Nottingham BBSRC DLA Programme : Net Zero Rice: Unravelling the role of root exudates in rice for low emission protein consumption (CASE project)

University of Nottingham, School of Biosciences

Start date September 2026

About

Thanks to £14m of funding awarded by the Biotechnology and Biological Sciences Research Council (BBSRC), the University of Nottingham and Nottingham Trent in partnership with the National Biofilms Innovation Centre (NBIC) are offering fully funded innovative four-year cohort-based training in frontier science.

Postgraduate researchers will be recruited to a research cluster within each of the overarching research areas:

- Alternative and Emerging Protein sources for Sustainable food and feed (Sustainable Agriculture and Food Security) - Cluster lead Professor John Brameld
- RIC@N-DLA: Multiscale RNA Science from mechanisms to applications (Bioscience for Human Health) – Cluster lead Dr Federico Daja-Bailador
- Future Genomes Across Life – Engineering biology for sustainability and innovation (Biotechnology for Sustainable Growth) – Cluster lead Professor Thorsten Allers

Project description

We invite applications for a BBSRC fully funded CASE studentship to investigate the role of root exudates in rice for low emission protein consumption. This sits under our Sustainable Agriculture and Food Security theme and is offered through partnership with Syngenta.

Rice is an important protein source globally, providing 15% of global protein intake. However, cultivation is the largest agricultural source of methane due to the anaerobic conditions in flooded paddies. As climate commitments intensify (e.g. the Global Methane Pledge), supporting a transition to “Net Zero” rice presents a promising mitigation pathway, but must continue to meet protein needs. Evidence suggests root exudates in the rhizosphere drive methane dynamics. Deeper roots or increased aerenchyma abundance can suppress methanogenesis by introducing oxygen into the soil; however, they may also promote emissions by enhancing methane transport or stimulating microbial activity through exudates. A more detailed mechanistic understanding of the extent to which these processes drive emissions will create opportunities to mitigate methane output, for example through selective breeding for low-emission crop traits while maintaining grain protein content.

Aim and Objectives

1. Characterise the biochemical and nutritional composition and coupled temporal dynamics of roots and exudates from contrasting rice lines

2. Quantify the impact of exudates, rhizodeposition and root oxygen on methane emissions in controlled pot-scale experiments using 13CO2 pulse labelling

3. Validate findings in field conditions at UoN Malaysia campus, using in situ $^{13}CO2$ labelling to quantify contributions of exudates to emissions at field scales.

Why choose this project?

The project will provide a broad and integrated academic and non-academic research environments designed to equip the successful candidate with both advanced technical expertise and broad professional development. Development in the academic environment will be led by Dr Nick Girkin, supported by Dr Hannah Cooper, Dr Rahul Bhosale and Dr Tom Holloway (Syngenta), who collectively provide complementary expertise in crop phenotyping, soil–plant interactions, plant development, biogeochemistry, agronomy, and wetland ecology and management. The student will receive comprehensive training in project-specific experimental and analytical skills, including advanced crop phenotyping techniques, protein and nutritional analysis, monitoring and quantification of greenhouse gas emissions, stable isotope approaches including $^{13}CO2$ labelling and isotopic analysis, and field-based agronomy. Through the supervisory team, the student will also develop wider research skills such as statistical analysis, experimental design, data management, scientific writing, and oral presentation for both specialist and non-specialist audiences.

The non-academic environment will be provided by Syngenta, offering industry-focused training that complements the academic programme. The student will gain exposure to rice agronomy through hands-on training with Syngenta specialists and will learn how crop improvement and crop management solutions are developed and tested within a commercial R&D framework. Training will also cover innovation pipelines, IP considerations, business partnerships and the translation of research outcomes into products and practices with commercial impact, delivered through the dedicated placement with Syngenta, where the student will gain experience in applied research approaches, data interpretation for commercial decision-making and cross-disciplinary teamwork within a global agricultural company.

For informal enquiries about the project please contact Dr Nicholas Girkin

Requirements

Applications are invited from candidates with backgrounds in Biosciences, Biochemistry, Microbiology, Biotechnology, Chemistry, Chemical/Biochemical/Process Engineering, Environmental Science, Pharmacy, Computer Science, Maths or related disciplines who have/expect to graduate with a first/upper-second UK honours degree, or equivalent qualifications gained outside the UK.

Applications are also welcome from candidates with a 2:2 undergraduate degree or lower, who hold a Masters degree in a relevant area or three or more years of full-time work experience relevant to your undergraduate degree, or to the PhD projects you are applying for.

Funding details

Funding is available for four years from October 2026. The award covers tuition fees at the UK rate, plus an annual stipend. The UK Research and Innovation (UKRI) stipend is tax free and was set at £20,780 for 2025/26 entry.

UK and International candidates are eligible to apply.