

Uncovering bacterial mechanisms to reverse phosphorus fixation in tropical soils

Project for Young Investigator Award

Research areas: microbiology and molecular biology

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Our ability to ensure food security is underpinned by phosphorus (P) availability

P is essential for growth and development of plants

Phosphate rock is finite and will be depleted within 30 – 300 years

P reserves are concentrated in Morocco, Iraq, China, Algeria, and Syria

2/3 of world's agricultural soils are P deficient

Oxisol (Latosolo)

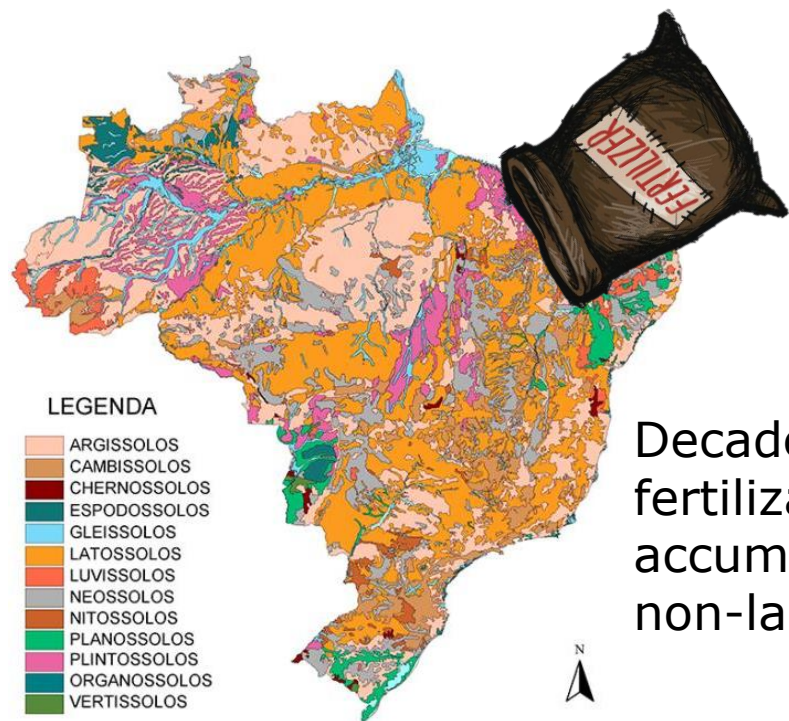
59% of Brazilian territory

Highly weathered/acidic

Naturally poor in P

Abundant in Fe and Al (hydr)oxides

Low organic matter content



Decades of intensive fertilization = accumulation of non-labile P

Source: Embrapa

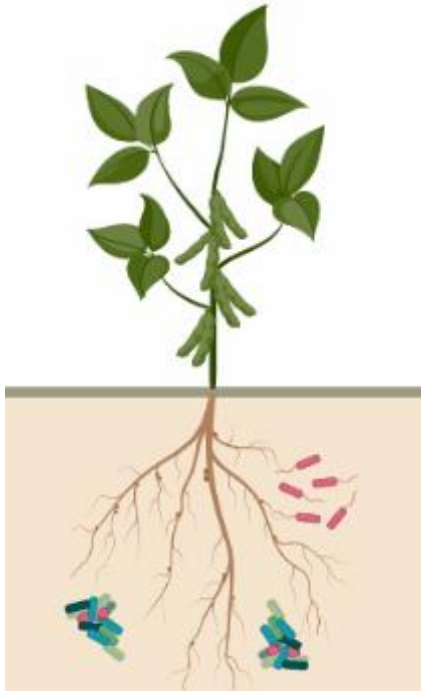
Project: "Uncovering bacterial mechanisms to reverse P fixation in tropical soils"

Motivations

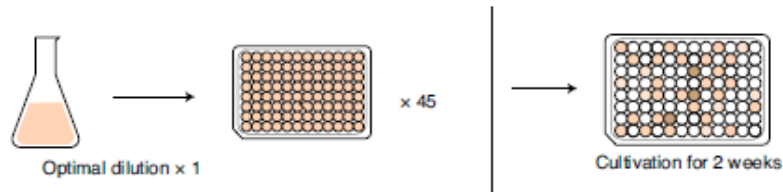
- Soil residual P: unexplored source of P
- Reduction of chemical fertilizers usage
- There is no technology for harnessing this stock of P

Project: "Uncovering bacterial mechanisms to reverse P fixation in tropical soils"

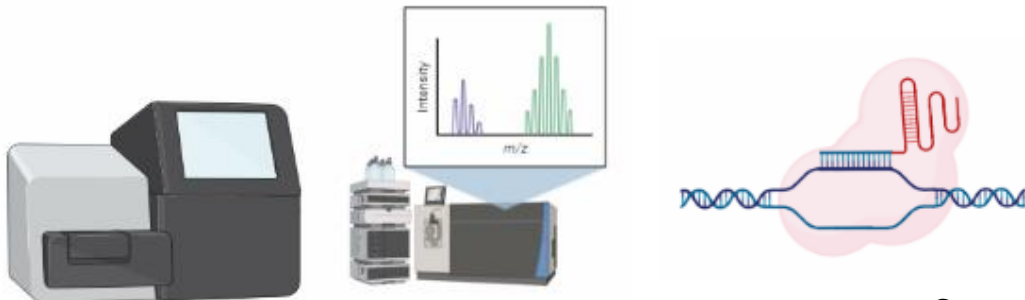
✓ Study the bacterial mechanisms of residual P mobilization in Brazilian oxisol



