Project title and location: Targeting biological control applications using automated spore sampling and disease forecasting (Newcastle).

IAFRI background: The Institute for Agri-Food Research and Innovation (IAFRI) is a joint venture between Newcastle University and Fera Science Ltd and a unique model for how universities can work with private sector research organisations. It operates under a private-public ownership to deliver both public good research and services as well as innovation and wealth creation in strategically important industrial sectors in the UK. Students will have a unique opportunity to benefit from supervision and facilities at both the Newcastle and Sand Hutton campuses to deliver research with real-world impact.

Lead Supervisors (and contact): For more information and details on how to apply please contact Neil Boonham (neil.boonham@ncl.ac.uk) or Judith Turner (judith.turner@fera.co.uk)

Key research gaps and questions: Under controlled glasshouse conditions, biopesticides for the control of insect pests is well established and the use to control diseases is becoming more established. The best approaches for effective use of biopesticides in arable crops under field conditions however is not well understood. Our underpinning hypothesis is that the key to improved efficacy of biopesticides for disease control in arable crops lies in the better understanding of the interactions between the pathogens and biopesticides. Better understanding will enable the application of the correct product at the right time under the right conditions to achieve the best disease control.

Project Description: Use of conventional crop protection products is under increasing pressure following withdrawal of actives due to regulation and resistance. This has driven significant growth in the biopesticide market, up 300% between 2008-2018 and worth £6billion globally. Despite the investment, biopesticides are not widely used in the arable sector, where the biggest benefits in terms of (i) reduction in the use of synthetic chemistry (ii) increased sales due to area of crop being managed and (iii) the potential for integrated crop management approaches to prolong the life of synthetic products would be realised. Microbial biocontrol agents act via a range of modes of action and as a result may need to be applied either before, at the same time or just after the arrival of the pathogen on the host plant. It is therefore thought that effective application should be dictated by better understanding the biology and epidemiology of the target pathogen and biopesticide rather than the growth stage of the host. Key questions include:
- Can optimising the timing of biopesticide application based on pathogen ingress improve efficacy.
- Can forecasting techniques be used to identify optimal conditions for biopesticide activity.
- Does disease forecasting enhance the implementation of IPM (integration of conventional and biological products) approaches to disease control.

The proposed model system for the project will be *Zymoseptoria* infection of wheat but other pathogens may also be included. The project will explore integration of state of the art, automated spore detection technology pioneered by Fera Science Ltd in collaboration with Optisense Ltd. and the CropMonitor disease forecasting platform. The project is interdisciplinary, utilising skills and facilities at both Newcastle University (trials on the farms, molecular diagnostics) and Fera (Molecular Technology Unit and disease forecasting techniques).

Desired skills: We are looking for a highly motivated and talented individual with skills in plant pathology, plant sciences, molecular biology and microbiology. Essential skills: a degree / post-graduate degree in a discipline related to microbiology/pathology/plant sciences; practical laboratory skills in microbiology, plant work, molecular biology and statistical analysis.