ Many trace metals (the proper term for "heavy metals") such as copper, iron, manganese, nickel, molybdenum and zinc are essential for all plants, e.g. for photosynthesis.

→ Even essential trace metals become toxic at higher concentrations, and other metals such as mercury, lead (and in most organisms cadmium) have no biological function but easily become toxic.

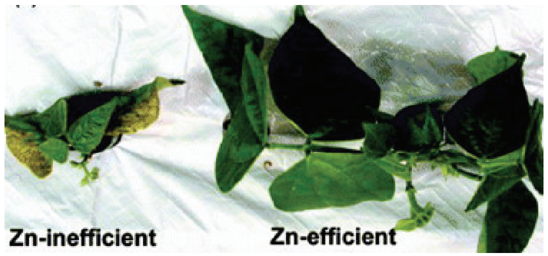
Trace metal deficiency is a global problem for agriculture.

Trace Metals like zinc are vital micronutrients for healthy, high-value crops. This map shows moderate (green) and severe (orange) zinc deficiencies in world crops.



From: Alloway BJ. 2008. Brussels, Belgium: Internat. Zinc Association

Therefore, understanding how plants adapt to different levels of trace metals can help in breeding more efficient plants that can grow well even on poor soils, as shown here for common bean.

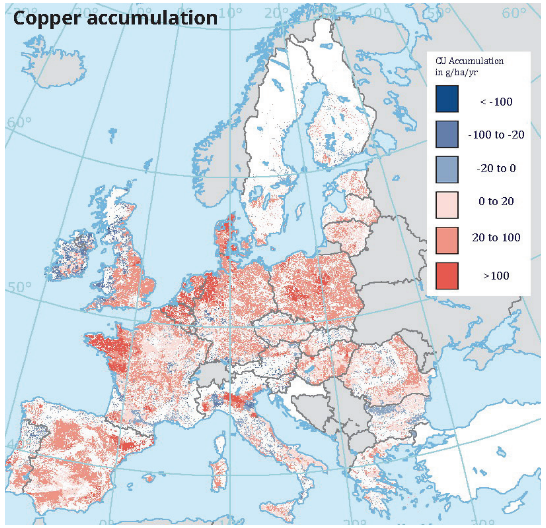


From: Hacisalihoglu G, Kochian, LV. New Phytologist 159 (2), 341-350

…but some heavy metals are causing serious pollution problems

Example of metal pollution

Copper pollution is a widespread problem, e.g. because of the use of copper-based pesticides and pig slurry in agriculture. Also cadmium pollution is very common, e.g. from contamination of fertilisers with cadmium.



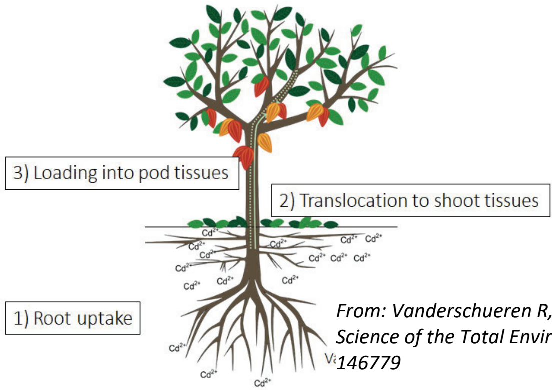
Annual accumulation rates of Copper in Soil, 2010

No data *Outside coverage*

From: European Environment Agency - www.eea.europa.eu

Metal transport in plants

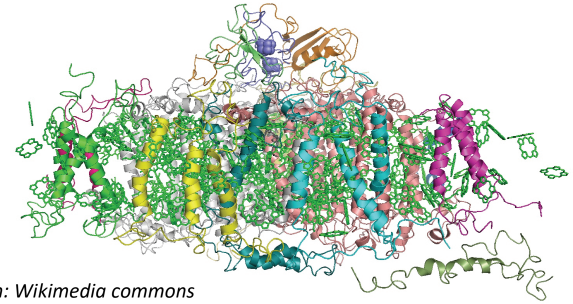
Different mechanisms control transport into the plant, between plant organs, tissues, cells and even within cells. Understanding molecular mechanisms of metal transport is a basic prerequisite for understanding metal metabolism and thus to breed better crops.



From: Vanderschueren R, et al. (2021) Science of the Total Environment 781, 146779

Why metals are needed: Metalloproteins

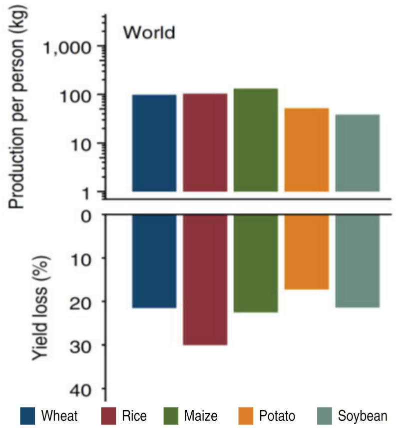
Plants require trace metals because about 30% of proteins for all organisms require a metal bound for their function. Such proteins are required for all parts of metabolism, e.g. photosystem 1 as shown here in a schematic representation of its structure.



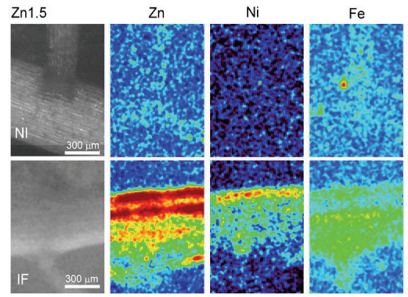
From: Wikimedia commons

Relation between metals and plant immunity

Pathogen infection leads to dramatic yield losses in agriculture (top). Trace metals are involved in plant immunity, and local metal accumulation occurs in response to pathogen infection (bottom). Thus, understanding better the role metals in plant immunity will help agriculture.



From: Savary S, et al. (2019) Nature Ecology & Evolution. 3:430-9.



From: Morina F, et al. (2021) Journal of Experimental Botany 72, 3320–3336