



# Plant Growth-Promoting Microbes

*Improving yield and resource use through beneficial plant-microbe interactions*

# About me

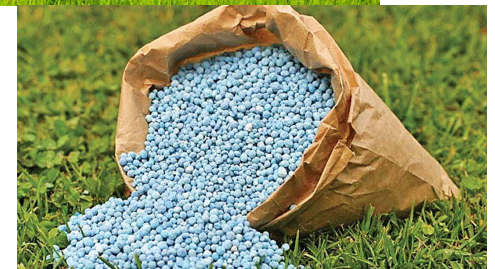
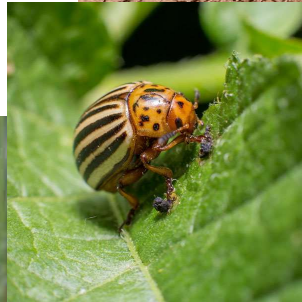


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# Problems



# Problems



# The Challenge

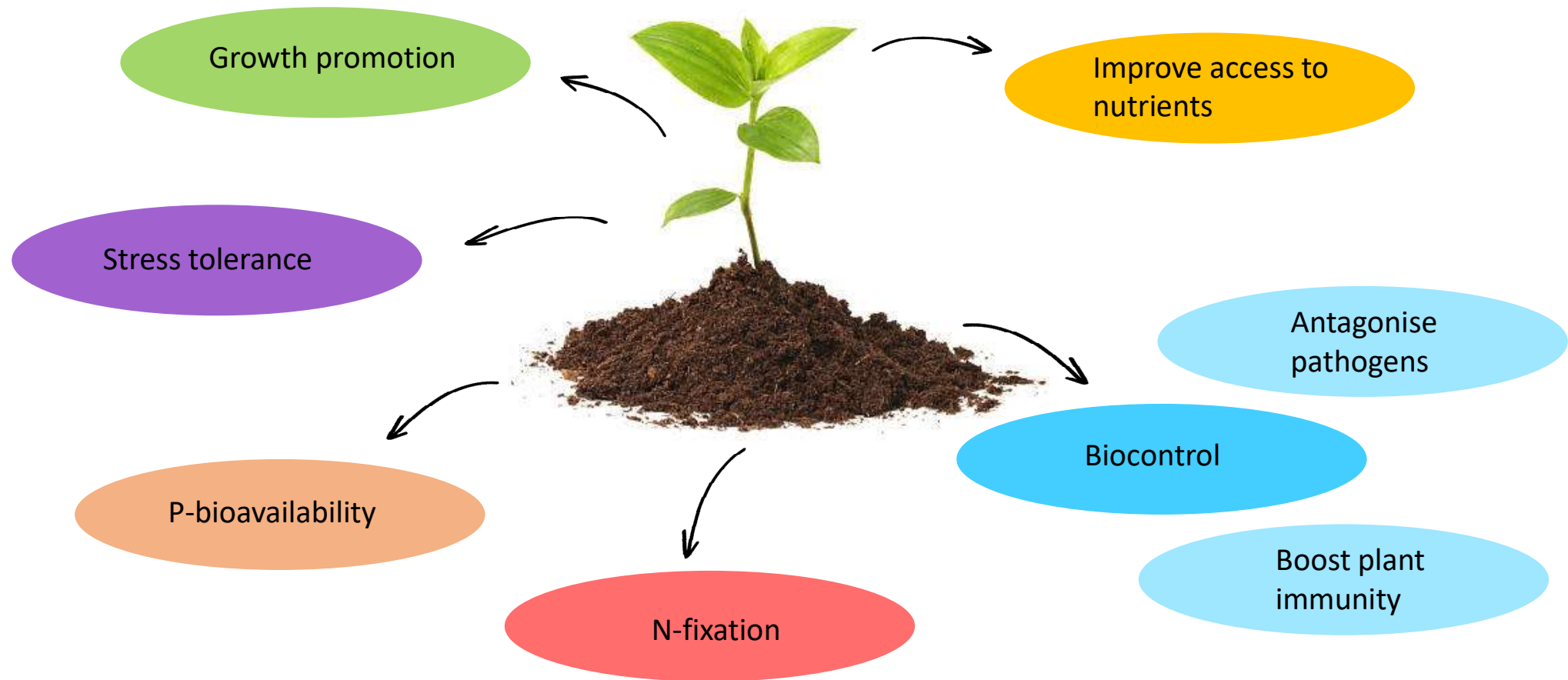
- Fertilisers
- Pesticides, fungicides
- Drought/salinity/extreme weather
- Disease management



