For when the chips are down—preserving UK soil microbial biodiversity for agriculture

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A UK wheat crop - one of the six to have its microbiome held and curated as part of the UK Crop Microbiome Cryobank. Credit: Pixabay

Scientists from the UK's foremost agricultural research institutes have teamed up to create a new UK Crop Microbiome Cyrobank (UK-CMCB) to safeguard future research and facilitate the sustainable yield

improvement of the UK's six major food crops including barley, oats, oil seed rape, potato, sugar beet and wheat.

CABI, who is leading the BBSRC project, joins researchers from Rothamsted Research, Scotland's Rural College (SRUC) and the John Innes Centre, in developing a 'Noah's Ark' of UK microbes from crop systems that will form the first publicly available resource of its kind anywhere in the world.

Scientists from the University of East Anglia (UEA) and the James Hutton Institute will also be collaborating on the initiative which will use state-of-the art cryo research techniques to preserve important crop microbiome samples from different soil types across the UK.

The UK-CMCB will provide a facility for researchers to source data and samples for their work, including living microbial material as well as genomic and metagenomic sequences (DNA) from different microbiome environments, including the rhizoplane.

Microbiomes are all the microbes present in any one ecosystem, in this case those associated with the crop plant, whether they are present in the leaves, seeds and stems or in the bulk soil around the roots. A beneficial microbiome results in a healthy plant and an improved crop yield and better-quality food.

Dr. Matthew Ryan, Curator, Genetic Resource Collection at CABI, said, "By preserving these valuable crop microbial samples, from a 'unique snapshot in time,' we will generate a representative, very valuable and unique resource from key UK crop systems that will become a vital resource for scientific researchers for generations to come.

"We will be using UK-developed cryotechnology that uses liquid nitrogen to keep the samples secure at very cold temperatures. If you

like, it is a 'Noah's Ark' of UK microbes from crop systems and one that has many potential exciting uses."

The culture collection at CABI where the microbiomes of the UK's major crops will be held and curated as part of the UK Crop Microbiome Cryobank. Credit: Tom Swindley/CABI

All of the project resources will be fully characterised using advanced DNA sequencing techniques in order for scientists to discover what microbes—fungi, bacteria, archaea (single-celled microorganisms with structure similar to bacteria) and viruses—are there, what they are doing in the microbiome and what role they play in enhancing crop growth. The UK-CMCB will create a curated database of sample information

associated with annotated sequences, meta-data and analytical tools for end-users.

This will be the first synchronised resource covering the total microbiome of a variety of crops in standardised soil types, supported by bioinformatics, microbiologists, plant health experts and world class storage facilities.

Dr. Tim Mauchline, Plant and Soil Microbiologist at Rothamsted Research, said, "Soil health is particularly important. If we can better understand the function of microbes present in our soils we can use this information to help farmers produce sustainable crops. There is a clear need to increase food production and reduce our reliance on chemical fertilizers and pesticides. It is imperative that biological solutions are found to help ensure the UK's food security."

Dr. Nicola Holden, leading the genomics and bioinformatics team at SRUC and James Hutton Institute, said, "We are at a very exciting time in our understanding of microbiomes because of advances in deep sequencing capabilities, telling us not just about the composition of the microbiomes, but also informing on their functions. This resource will provide base-line data for how different crop types and the soils they are grown in impact the microbiome. Our ambition is to provide a comprehensive resource that will be used to optimise crop production systems."

A further work package will be focussed on demonstrating the utility of the UK-CMCB for isolation of plant growth promoting bacteria and synthetic community construction.

This will involve characterisation of the culturable microbiota associated with crop plants and the generation of crop-associated synthetic microbial communities (SynComs) and testing for their positive impact

on plant growth. The microbial consortia generated through this work package will be added to the CryoBank and made available to the public.

Dr. Jacob Malone, Group Leader, Molecular Microbiology at the John Innes Centre, who will be leading the SynCom construction and testing work said, "The UK-CMCB will provide a comprehensive platform to enable research towards optimising plant yield and providing sustainable alternatives to environmentally damaging agrochemicals."

The 5-year project starts in October 2020 and will engage with CHAP, the UK's Agritech centre for crop health and protection, academic researches and industry.

Provided by CABI

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