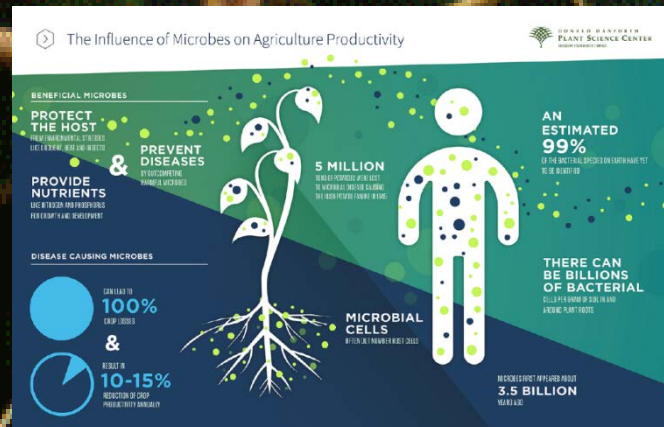
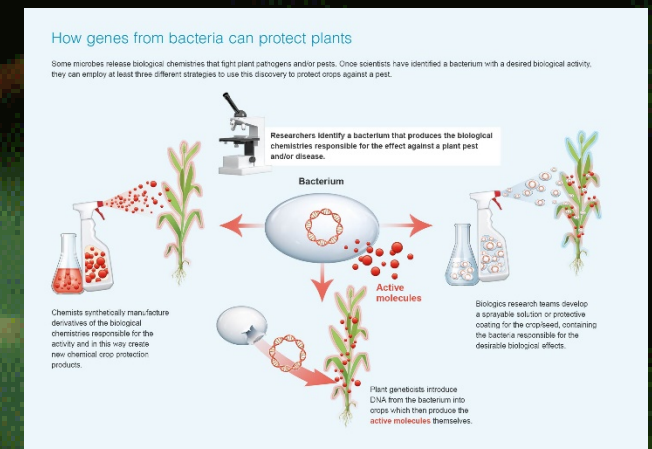


Development of Environmentally Friendly Inputs for the Agricultural Industry

Biofuels Feedstock and Food Crops

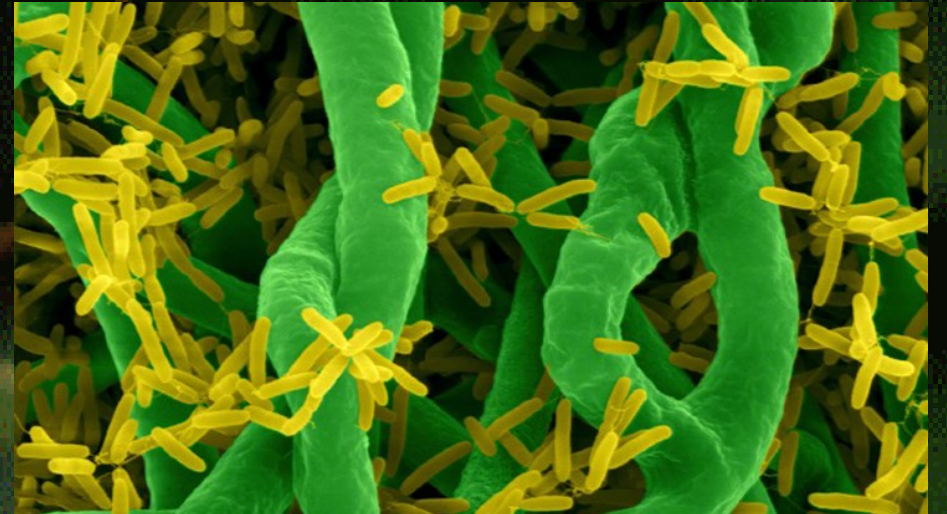


Donald L. Smith
Plant Science
McGill University



Why?

