Developing more effective fertilizers

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Outline

- Why fertilizer efficiency is important
- Improving fertilizer efficiency
- Linking science to engineering
- The future

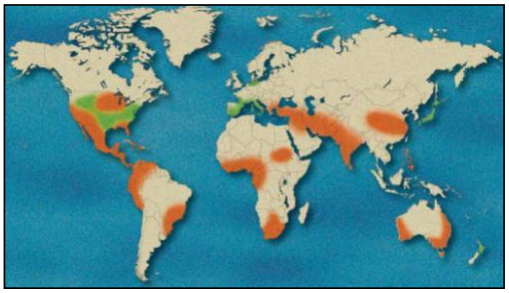
Fertilizer efficiency = farmer viability/profitability

Fertilizer efficiency = less environmental impact

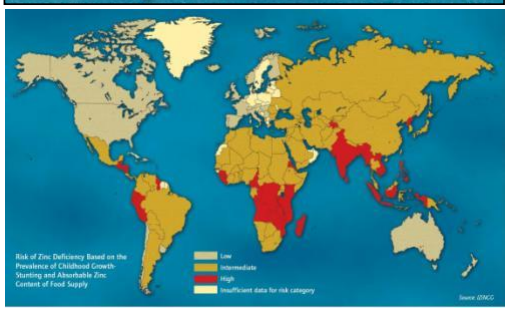
- Off-site movement of nutrients into waterways

- Emission of greenhouse gases to the atmosphere

Fertilizer efficiency = improved human health



Soil Zn deficiency



Human Zn deficiency

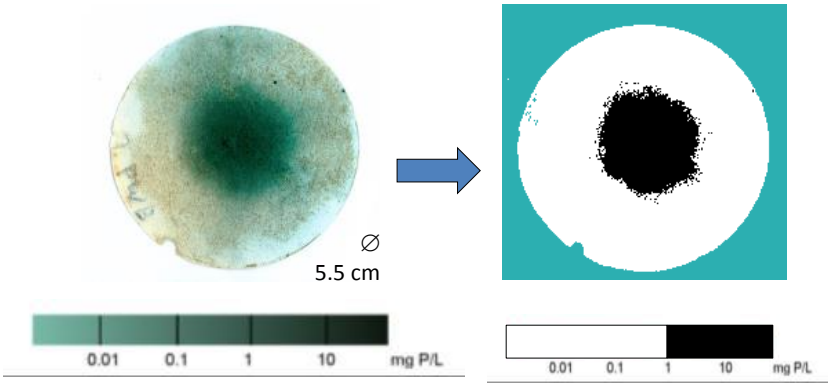
Phosphorus

Better P fertilizers for calcareous soils

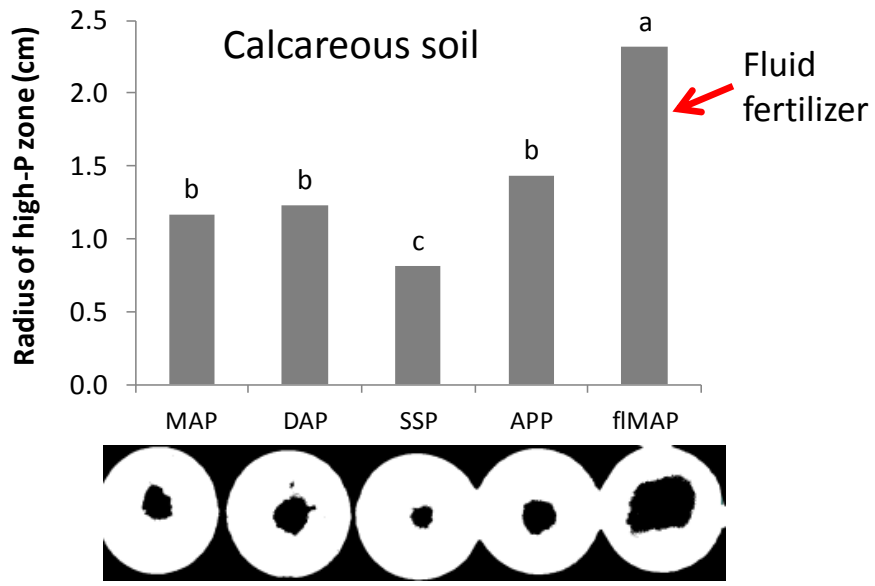
- In calcareous soils P use efficiency is low due to strong P reaction with soil

