



Impacts of Macro- and Microplastics on Plant and Soil Health

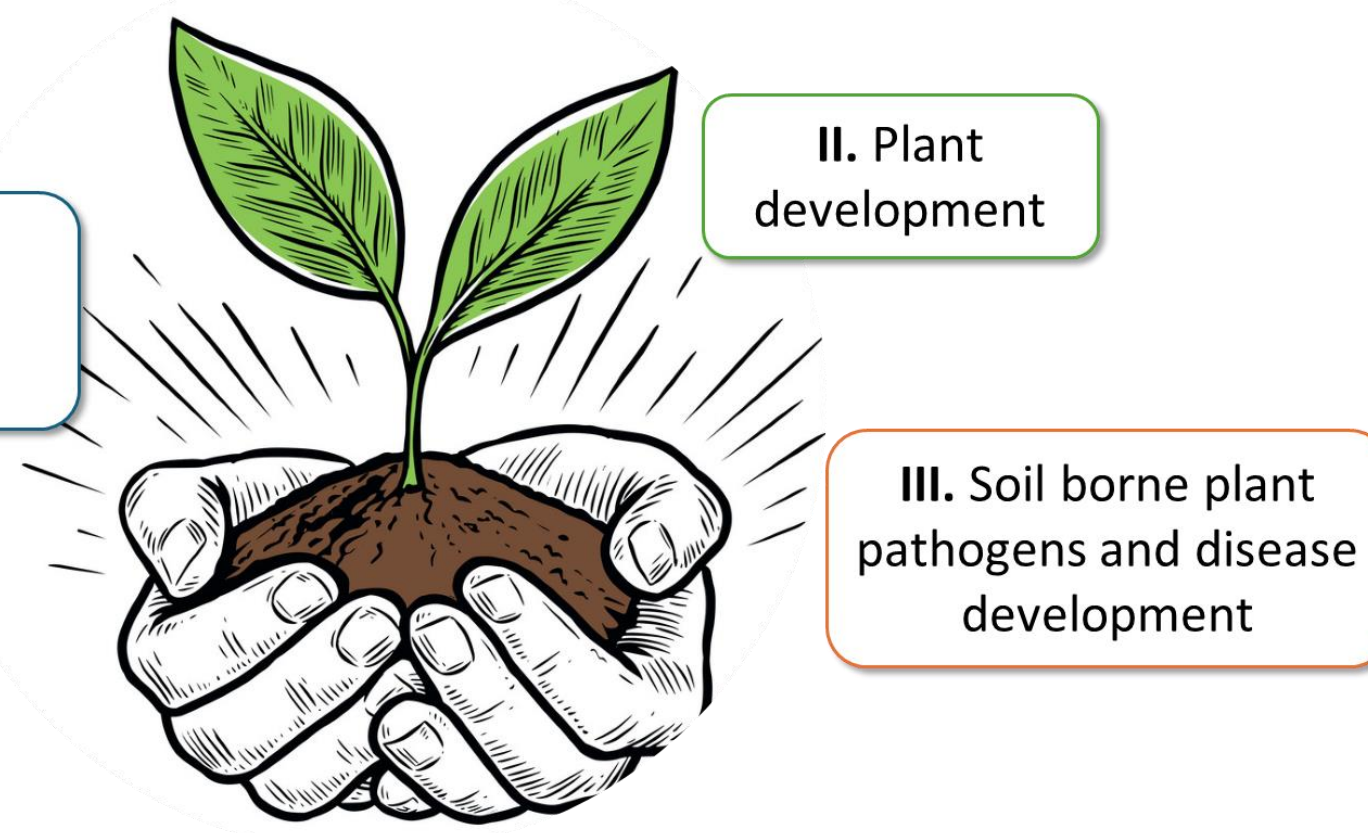
Giovana P.F. Macan^{1,2*}, Carmen Haro¹, Concepción Olivares-García¹, Guillermo León-Ropero¹, José Luis Trapero-Casas¹, Juan A Navas-Cortés¹, Blanca B. Landa¹