- We are realizing that plants, like mammals, have a microbiome
 - Phytomicrobiome
- Community of microbes associated with all plant parts
 - Roots, in humid soil, have most well developed
- Help in a wide range of ways
 - Nutrient mobilization
 - Hormone production
 - Disease control
 - Signals



Why?

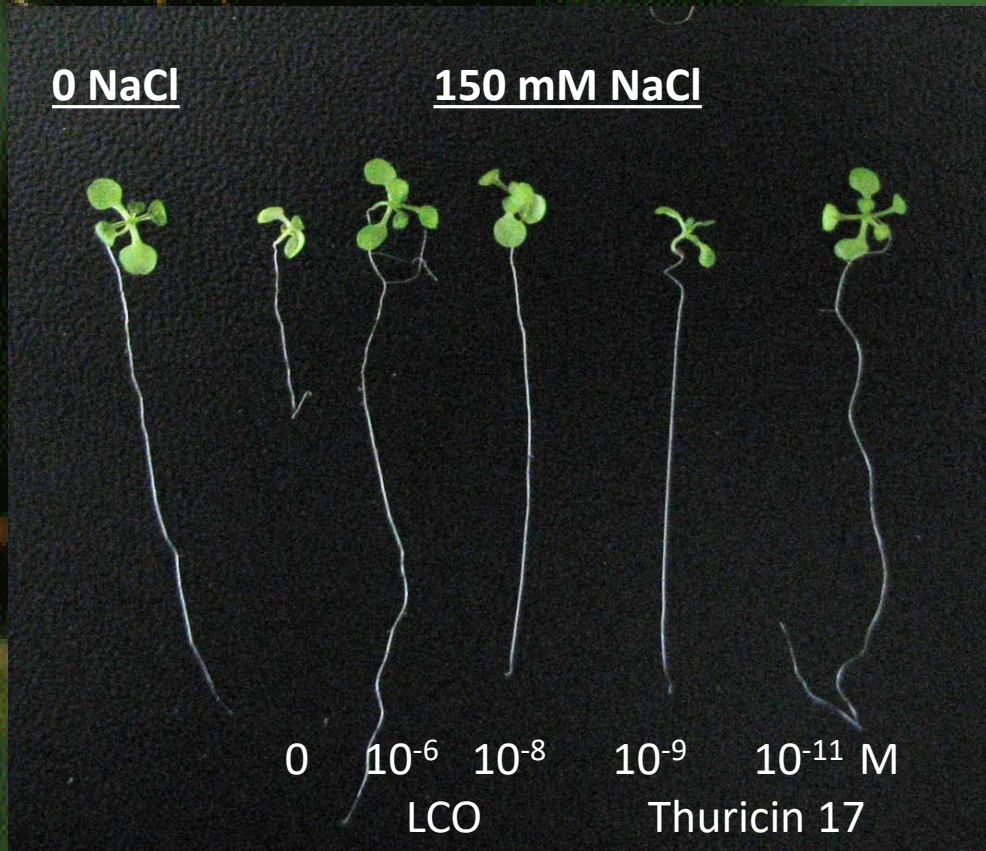
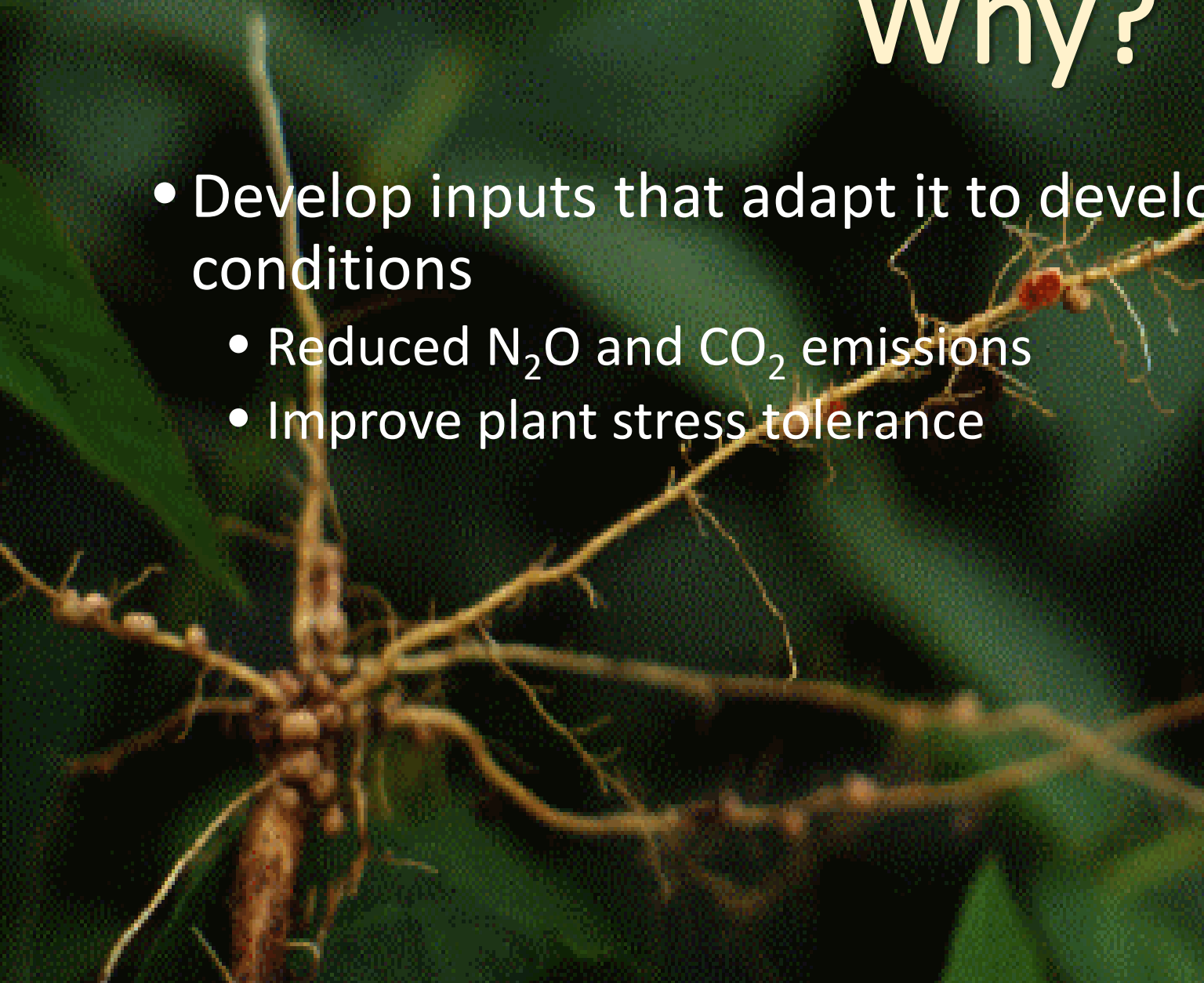
- Reduce the environmental footprint of agricultural
 - Nitrogen fixation
 - Reduced N_2O emissions
 - Reduced CO_2 emissions from fertilizer manufacture
 - Reduced contamination of ground and surface water
 - Also reduces crop production costs
 - Nutrient mobilization (mycorrhizal fungi, bacteria)
 - Less eutrophication of waterways by P
 - Reduced use of chemical pesticides