Microphotograph of P fertilizer granule incubated for 4 wks in a calcareous soil

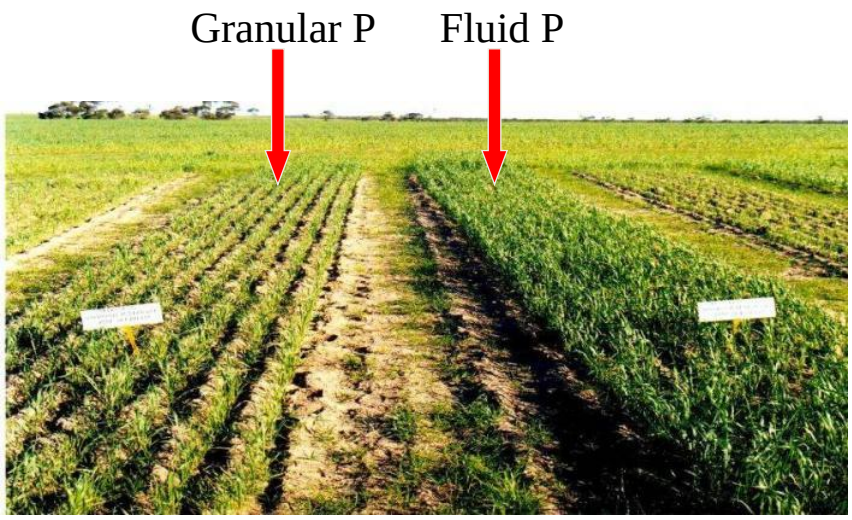
Screening fertilizer P movement into soil