¹ Institute for Sustainable Agriculture, Spanish National Research Council (IAS-CSIC), 14004, Córdoba, Spain

² Programa de Doctorado de Ingeniería Agraria, Alimentaria, Forestal y de Desarrollo Rural Sostenible, Universidad de Córdoba, Córdoba, Spain

Introduction:

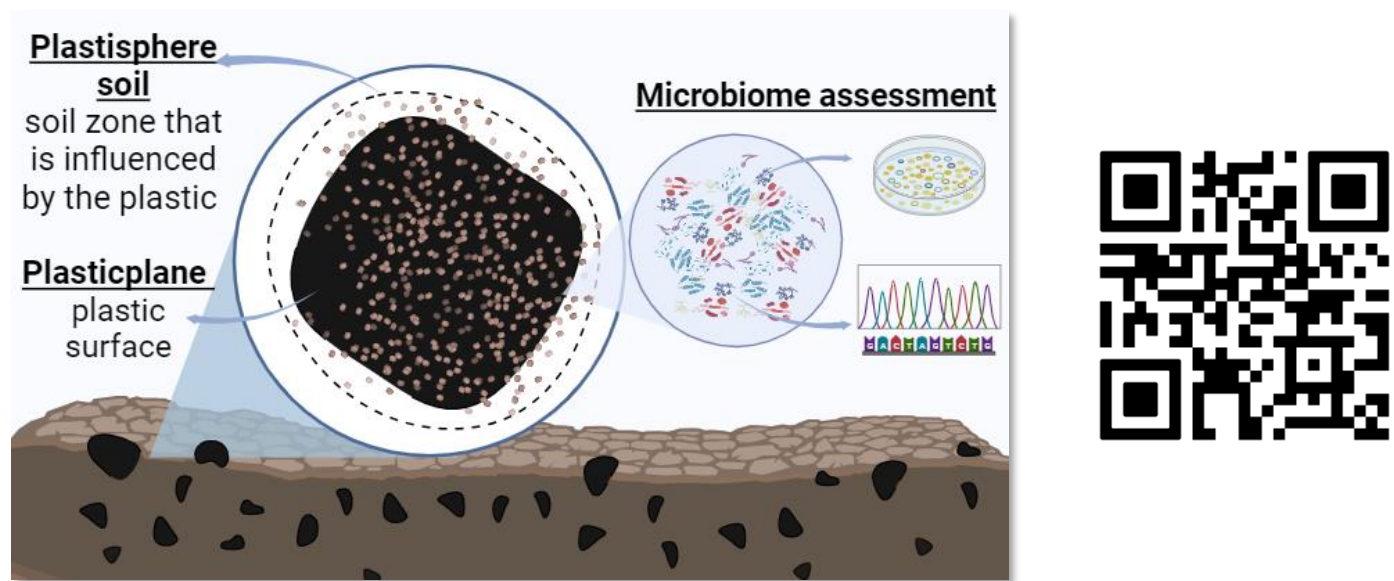
- **Plastics**: crucial role in **crop production** (greenhouse covers, plastic mulches)
- **Plastic pollution** on **agricultural soils**: improper disposal and accumulation
- Understanding the **impact** of these **anthropogenic materials**, particularly on **plant and soil health**, remains limited
- **PhD thesis**: impact of **macro- and microplastics** on **soil microbiome** functioning and diversity, **crop growth**, and **disease development**



Experiments and main findings:

Terrestrial Plastisphere:

