National Biofilms Innovation Centre

Case Study

A PARADIGM SHIFT IN THE APPLICATION OF BIOINPUTS

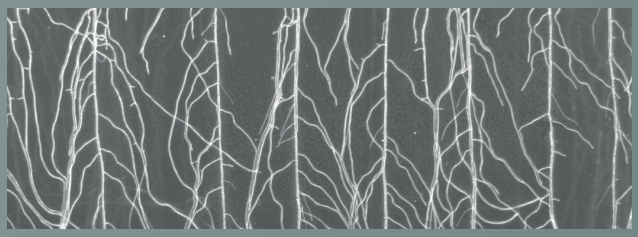
Supporting academic and industrial partnerships to tackle global biofilm problems

The extensive use of chemical fertilisers and pesticides has facilitated the expansion of agricultural practices as a solution to global food supply. However, their excessive and prolonged application has led to detrimental effects such as soil degradation, water contamination, and the detection of residues in food.

Plant growth-promoting bacteria (PGPB) represent a widely adopted approach globally to enhance plant growth and productivity. North America has the largest market of biofertiliser, meanwhile, South America hosts the fastest growing market.

In October 2022, NBIC, in collaboration with a group of Argentine researchers organised a workshop, within the framework of the annual congress of the Argentine Society for General Microbiology (SAMIGE), focused on biofilms in agriculture, which took place in Los Cocos, Córdoba, Argentina. The workshop brought together researchers and industry representatives from the UK and Argentina, to improve agricultural productivity in both countries by reducing the use of chemical treatments and their environmental impact.

As a result of the workshop, University of Nottingham attendee, Dr Gabriel Castrillo, applied for NBIC's Flexible Talent Mobility Account (FTMA) and was awarded funding for a research project to analyse the impact of the root microbiome biofilm on the beneficial effect of *Azospirillum* bacteria on crops. Understanding this type of interaction is extremely important to optimise the application of inoculants. Based on the hypothesis that the ability of an inoculant to colonise the plant and exert an effect can be modified by the presence or absence of member of the plant and soil microbial communities, a model experiment was designed. The impact of the different inoculant combinations on root growth was established and



Examples of the root system of the model plant Arabidopsis thaliana inoculated with a beneficial bacterium. Image by Dr Gabriel Castrillo.

samples prepared for more in-depth analysis following the FTMA award. Dr Castrillo said:

"In addition to scientific goals, the project also aims to establish a collaborative relationship between Argentina and the UK, with the objective of fostering scientific cooperation".

This objective was successfully achieved through the training of a postdoctoral fellow, who received the necessary expertise to conduct experiments relevant to the project. This collaborative effort has facilitated the joint work of laboratories from both countries, promoting knowledge exchange and cooperation in the scientific community.

The results obtained so far could serve as the basis for initiating a paradigm shift in the application of bioinputs on a global level. They represent one of the first steps in understanding the interaction between exogenously added inoculants and the established microorganisms in the plant tissue. Although these results come from a basic experimental model, further progress in this field will enable the development of biotechnological tools that will have an impact on both bioinput production and the companies involved, as well as their application in the productive sector. Moreover, advancements in the field of biological inoculants will also have a positive environmental impact by promoting the use of eco-friendly products.

Dr Gabriel Castrillo

Dr Castrillo studied biochemistry at Havana University, Cuba. His PhD focused on phosphate starvation response signalling at the Spanish National Centre for Biotechnology. He conducted a Postdoc there, unravelling arsenate signalling in plants. Later, he pursued a second Postdoc at the University of North Carolina, studying plant microbiome interactions. In 2018, he was awarded a University of Nottingham Research Fellowship, and continues his work there as an Associate Professor.