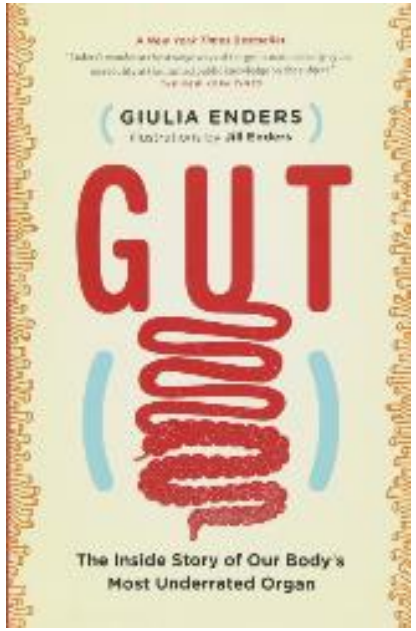
Deciphering plant-microbiota interactions to enhance crop defenses to pests – DEEP IMPACT

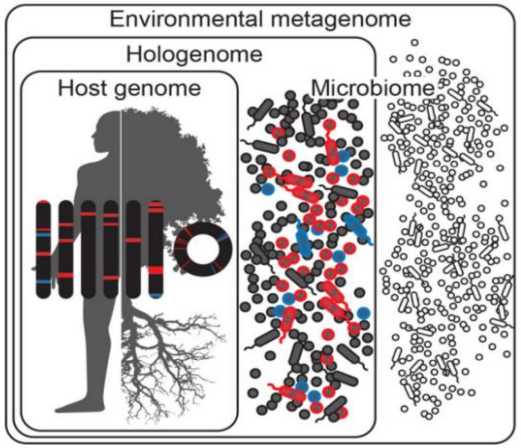
Mougel Christophe

Kick-off meeting, 23 Septembre 2020



Host and its associated microbiome

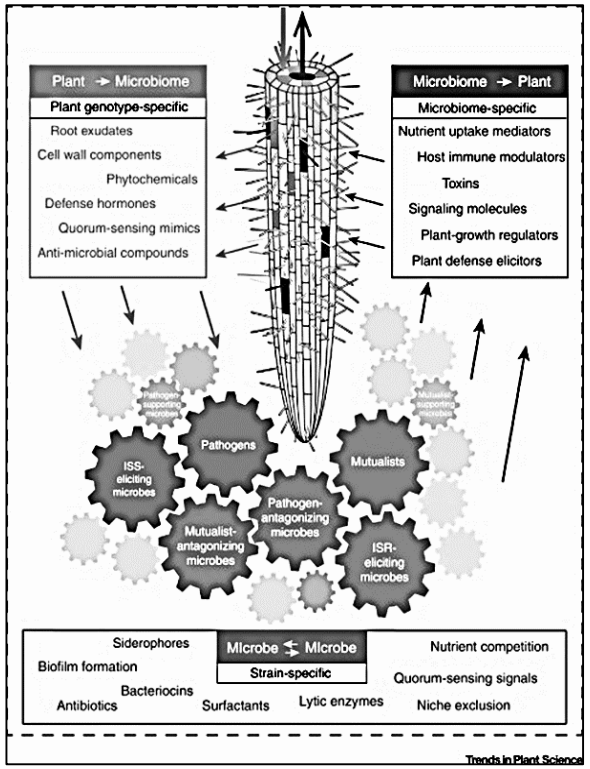




Environmental microbiota: a seedbank for the host

Host-associated microbiota (co-adapted/co-evolved)