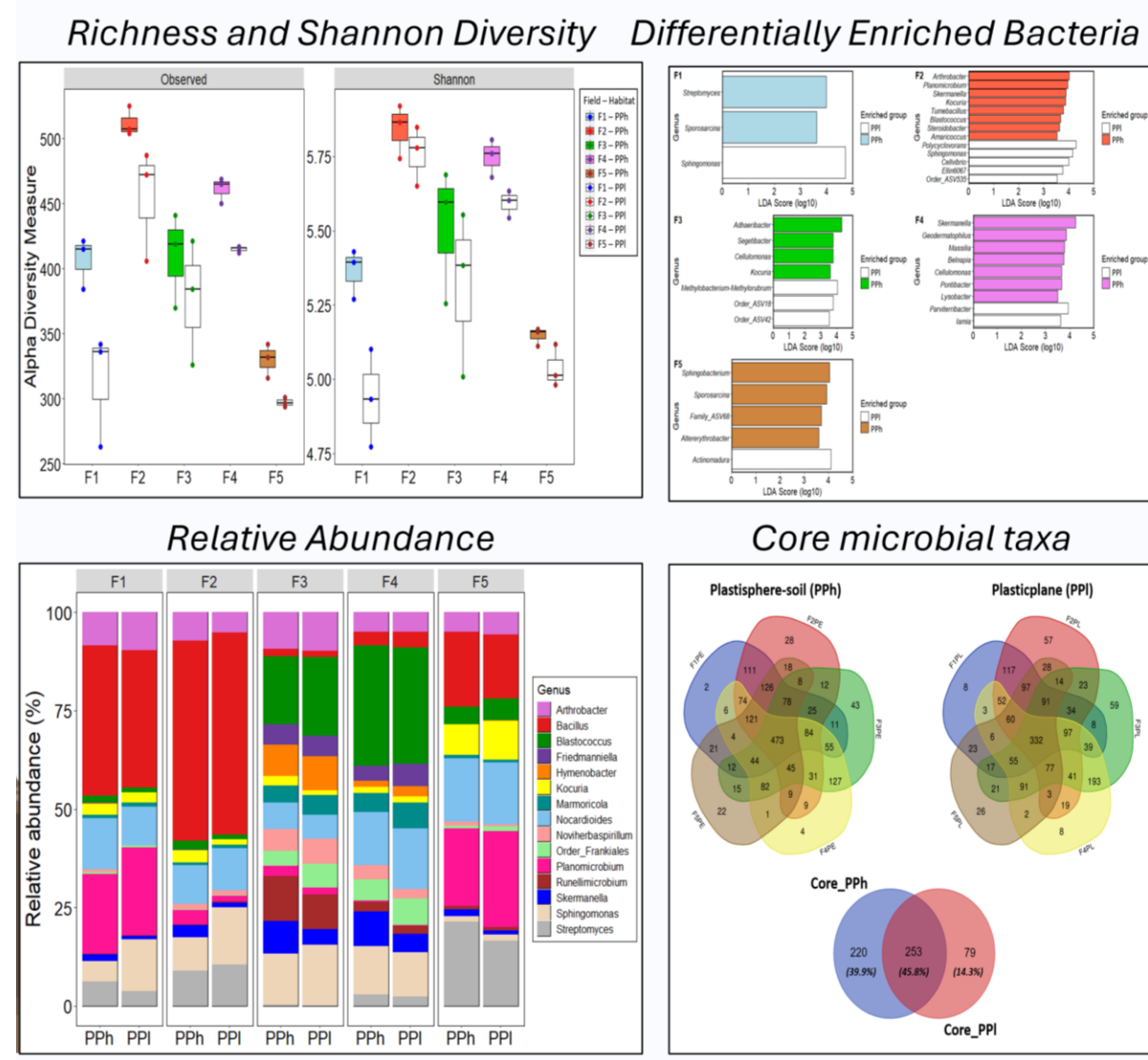
- What do we find on the **field**?



- Which **microorganisms** are colonizing these **plastic debris** ?
- Are they different from the **attached-soil** ?