Why?



- Develop inputs that adapt it to developing climate change conditions
 - Reduced N₂O and CO₂ emissions
 - Improve plant stress tolerance



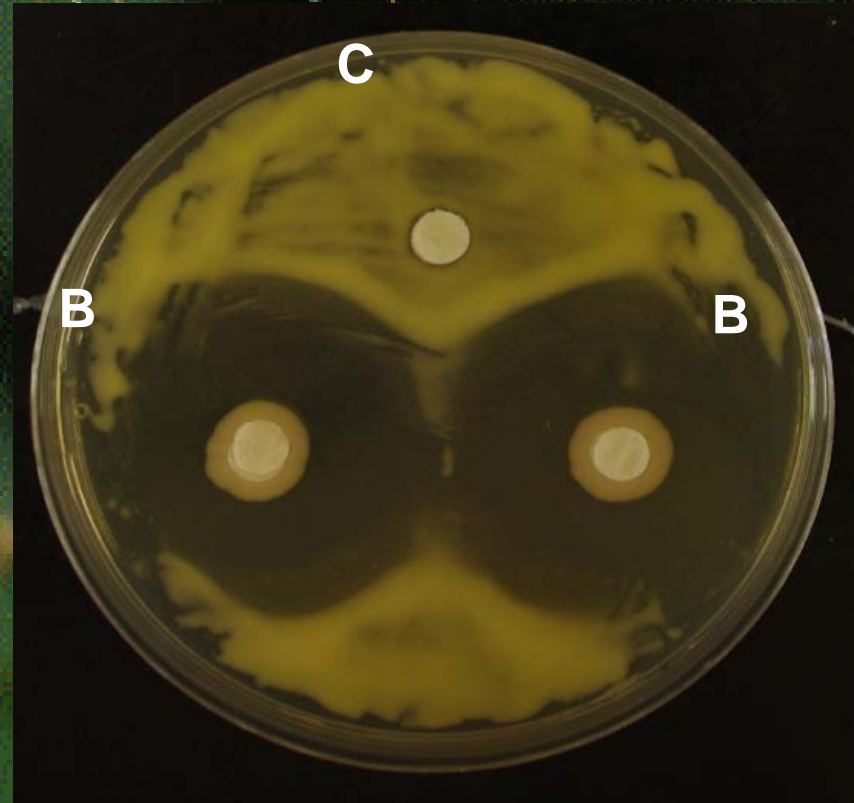
Why?

- Advanced biofuel biomass production
 - On “marginal” lands to compete little with food production
 - More frequently stressed because of this
 - Shallow soils
 - Dry
 - Nutrient limitations
 - Allows more production on these soils
 - Food crops more productive so more crop residue
 - More advanced biofuel production, so more reduction in CO₂ emissions from fossil fuels



What?

- Biological inputs
 - Addition of small amount of inexpensive materials that enhance crop growth
 - Reduced costs
 - Enhance stress resistance
 - Both abiotic and biotic
 - Improve yield



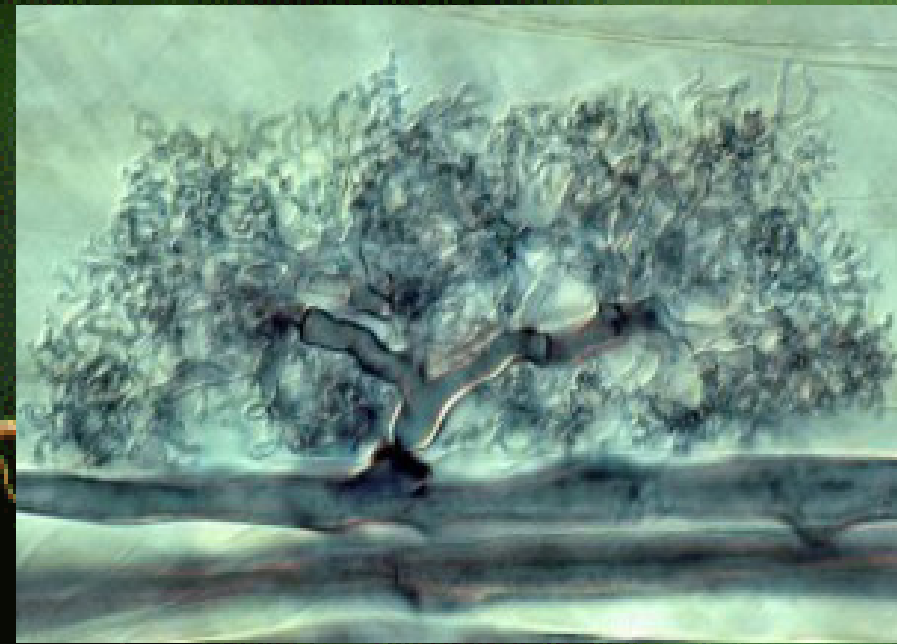
What?