Higher yields  
using fewer  
resources



# Beneficial plant-microbe interactions





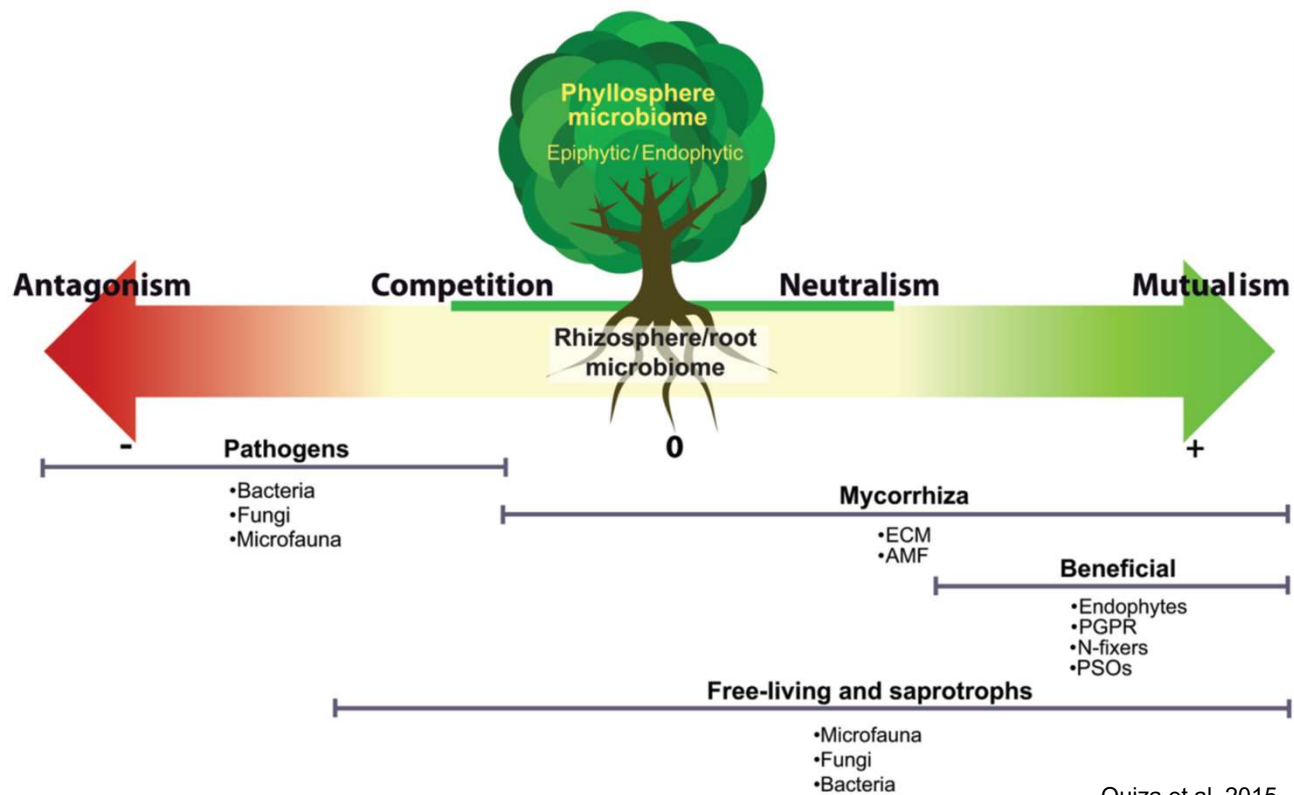
# The metaorganism concept



- Plants and microorganisms are actively interacting
- Influencing each others physiology
- Increasingly studied as one entity
- Plant health and productivity is dependent on health of microbial community
- Same functionality of microbes, despite different soils hosting genetically different organisms