- Methodology to assess the **microbial community** at the **soil-plastic interface**
- Enrichment or depletion of specific **taxa** on the **plastic surface**
- **Key bacterial genera** closely associated to plastic debris:
Bacillus, *Neocardioides*, *Nostrospira*, *Paenibacillus*, *Solirubrobacter*, and *Sphingomonas*



Macan et al. 2025. *Applied Soil Ecology*. <https://doi.org/10.1016/j.apsoil.2025.105900>

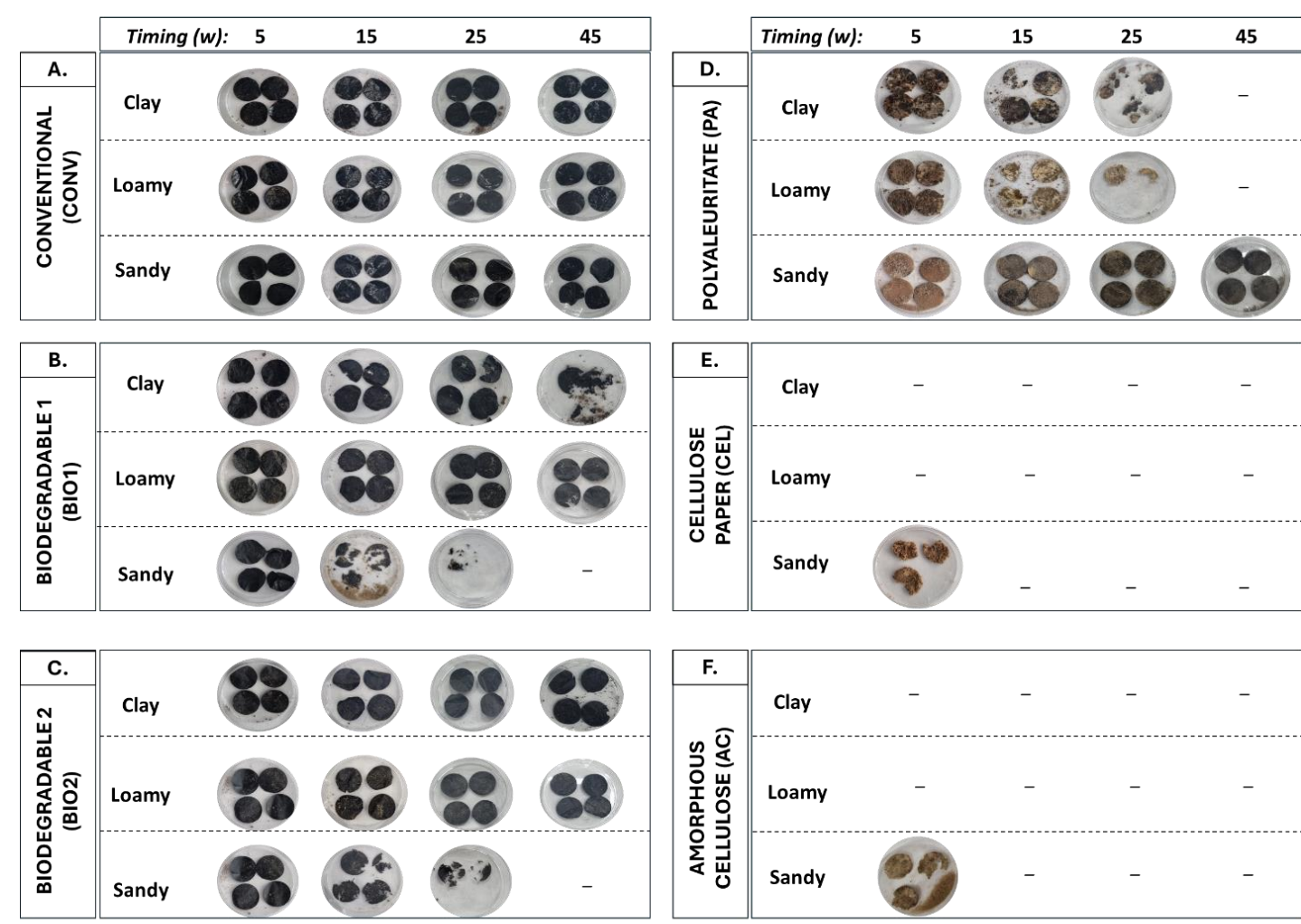
Temporal dynamics of plastisphere microbiome during polymer degradation in agricultural soils:

- How **conventional** and **biodegradable plastic mulch** vs **natural polymers** behave in different **soil types** ?