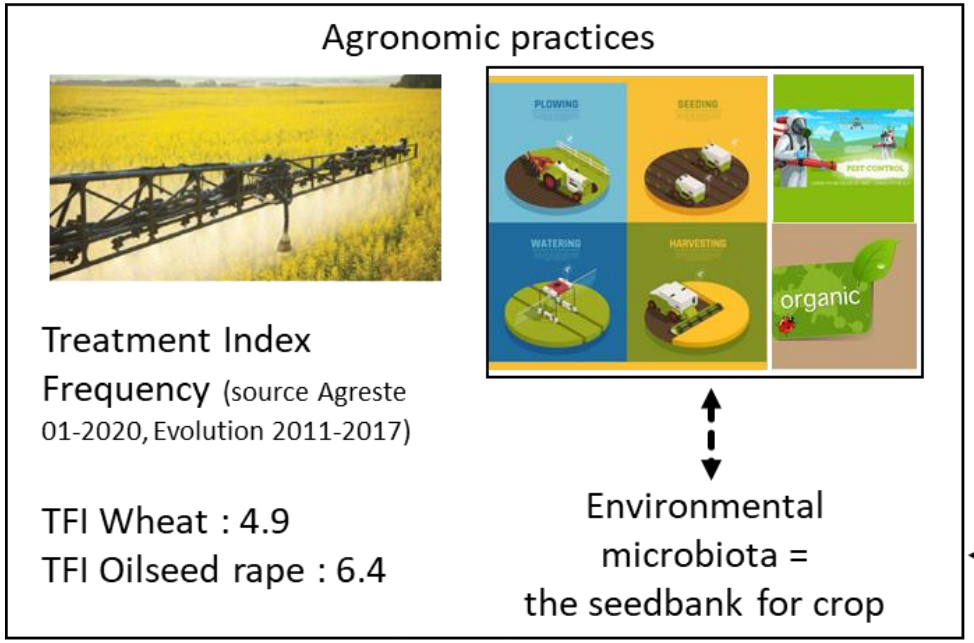
Theis et al. 2016

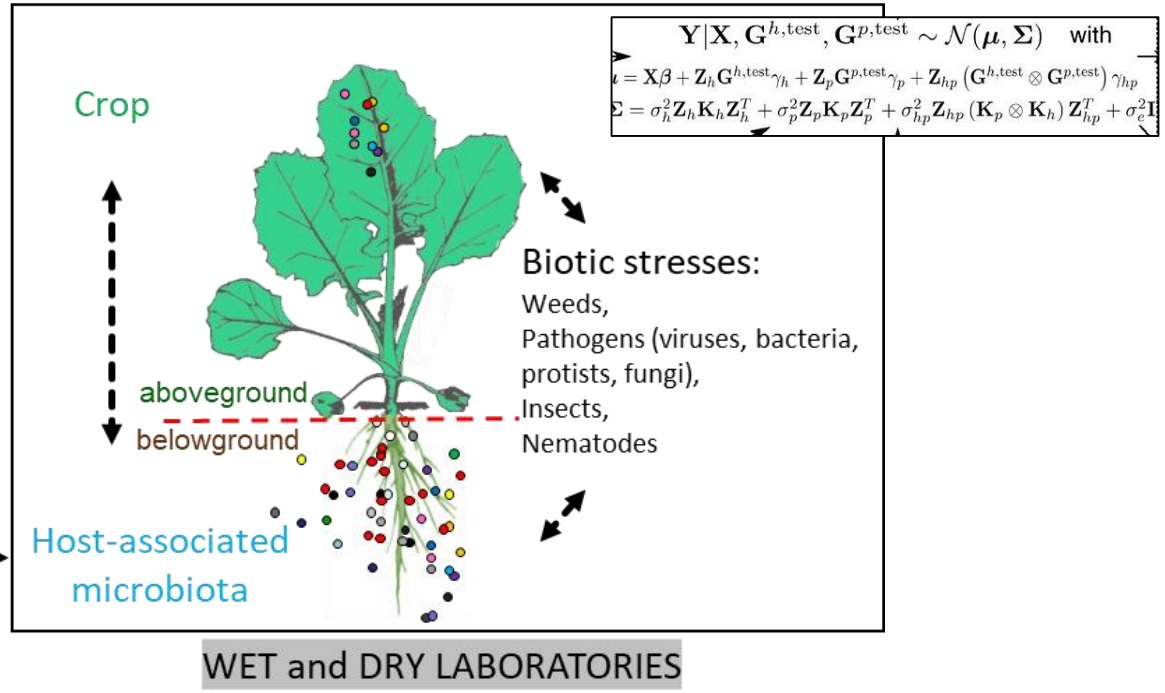


Pieterse et al. 2016

- Mounting evidence, from basic sciences (human, model plant), indicates that the **host-associated microbiota plays key roles** in dysbiosis, behavior, host immunity and health, and contribute **to host adaptation to different stresses**
  - **Huge diversity (species, functions)** of microorganisms reside in and on plant tissues/organs
  - **Horizontal recruitment of microbiota via the environment >>** vertical transmission via the parents
  - **Plant-associated microbiota improve plant health**: host immune modulation and pathogen inhibition

Microbiota at the interface of crop health and disease





Main hypotheses :

- **Pedo-climatic features and agronomic practices** drive the microbiota seedbank.
- The **plant genotype recruits a functional microbiota**, beneficial for the host plant health

Major questions:

- How should we tackle **plant-associated microbiota diversity and functional traits** to better manage plant health ?
- What are **the plant x microbiota genetic traits important for plant health** ?