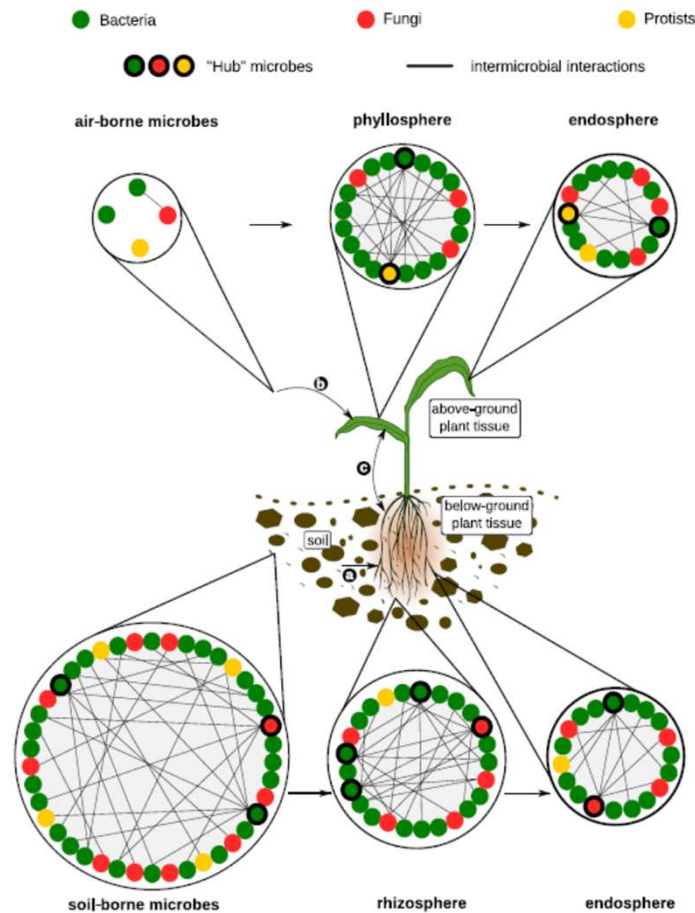


# Plant-microbe interactions: a spectrum



Quiza et al. 2015

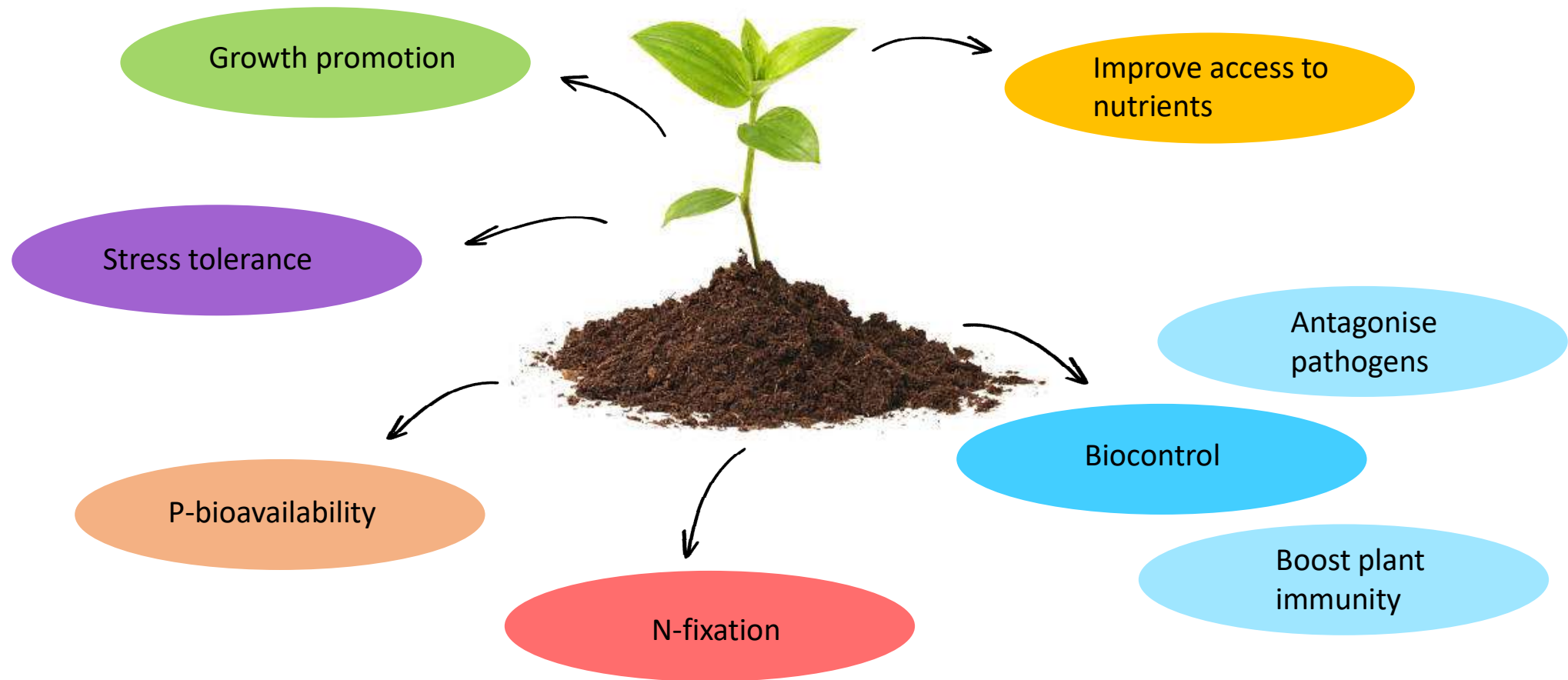
# Microbial community niches

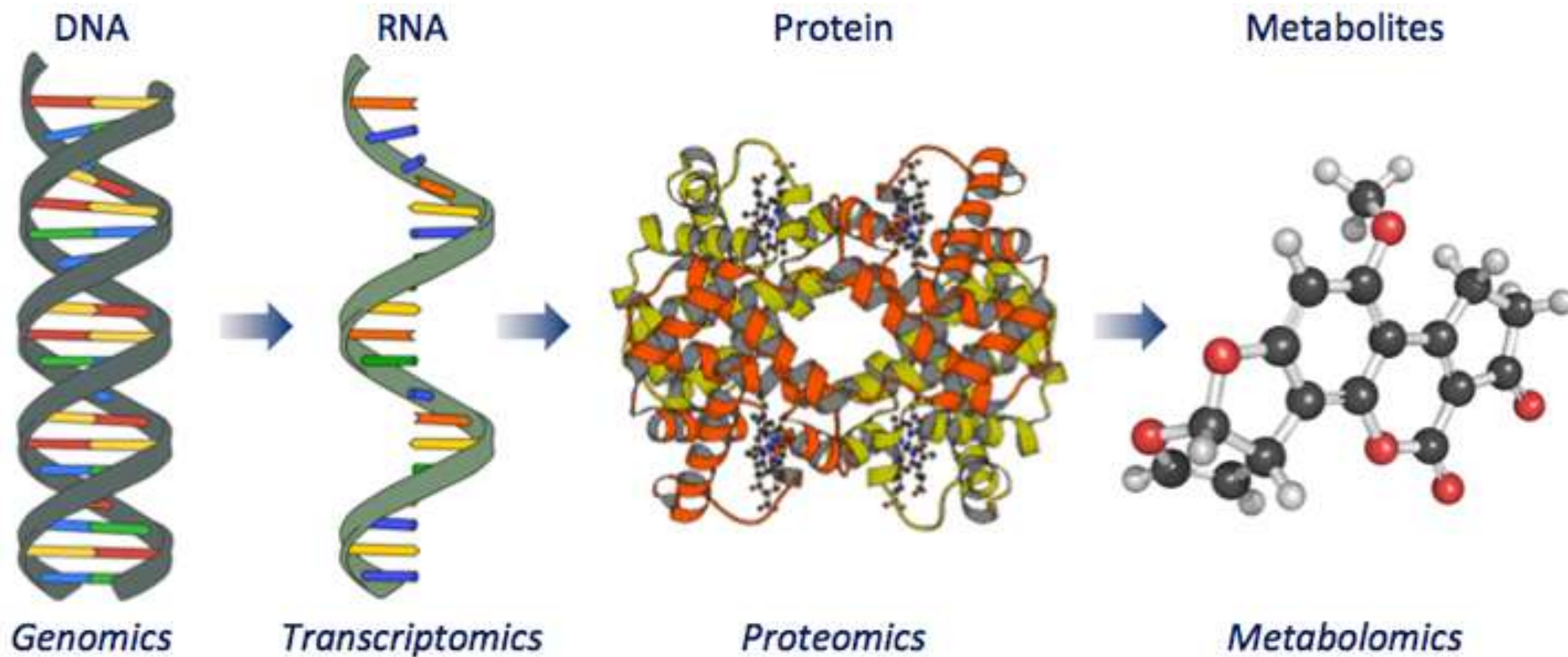


Hassani et al. 2018

- Microorganisms colonize both the exterior and the interior of the plant