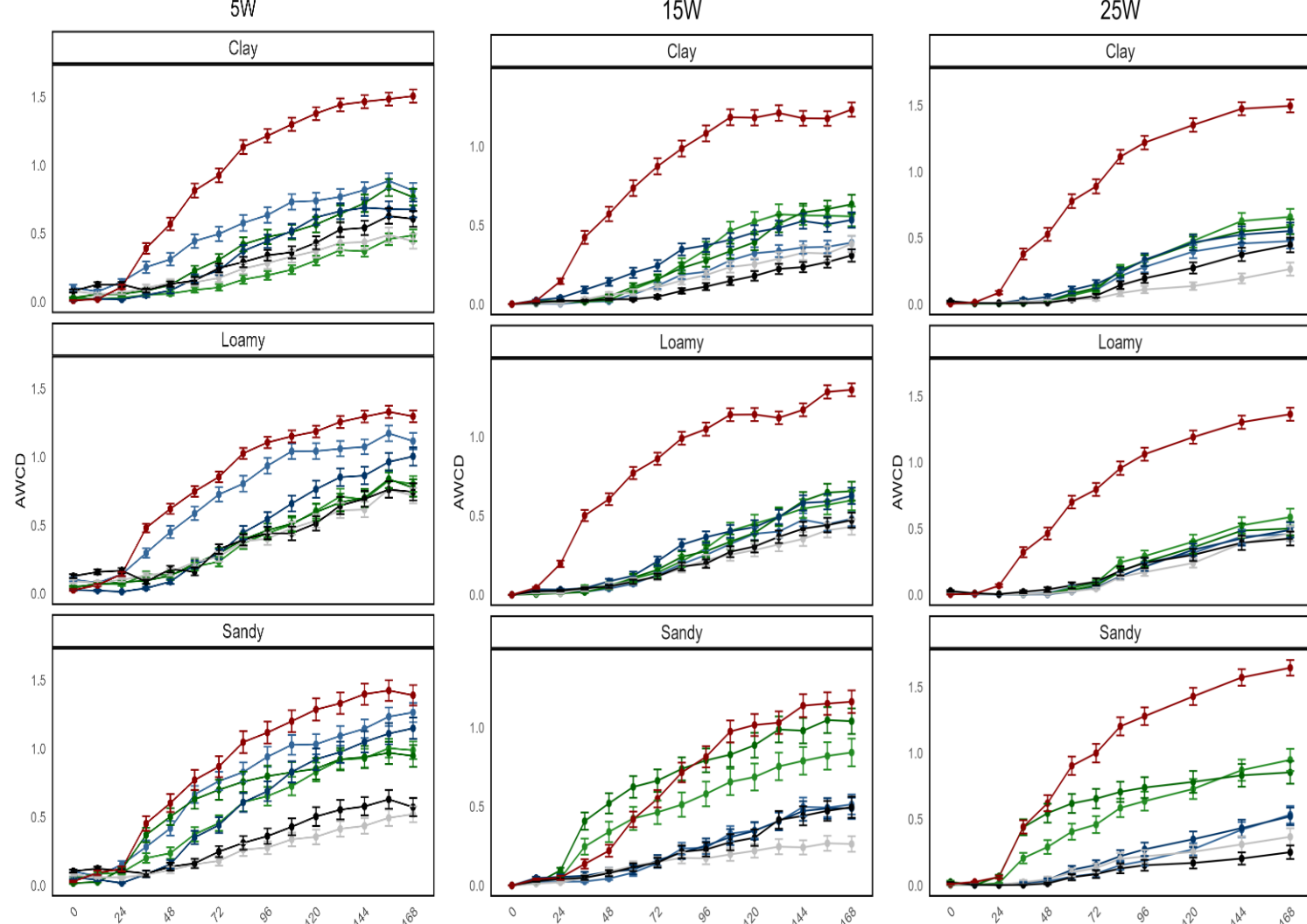
- Does it **degrade** faster in a specific soil?
- Which are the **microorganisms** involved in their degradation? Are they the same? Do they change **overtime**?
- How their presence in the soil affects the **surrounding soil microorganisms**?

