

# Challenges, environmental and health concerns of nanofertilizers

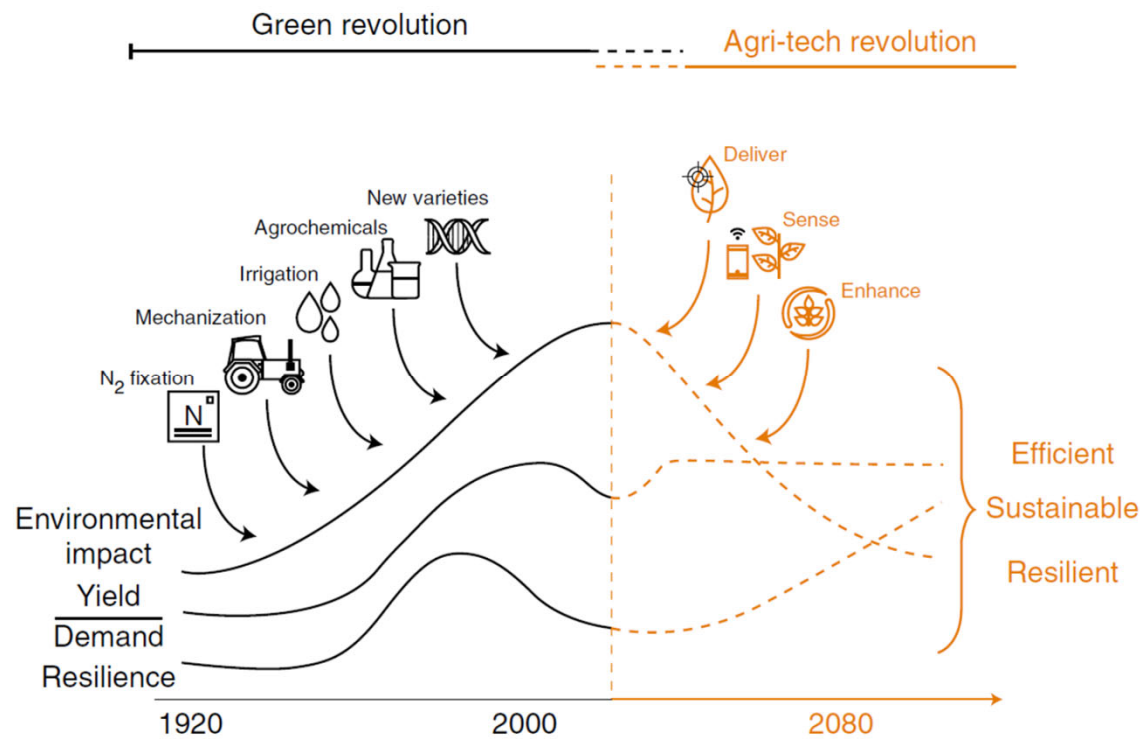
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**THE UNIVERSITY OF  
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# Agri-tech revolution

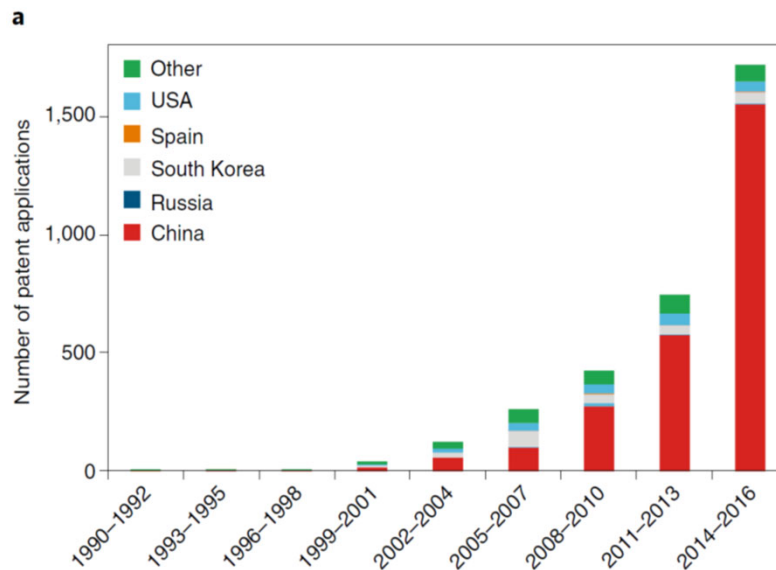


## Nanomaterials <100 nm

- Can cross barrier
- Can be tuned to new functionalities



Overview on nano-strategies to improve use of light, water, agrochemicals



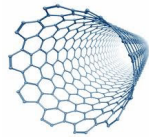
**Number of patents for nano + agrochemicals**  
**Google Patents search**

((agri\*) OR (agro\*) OR ("crop protection") OR ("plant protection") OR ("crop yield") OR ("plant yield") OR (pesticide) OR (herbicide) OR (fertilizer) OR OR (micronutrient) OR (fungicide) OR (insecticide)) AND (nano\*)). Application phase