Screening fertilizer P movement into soil

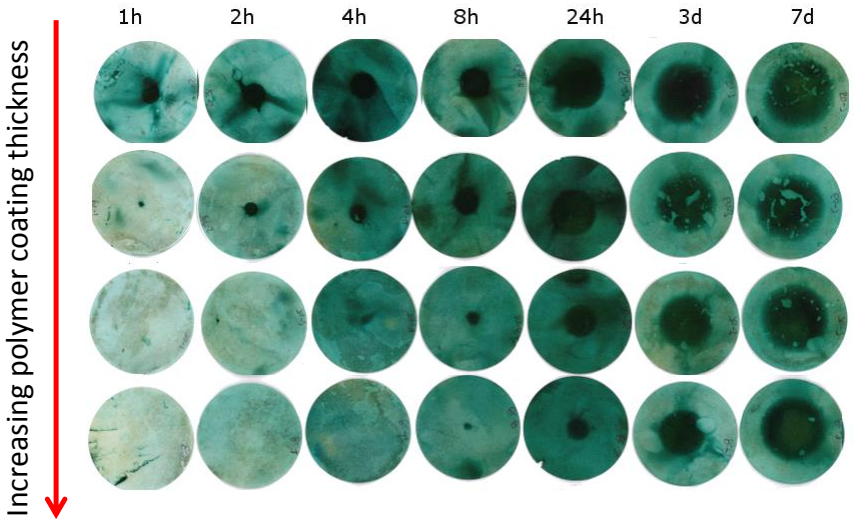


Fluid P effective in calcareous soils



Stopping P losses to waterways

Evaluating controlled release P products



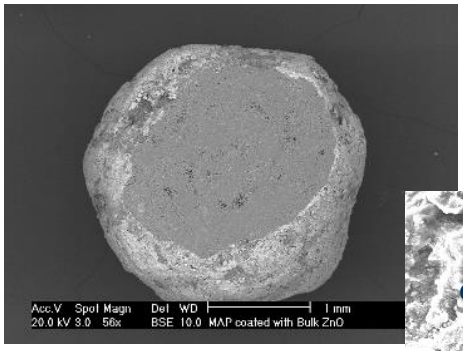
Zinc

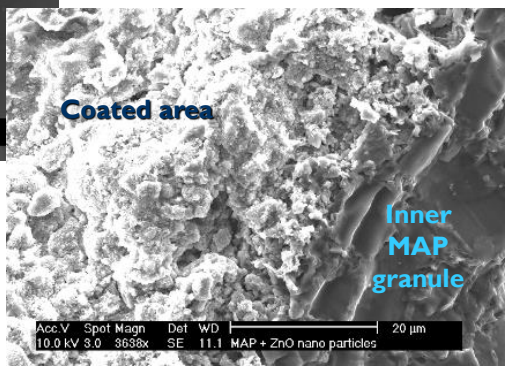
Zinc fertilizers under the microscope

Advanced Photon Source, Argonne National Laboratory, Chicago

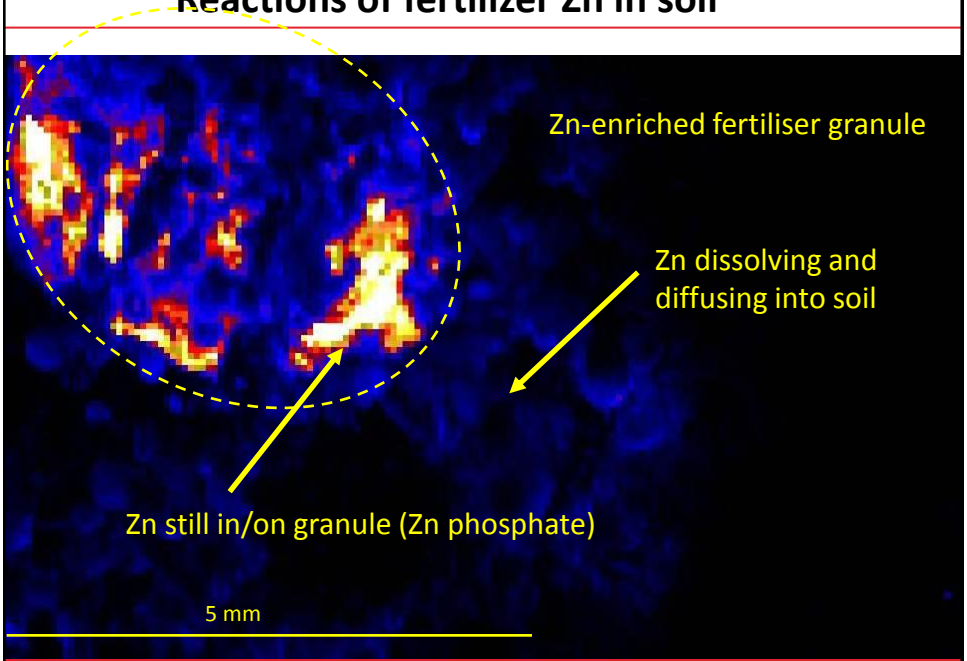
- Zinc mapped in fertilizer granules, and form of zinc determined
- Movement of zinc out of granules mapped and forms of zinc in soil determined