- **Soil type**: influence on degradation rate



- **Biodegradable plastic mulches** (PBAT based): opposite trend in **sandy soil**

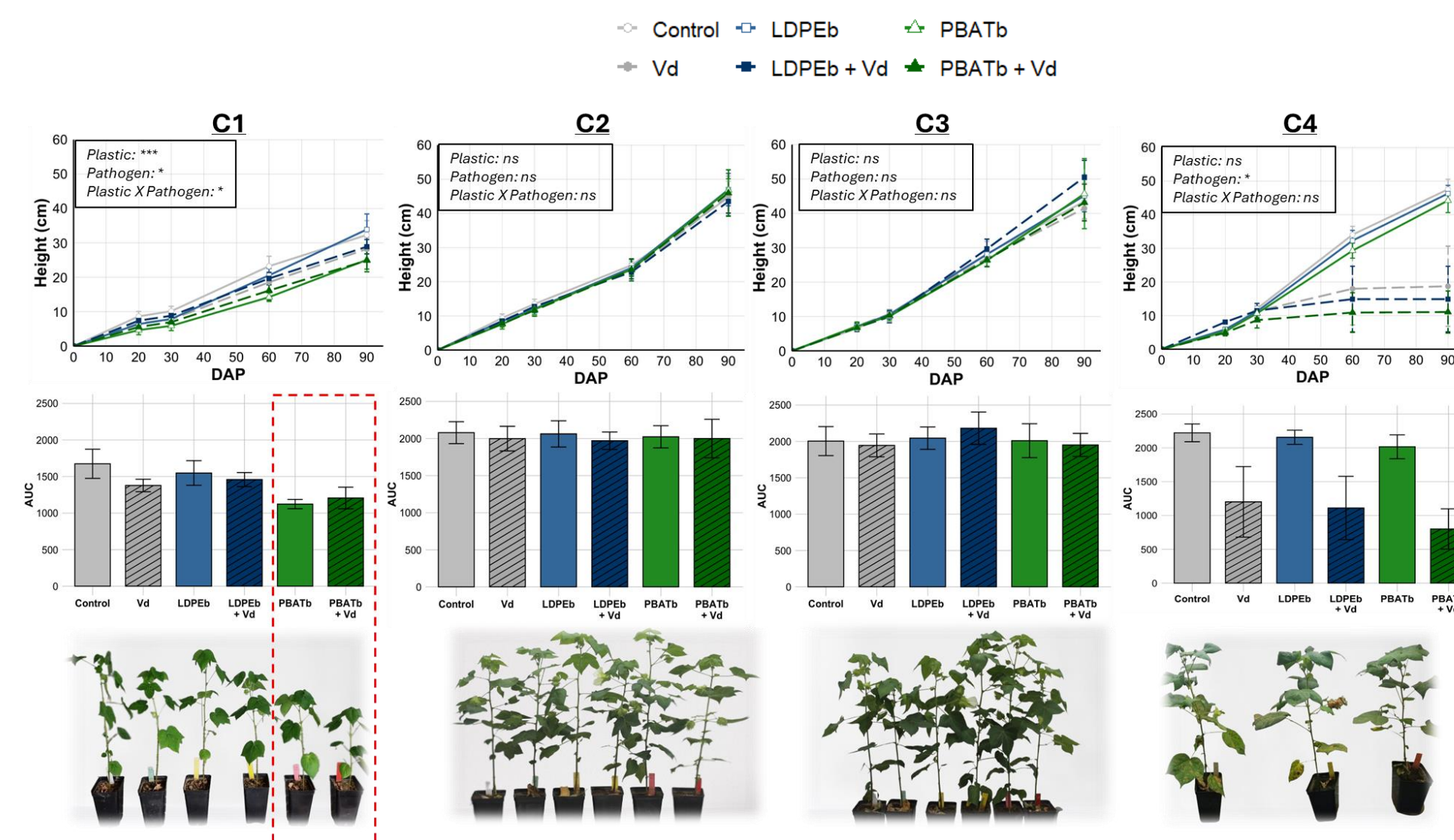
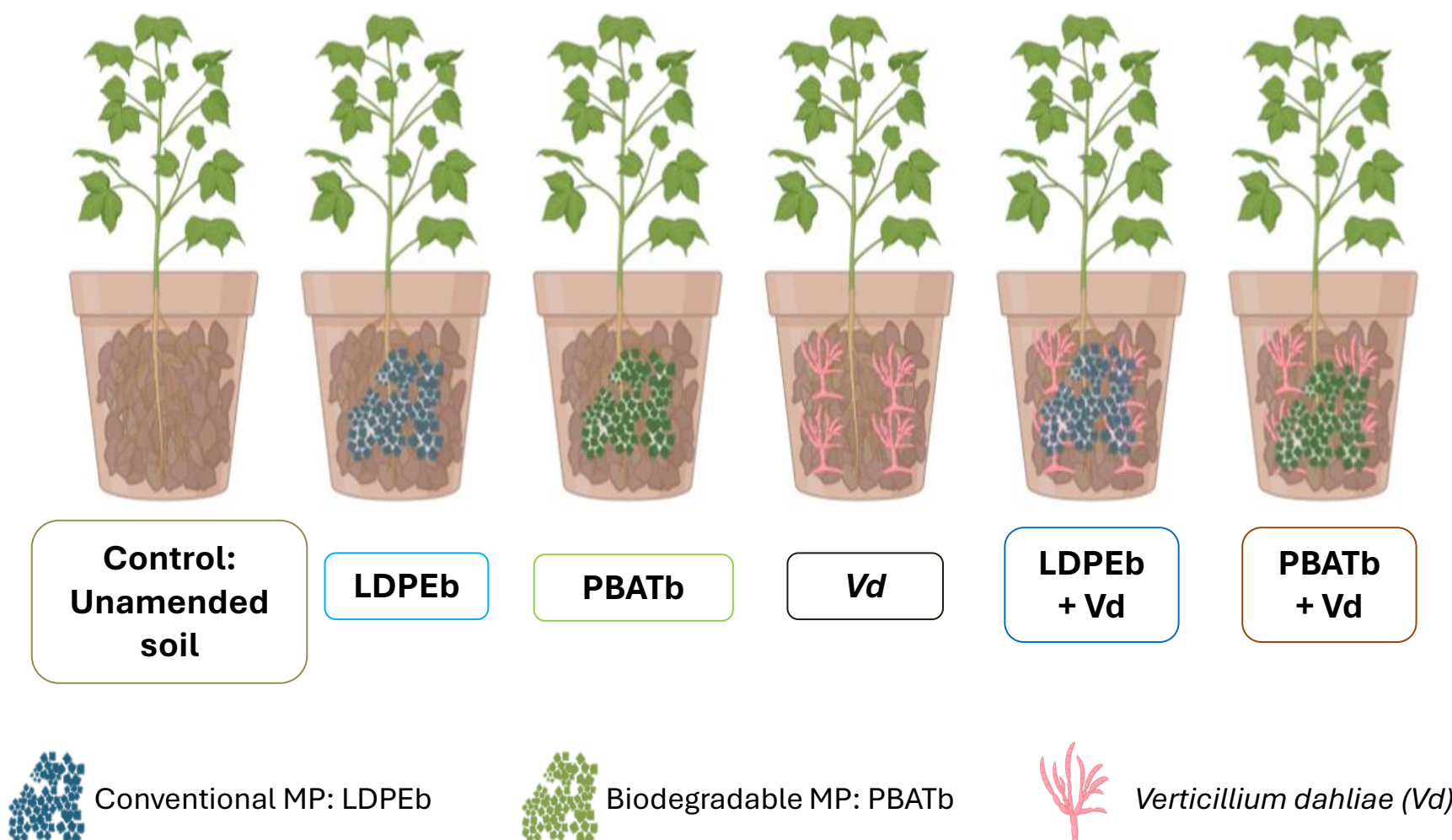
- Their presence may affect the overall **soil activity**



