



# THE UK CROP MICROBIOME CRYOBANK

**Locations** United Kingdom

**Dates** 01/10/2020 - 30/09/2025

## Summary

Plant microbiomes are the microbial communities essential to the whole ecological area of a plant's 'phytobiome' – a term used to describe a plant's specific ecological area. Having a healthy phytobiome is critical to crop health, improved crop yields and quality food. However, crop microbiomes are relatively under-researched. The UK Crop Microbiome Cryobank project will develop a unique, exploitable and integrated resource that will provide the biological and bioinformatic tools to enable the development of solutions to improve soil and crop health. Six of the UK's key crops will be the focus and usable outputs will underpin UK research activity in line with the Biotechnology and Biological Sciences Research Council (BBSRC) strategic priorities in agriculture and food security. The project will support three of the UN's Sustainable-Development Goals: Zero Hunger, Responsible Consumption, and Production and Life on Land.

## The problem

*A microbiome is the community of micro-organisms that live together in a particular ecosystem. Humans, animals and plants all have their own unique microbiomes.*

The plant microbiome is the microbial communities associated with plants, soils and fauna and can be considered as an essential component of the functional 'phytobiome' – a term used to describe a plant's specific ecological niche (the plant itself, the environment and its micro and macro-organisms living on and around the plant). A healthy 'phytobiome' is essential for crop health and the need to improve yields and nutritional quality.

Whilst we understand the importance of healthy microbial communities for better crop health, research and studies carried out on what has been published is uncoordinated and fragmented and, as a result, there are no 'crop microbiome' resources publicly available. This leads to the problem of research that cannot be verified and a lack of resources to facilitate further research or the development of new biological solutions for Agritech.

Having the right tools and resources available will help safeguard future research and facilitate the sustainable production of the UK's key food crops. They will support researchers in their work and provide industry with what they need to develop biological alternatives to chemical interventions in farming systems.

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## What we are doing

The UK Crop Microbiome CryoBank (UK-CMCB) project will provide a comprehensive bank of cultures, resources and information to help facilitate research into optimizing plant yields using a sustainable agricultural approach.

As a lead on this project, CABI will manage the research project, cryopreserve the samples and host the CryoBank. We will also coordinate the establishment of the publicly available [AgMicrobiome Base](#).

The project will establish a cryopreserved and characterized crop microbiome resource to underpin UK and international crop research, building on the UK Agritech capability provided through the Centre for Crop Health and Protection (CHAP).

The resource will provide a facility for researchers to source data and samples for their work, including living microbial material from the rhizosphere and genomic sequences from different microbiome environments (as axenic cultures, microbiome samples and in 96 well plates).

This will enable soil scientists and plant researchers to assess and compare their work against validated datasets generated by the project.

The key projected outputs of the UK-CMCB project include:

- A cryopreserved resource of characterized material from crop microbiomes with a prioritized collection strategy, consisting of fungi, bacteria and 'whole' microbiome samples. Frozen samples will also be made publicly available through the CABI database and linked to genomic data
- Robust methodologies, which will be available to researchers, for collection and storage of intact microbial communities in environmental samples and extracts of total DNA
- Using 'state-of-the-art' cryopreservation technology to develop advanced cryopreservation regimes which will enhance the capability of sustainably maintaining the resource in a genotypically and phenotypically stable state
- Genomic characterization of samples for assessing microbial diversity (including symbionts, endophytes, pathogens), from whole community taxonomies (bacteria, fungi, viruses) to individual isolate genomes, will be undertaken
- Finding new biological-based products for the Agritech industry which will be demonstrated to the user community and will take advantage of Plant Growth Promoting Rhizobacteria (PGPR) isolation and synthetic community construction

- A validated sequence resources database, 'AgMicrobiome Base' linked to European Bioinformatics Institute (EBI) tools and data and available to the Agritech sector and researchers, including model organisms and novel product outputs.

The focus will be on the microbiomes of six major UK crops (barley, oats, oil seed rape, potato, sugar beet and wheat) from three different soil types obtained from across the UK.

The CryoBank will also be of interest to the general public. Through CABI and the projects' partners, research will be presented to the public as well as ways in which they can engage with this unique resource.

**Results so far**

In October 2023, the construction of the UK Crop Microbiome Cryobank (UK-CMCB) was completed. The resource uses state-of-the-art cryo research techniques to preserve important crop microbiome samples obtained from different crops cultured in a range of UK soil types. The resource also includes living microbial material as well as genomic and metagenomic sequences (DNA) from the crop root environment.

The cryobank is a vital resource for scientific researchers investigating how to ensure food security amid a range of challenges, including the impact of climate change on crops.

The microbial consortia generated through this work package are being added to the CryoBank and will soon be available to the public. The UK-CMCB has also created a curated database of sample information associated with DNA sequence data, metadata, and provision for analytical tools for end-users.

**Donors**

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**Partners**

Rothamsted Research, Scotland's Rural College, John Innes Centre, James Hutton Institute

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