- Keystone species can be identified – species that are expected to exert stronger impact on the microbial community structure

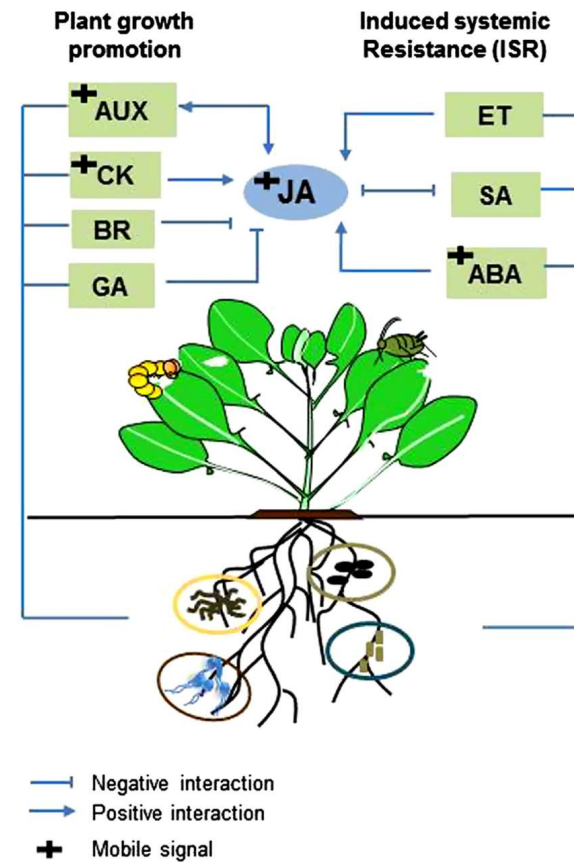
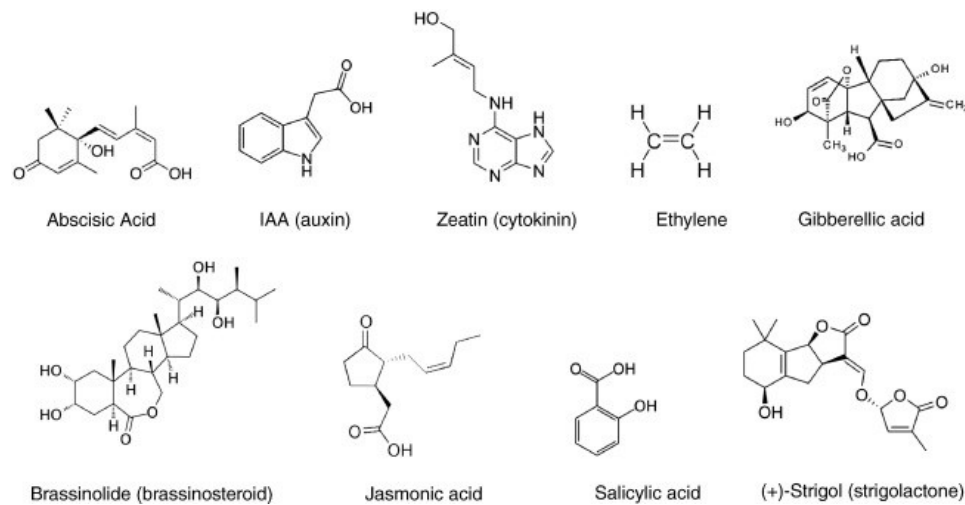
# Beneficial plant-microbe interactions