- N₂ fixation inoculants for legumes
- Rhizobia (*Rhizobium*, *Bradyrhizobium*, *Sinorhizobium*, etc.)
- Widely used for over a century



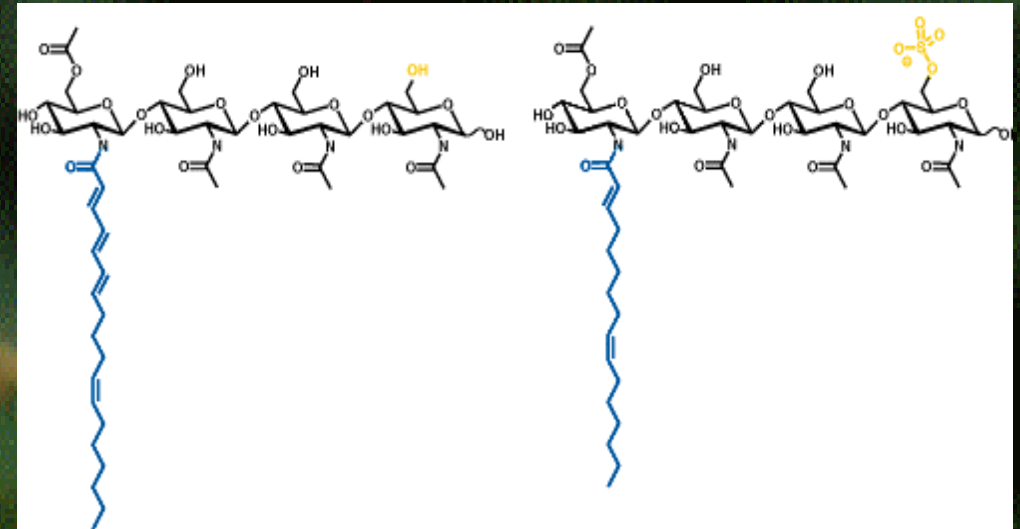
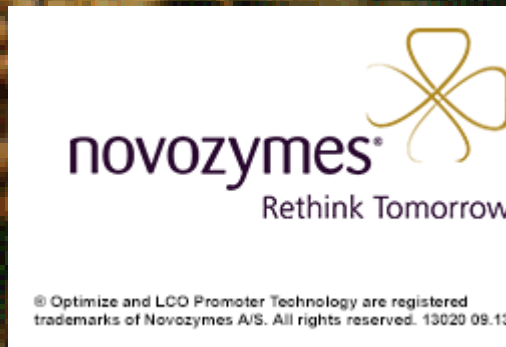
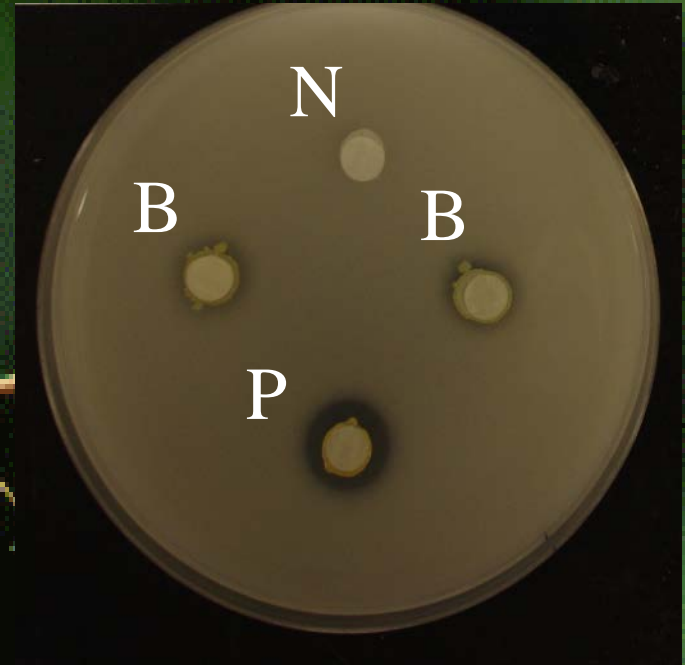
What?