- Importance of **long-term** assessments
- **NGS analysis** regarding who is there

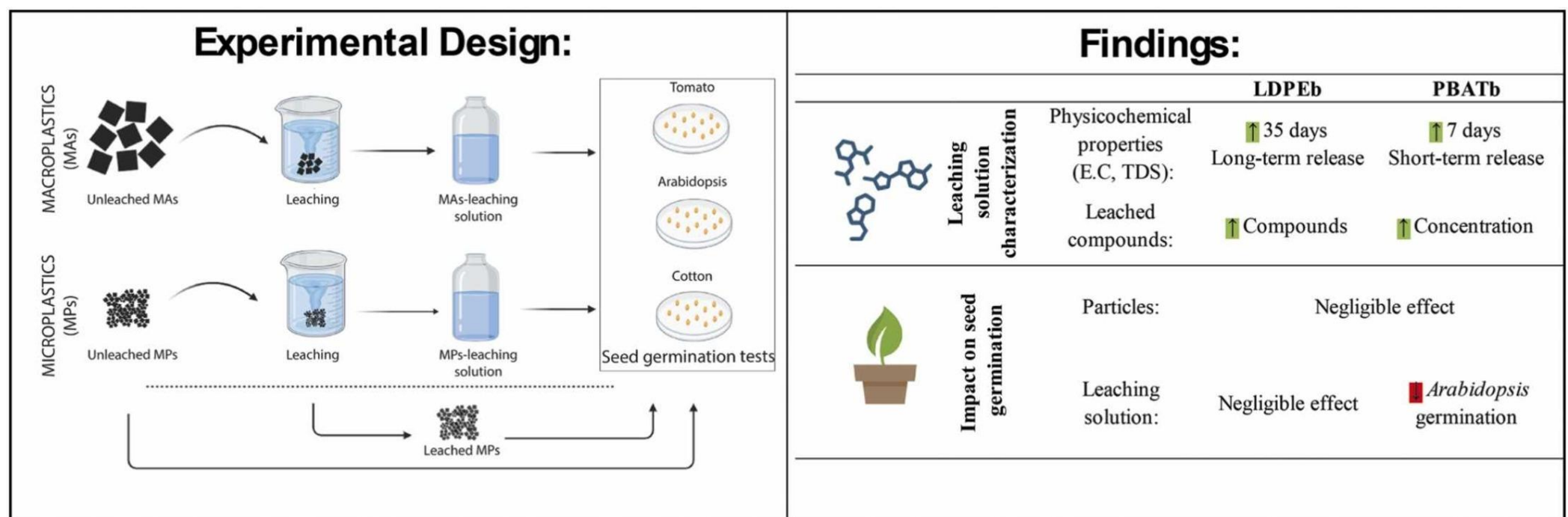
Short- and long-term impact of MPs on soil plant systems:

- Does **conventional** and **biodegradable microplastic** can affect **plant growth**?
- Does this effect change **overtime**?
- Does the presence of a soil-borne **pathogen** interfere on those processes?



Macro- and microplastics leachates: Characterization and impact on seed germination:

- Impact of microplastics mainly due to physical particles or associated additives?



Macan et al. 2024. *Hazardous Materials*.
<https://doi.org/10.1016/j.jhazmat.2024.136013>

Microcalorimetry x respirometry to evaluate short- and long-term impact of microplastics on soil microbial activity:

- Can isothermal microcalorimetry detect the impact of microplastics on soil activity?