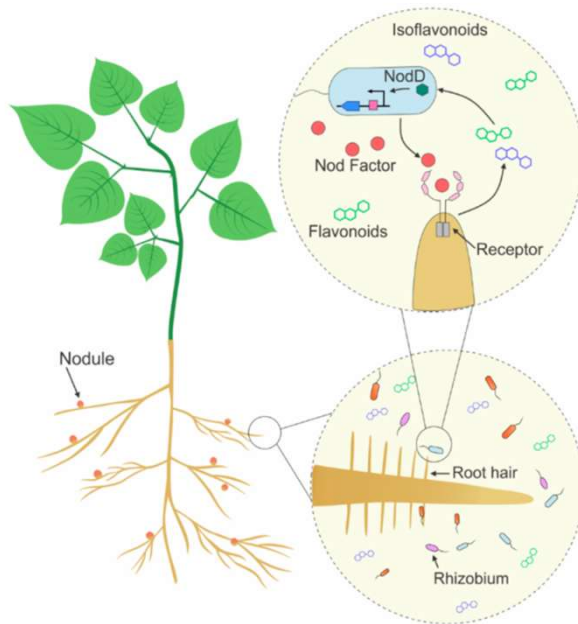
# Growth promotion & stress tolerance

- Phytohormones, volatiles

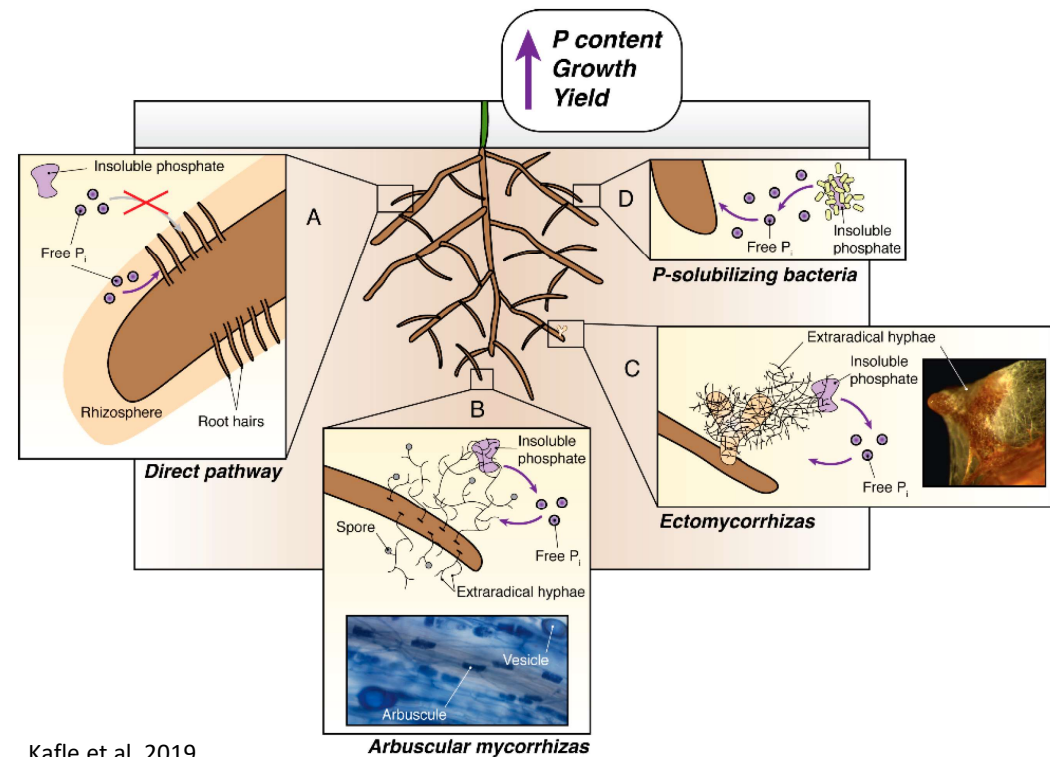


# N-fixation & P-bioavailability

- Enzymes, volatiles