# Many different types of nanomaterials

## FIRST GENERATION

Carbon nanotubes



C60



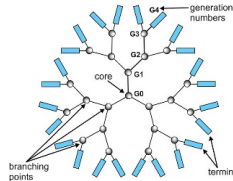
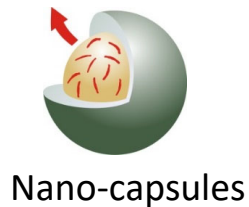
Metal/metal oxides



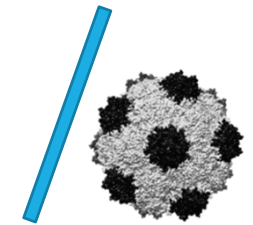
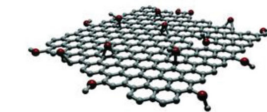
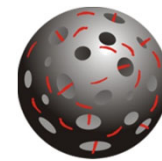
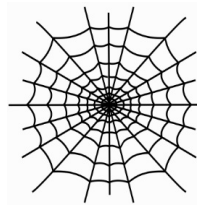
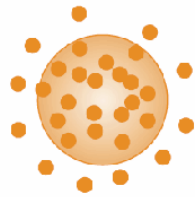
## SECOND GENERATION

Often nanocarrier loaded with an active substance:

- Existing (→ reformulation)
- Novel (e.g. pheromones, RNAi, biostimulants)



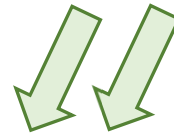
Dendrimers



# Key objectives of nano-agrochemicals

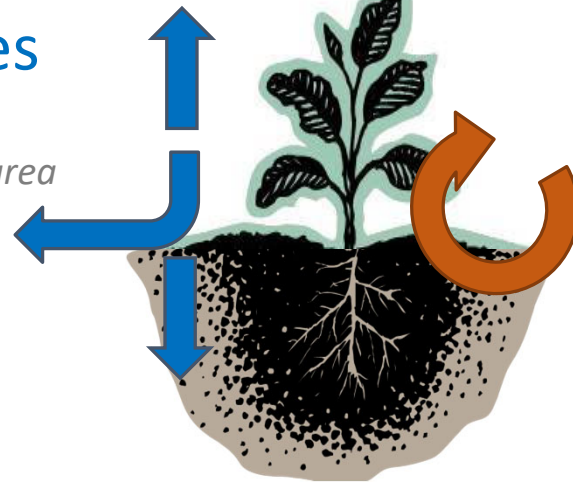
## More efficient application

*Stable suspensions  
Homogeneous coverage  
More precise target area*



## Reduced losses

*Reduced photolysis and  
transport to non-target area*

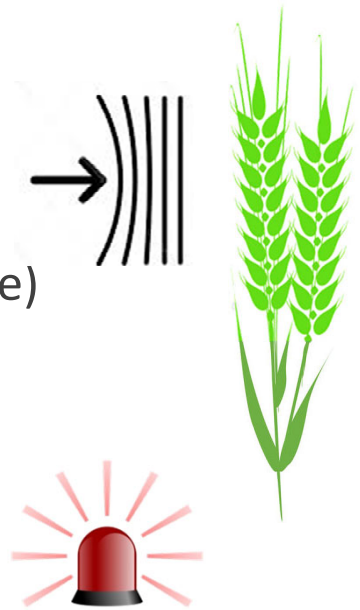


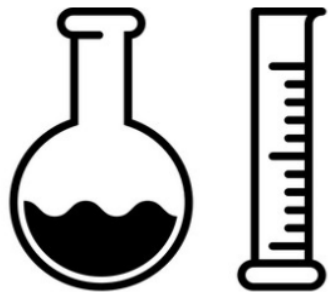
## Improved bio-interactions

*Improved uptake  
Controlled release  
Target delivery*

# What else can they do?

- Plant nutrition as a defence against disease
- Nanoparticles to increase **resilience** (drought, salinity, temperature)
- Crop **biofortification**
- **Nano-sensors** for plant stress (pathogens, water, nutrient status)
- **Soil** structure and health





Critical evaluation  
against current solutions

Validation of  
**performances**

Field studies

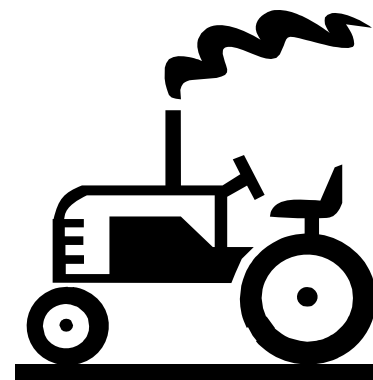
Cost analyses,  
accessibility

Environmental  
fate

Toxicity

**Regulatory  
compliance**

Detection and  
characterization





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# Thank you

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IF YOU HAVE QUESTIONS OR COMMENTS: [MELANIE.KAH@AUCKLAND.AC.NZ](mailto:MELANIE.KAH@AUCKLAND.AC.NZ)