Zinc fertilizers under the microscope

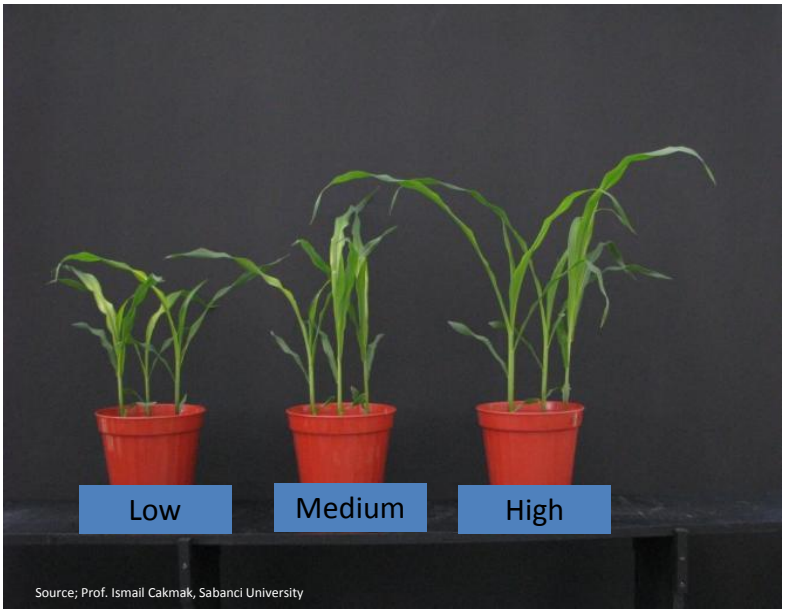




Reactions of fertilizer Zn in soil

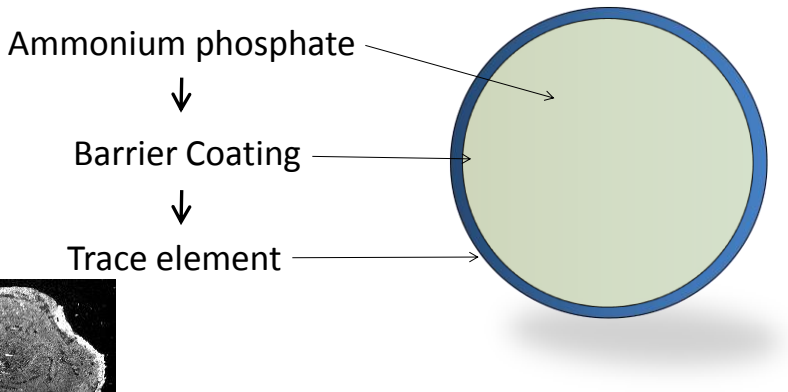


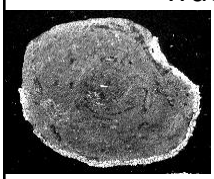
Water solubility of Zn important



Improving zinc fertilizers

Physical barriers to reduce phosphate precipitation of zinc and to increase water solubility





Peacock A, Stacey SP and McLaughlin MJ. 2010. United States Patent and Trademark Office Application No 61/309,894. Fertilizer Composition Containing Micronutrients and Methods of Making Same.