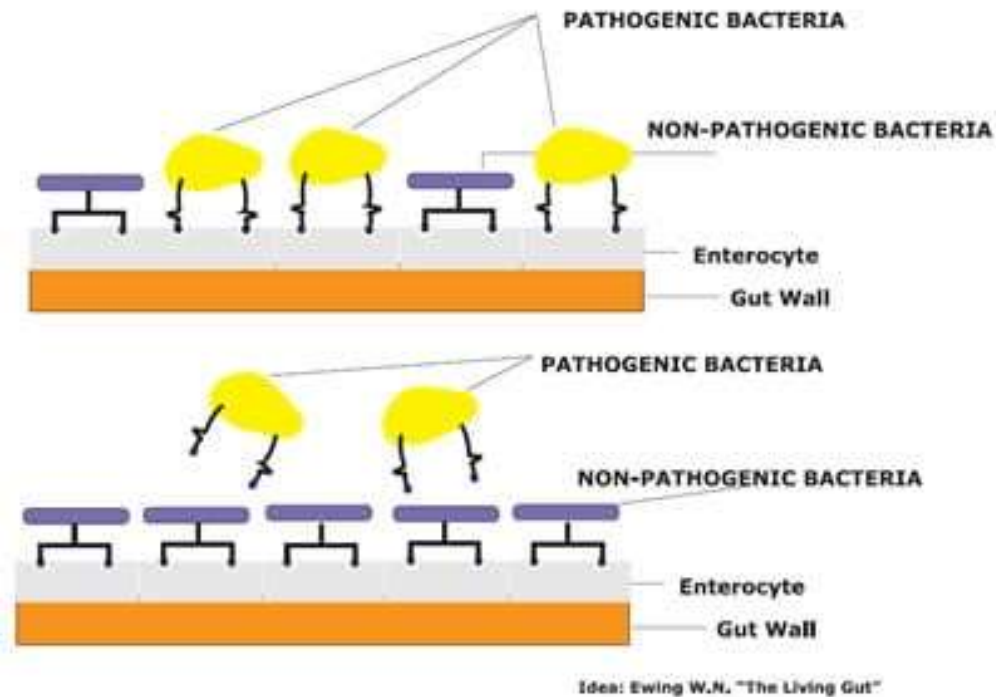
Clúa et al. 2016



Kafle et al, 2019

# Biocontrol

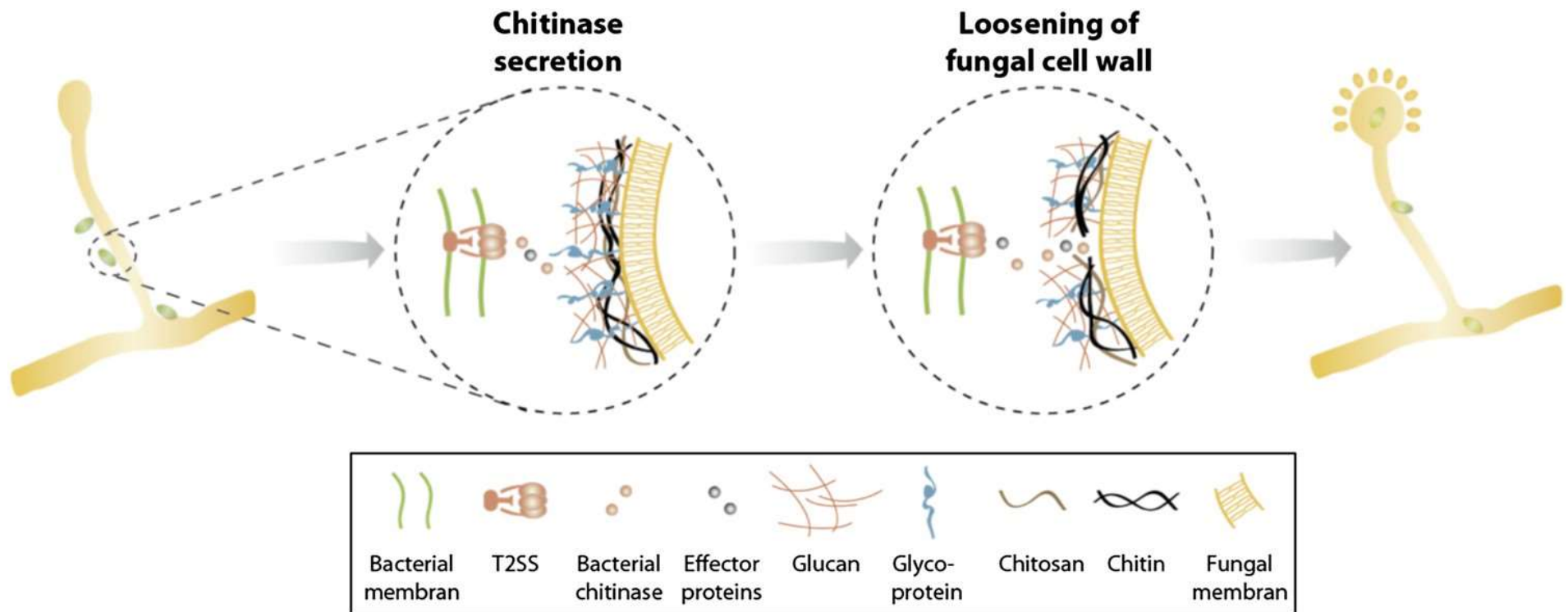
- Competitive exclusion - competition for space and/or nutrients