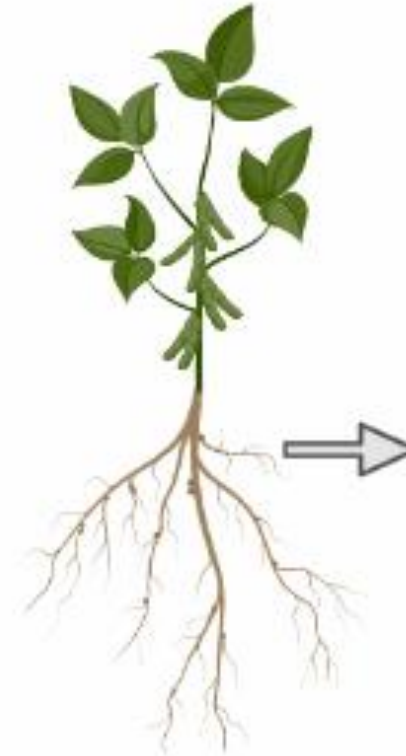
High throughput isolation of bacteria



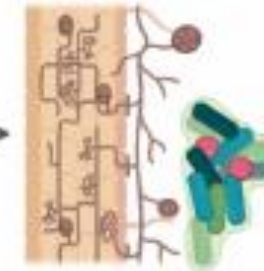
Multi-omics and CRISPR technology



✓ Develop biotechnological strategies for efficient residual P mobilization in field conditions



Strategy 1



Microbial bioinoculant

Strategy 2

Biosynthesis of P mobilizing compound



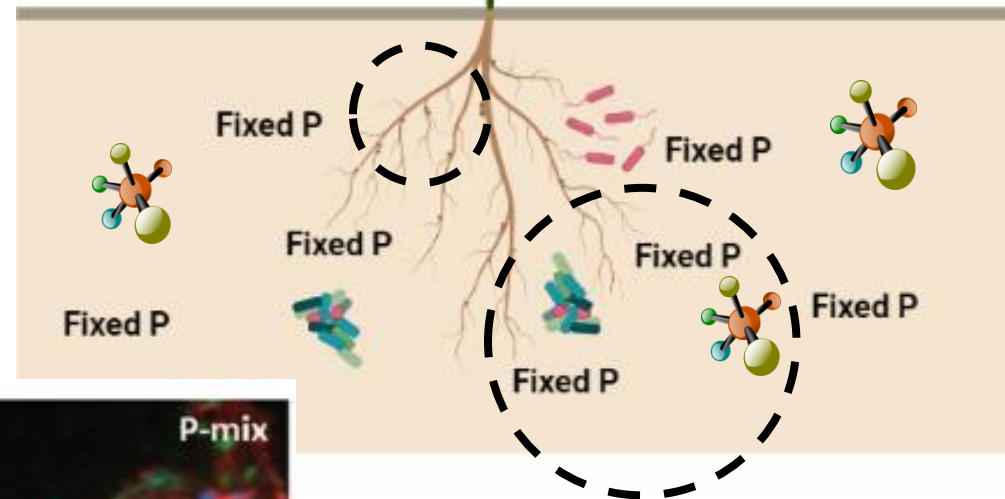
Validation of the proposed systems using Synchrotron light technologies



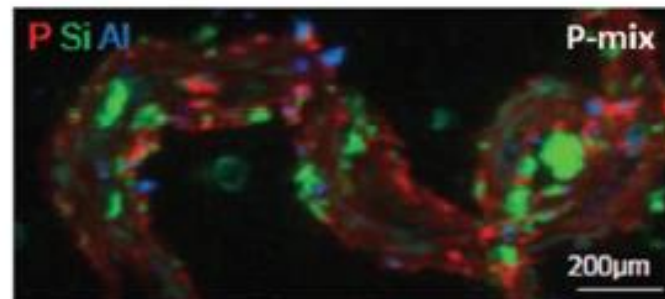
Brazilian Synchrotron
light National Laboratory



Desorption of soil P
by microorganisms
and biomolecules



P inside plant roots:
nutrient uptake



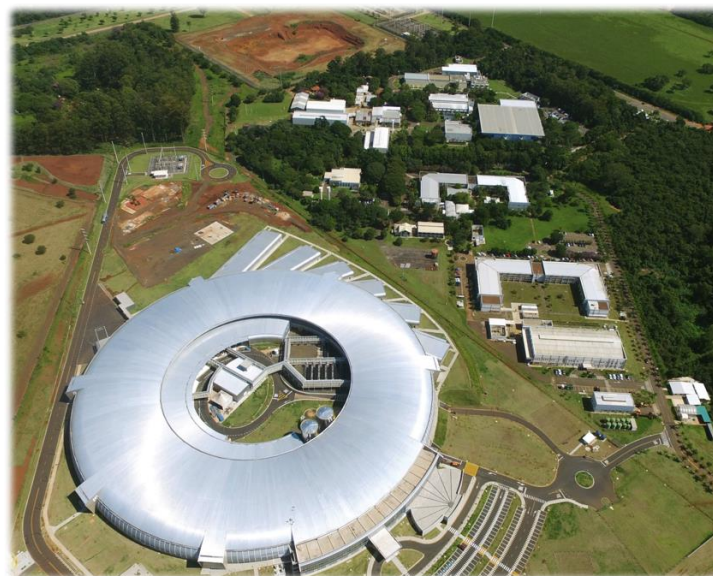
Varga et al. (2020)

Partners wanted

(examples, not limited to)

Dutch scientists:

- Mathematical/Computer modeler (e.g., investigation of P management strategies to optimize P use in agriculture)
- Soil scientists
- Plant scientist (e.g., specialist in root exudates, genetic modification to increase P use efficiency)
- Geologists
- Biologists



Campinas, São Paulo



Biorenewables



Synchrotron light



Nanotechnology



Biosciences

Collaboration partner interested in tackling the P problem in agriculture (e.g., industry seeking for nature-based solutions).

Thank you!



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