Improving zinc fertilizers

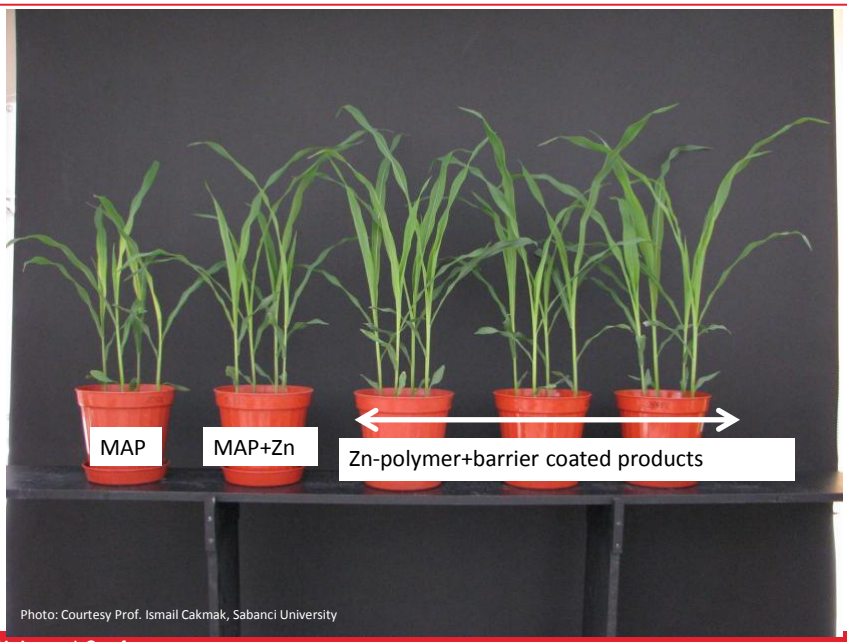
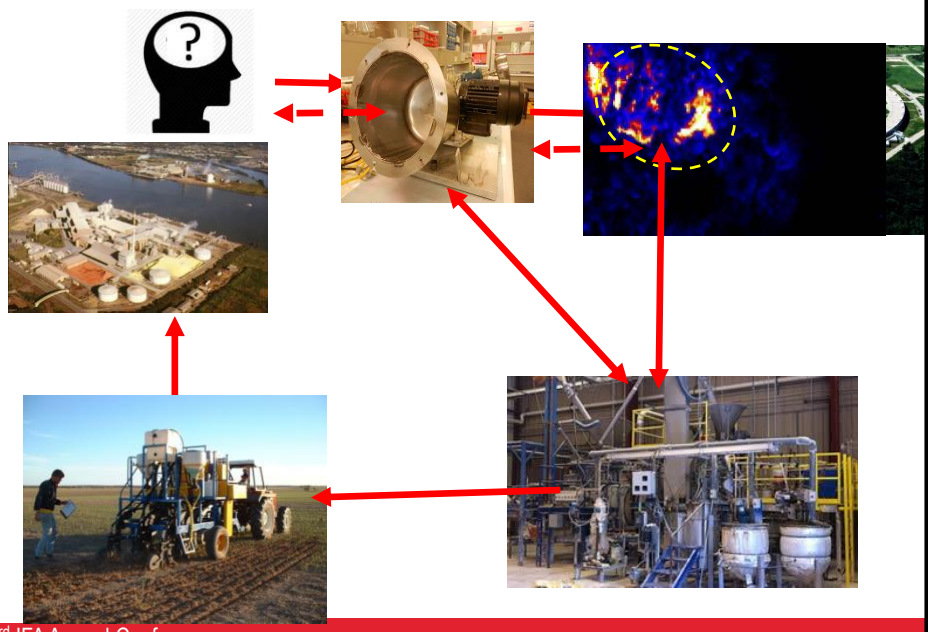


Photo: Courtesy Prof. Ismail Cakmak, Sabanci University

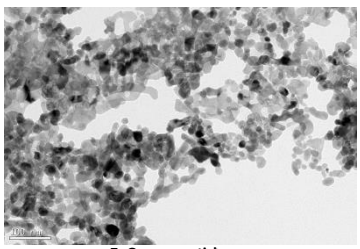
Effective innovation

Developing effective fertilizers



Fertilizer efficiency - the future

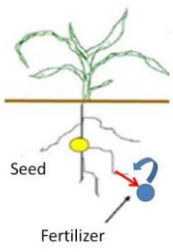
- Nanofertilizers and nanocomposite fertilizers



ZnO nanoparticles

(Nanostructure & Amorphous Material Inc., USA)

- Signalling fertilizers & biostimulants



Acknowledgements

Acknowledgements

Mosaic™

Australian Government
Grains Research and Development Corporation
GRDC Grains Research & Development Corporation

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AUSTRALIAN SYNCHROTRON RESEARCH PROGRAM

Australian Government
Australian Research Council

IPNI INTERNATIONAL PLANT NUTRITION INSTITUTE

Fluid Fertilizer Foundation

SAGIT

Further information

www.adelaide.edu.au/fertiliser/