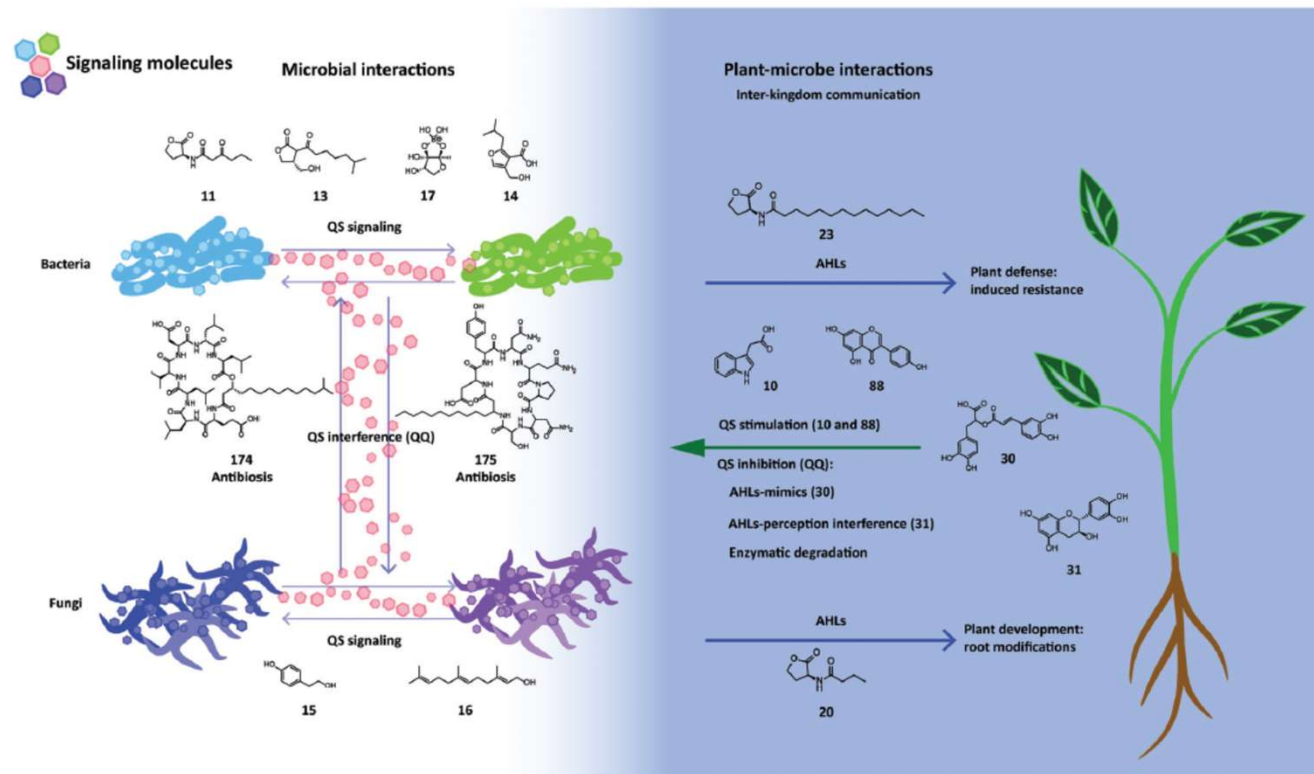
# Biocontrol

- Direct antagonism via metabolites, enzymes



# Biocontrol

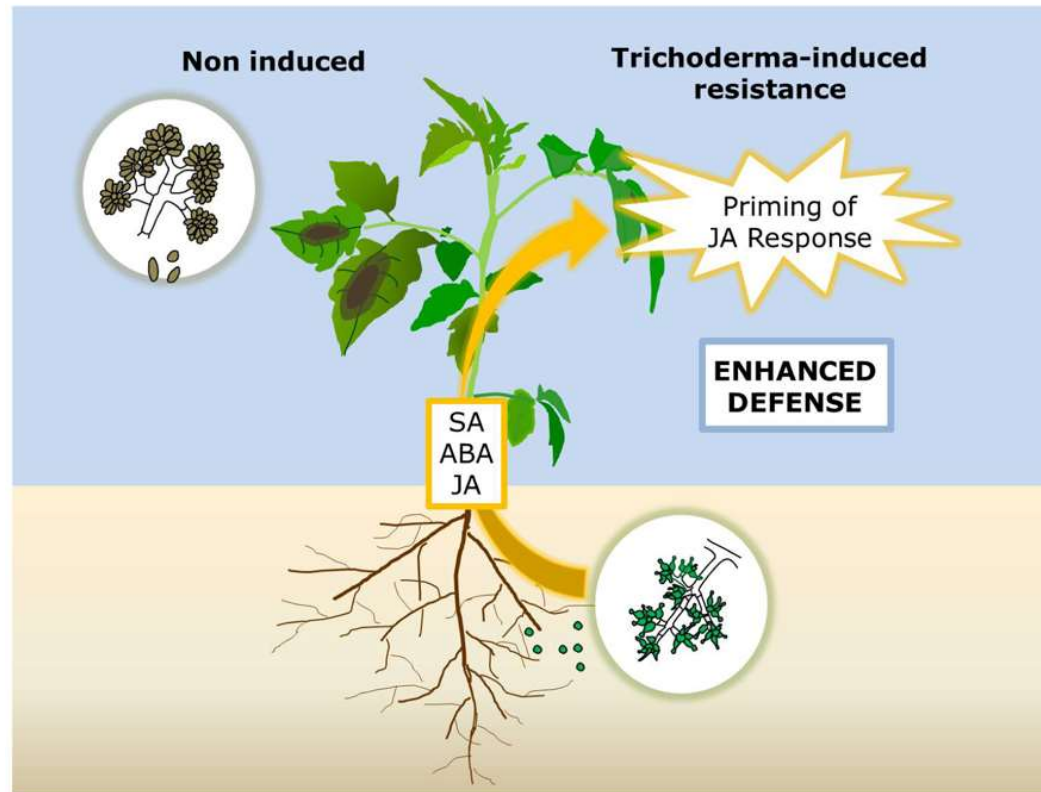
- Interfering with quorum sensing



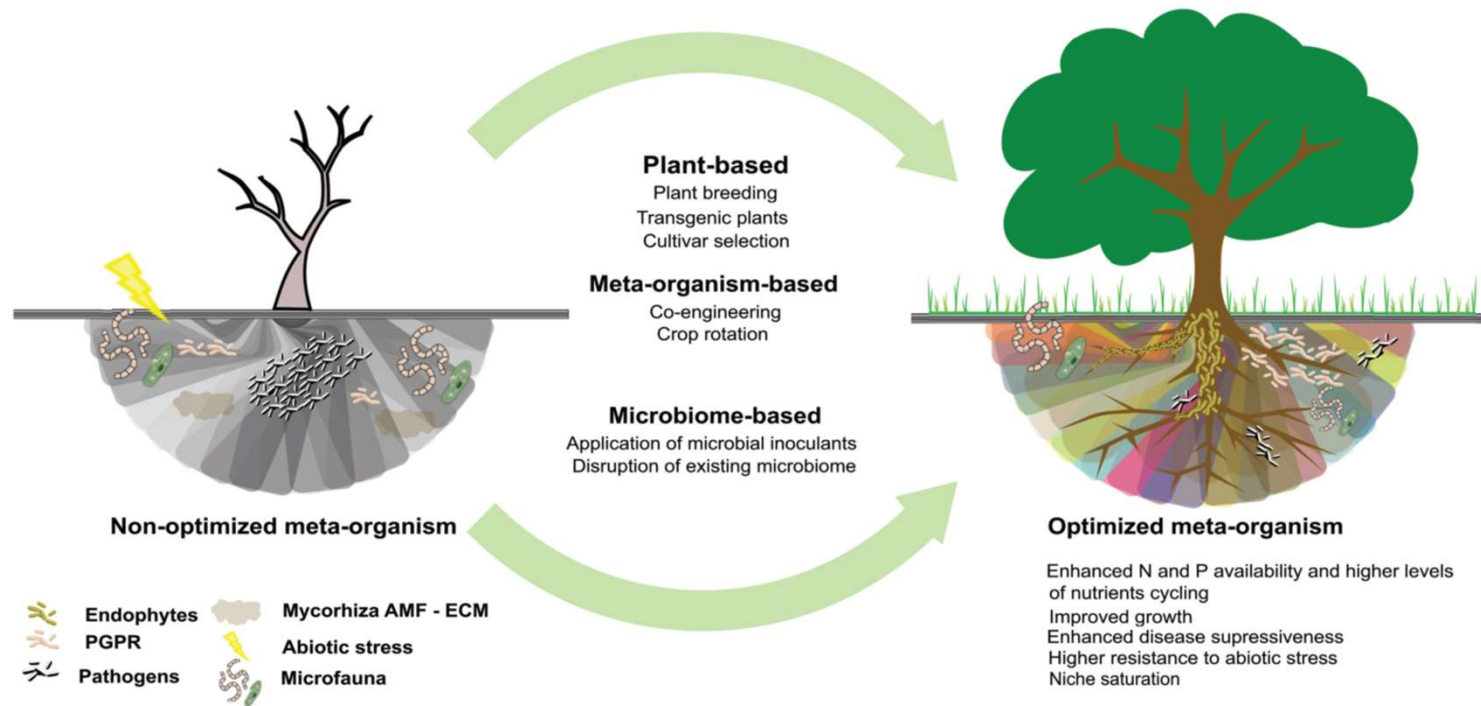
Chagas et al. 2018

# Biocontrol

- Induced systemic resistance in plants



# Optimization





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What is  
BIOTECHNOLOGY?

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# Biotechnological approaches

- Identify beneficial microbes
  - Isolate from soil
  - Metagenomics
- Study molecular mechanisms: signal-receptor-pathway
- Apply whole organisms or isolated enzymes/metabolites

# Issues

- From lab to field
  - Growing soil microbes in lab, dual-culture assays insufficient
- Formulation
- Effect on existing soil microbial community



Thank you 😊