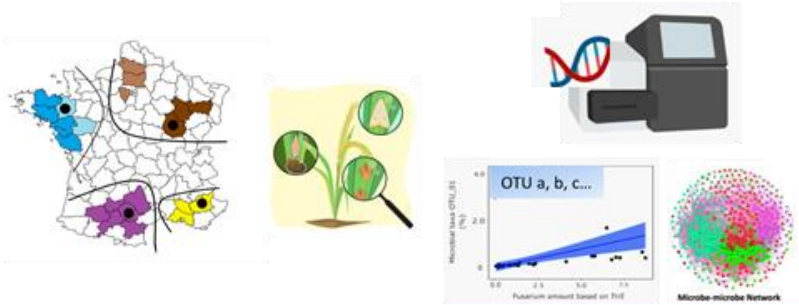
A multidisciplinary consortium

- 10 academic partners / 5 scientific disciplines (agronomy, ecology, pathology, plant sciences, mathematics)

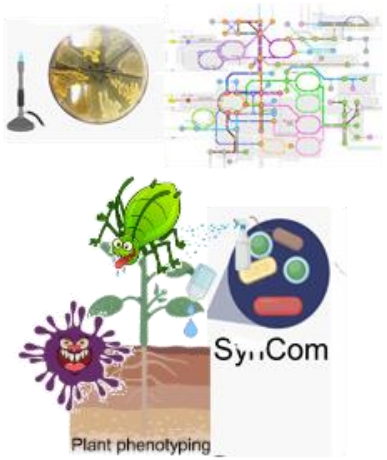
- 5 agricultural support institutions/Chamber of agriculture : ACTA, ARVALIS, CA Bretagne, CA Haute Marne et CA Pays de la Loire
- 5 cooperatives/association/companies : Agro d'Oc, BIOVITIS, Dijon Céréales, Groupe Limagrain, Clé de Sol, Gassler SAS

Deep Impact project

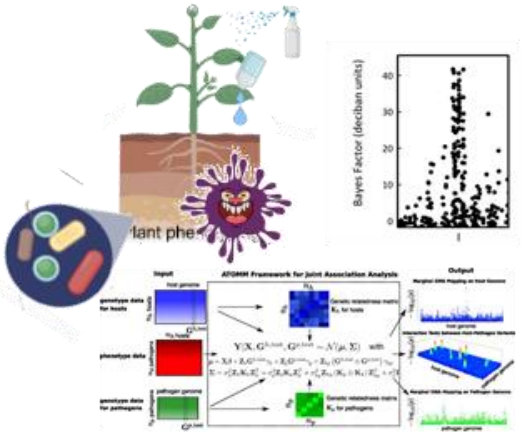
WP1 – Microbiota & Pathobiota analysis in open fields



WP2 – SynCom design and evaluation

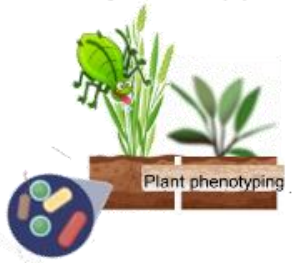


WP3 - Plant x microbiota genetic traits for plant health

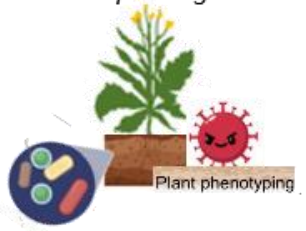


WP4 - Decipher molecular microbiota-plant-pest-interaction

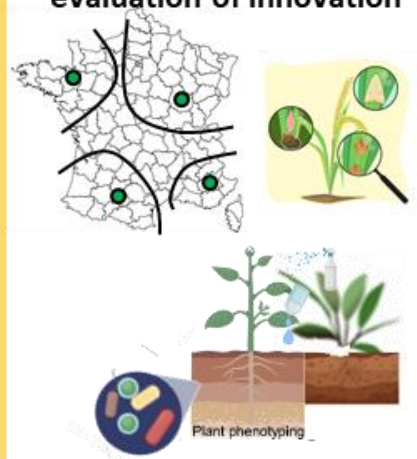
Role of auxiliary plants



Functional dialogs between microbiota-plant-pathogen



WP5 - Back to the fields: evaluation of innovation



WP6 - Data management platform

Impacts of Deep Impact project in the perspective of a pesticide-free agriculture in France

- Basic sciences : **we aim at validation new concepts and approaches on beneficial plant-associated microbiota** (outstanding academic dissemination)

- Education : a **research learning interface to promote microbiota concepts** and their relevance in the field of agroecology to a wide range of students ranging from Engineer's degree, M2 level and PhD: the future generation of decision makers for a zero-pesticide agriculture.

The Deep Impact research learning interface

- **Microbiota-based ecosystem** services can be steered by stakeholders and end-users paving the way for the **second Green Revolution**
  - **Agronomy**: guidelines and microbial indicators (species, functions) to evaluate agronomic practices on microbiota seedbank, drive a beneficial microbiota for plant health, personalized/precision agriculture
  - **Breeders**: plant genetic traits involved in shaping the recruitment of beneficial microbiota for increased plant health. Novel plant selection criteria, the plant and its microbiota
  - **Biocontrol firms**: design of new biocontrol solutions based on culturomics and SynCom strategies

Manifestation of interest by end users:

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