- Mycorrhizae
- Difficult to produce
- Now commercially available



What?

- Others:
 - P mobilizers
 - Consortia
 - Signals



Lipo-chiooligosaccharides

Who?

- Scope is large
- Collaboration
 - Basic research labs
 - Academic
 - Government
 - Industry laboratories



Agriculture and
Agri-Food Canada

BASF

The Chemical Company

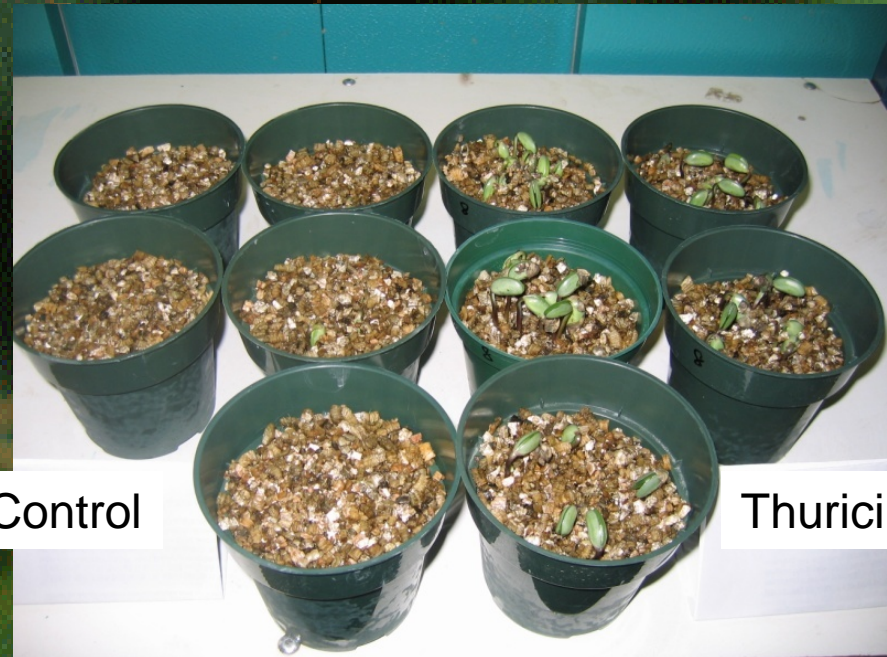
inocucor[®]
THE PHYTO-MICROBIOME COMPANY[®]



McGill
UNIVERSITY

How?

- Sample plant-associated microbes
 - The phytomicrobiome
- Efficient/rapid screening to identify microbes of interest
- Biological assessments
- Agronomic assessments



How?

- Collect microbes that can be cultured
 - Crop plants
 - Specific resilient species
 - Range of habitats
- Efficient/rapid screening for early growth response
 - Seed germination
 - Seedling emergence
 - Early seedling growth



How?

- Biological assessments
 - Controlled environment growth
 - Photosynthetic activity
 - Gene and protein expression
- Agronomic assessments
 - Field experiments
 - Range of soils and climates
 - Reduced inputs allowing full yield
- Regulatory process
- Commercialization



The End



Thank You!