

FoodBioSystems DTP - PhD Project Advertisement Text

Project Title: FOODBIOSYSTEMS - Willow (*Salix* spp): The potential of a tannin-rich tree fodder to reduce ammonia emissions and improve productivity of dairy cattle.

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Research Group: FOODBIOSYSTEMS BBSRC DTP

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Project Description: Farm productions systems face multiple challenges as animal products need to be produced with less environmental impact without affecting animal welfare. Currently, 12% of total UK ammonia (NH₃) emissions come from N. Ireland and 91% of those in 2015 came from agriculture. At the same time, protein is poorly utilized as 55-95% of the ingested N is excreted via urine or faeces. One strategy to improve feed efficiency and decrease emissions, is the use of condensed tannins (CT) in the animal diets. Those are phenolic compounds which bind to proteins and reduce their ruminal degradation and NH₃. CT are able to shift the N excretion from urine to faeces. The excreted urea can be hydrolysed and is susceptible to NH₃ volatilisation while faecal N outputs are considered to be an environmentally friendly N form. Willow (*Salix* sp.) is a tree fodder contains CT and although it's great potential in animal nutrition, data on UK willows are scarce. The aim of the proposed project is to evaluate the nutritive value of willow and assess its potential to reduce ammonia emissions and improve N use efficiency. This PhD work will address key knowledge gaps on the use of novel feeds and this will be achieved via the following studies:

- 1) In vitro assessment of the effect of condensed tannins in willow, on the digestive process in the rumen; via the in vitro gas production technique and analysis for total gas production/composition, fermentation end products (VFA/ammonia) and N disappearance that will take place at Queen's University Belfast.
- 2) Optimization of the ensiling process of willow; via a lab scale study using two selected willow varieties with the most potent ammonia inhibitory properties. Ensiling process will take place at Queen's University Belfast and the most efficient ensiling method will be decided for the animal trials at a later stage that will take place at Agri-Food and Biosciences.
- 3) Assessment of the effect of inclusion the willow silage in the diet of dairy cattle on feed intake, milk production, nutrient digestibility, energy and N utilisation efficiencies and enteric methane and ammonia emissions; via an animal trial that will take place at Agri-Food and Biosciences Institute.
- 4) Reveal how rumen microbes influence metabolic pathways related to N use efficiency and milk quality using this novel tanniniferous feed; via metagenomics and metabolomics and fatty acid analyses that will take place at Queen's University Belfast and University of Reading, respectively.

Funding Notes: This project is part of the FoodBioSystems BBSRC Doctoral Training Partnership (DTP), it will be funded subject to a competition to identify the strongest applicants. Due to restrictions on the funding, this studentship is only open to UK students and EU students who have lived in the UK for the past three years.

This project is a CASE studentship with Agri-Food and Biosciences Institute (AFBI). Agri-Food and Biosciences Institute will additionally provide £1,400 of research fees per annum. The student will spend a total period of approximately 6 months in Agri-Food and Biosciences Institute to undertake the research work for study 3 in this project. Agri-Food and Biosciences Institute will fund student's accommodation costs (£1,080 for 6-month stay at the institute's accommodation). The in-kind contribution of the Agri-Food and Biosciences Institute towards research and staff costs for the animal trial is also valued at £60,000.

The FoodBioSystems DTP is a collaboration between the University of Reading, Cranfield University, Queen's University Belfast, Aberystwyth University, Surrey University and Brunel University London. Our vision is to develop the next generation of highly skilled UK Agri-Food bioscientists with expertise spanning the entire food value chain. We have over 60 Associate and Affiliate partners. To find out more about us and the training programme we offer all our postgraduate researchers please visit <https://research.reading.ac.uk/foodbiosystems/>.

Training opportunities: Training will be provided via all partners and will cover cross-disciplinary transferable skills to enhance student's future career prospects. At Queen's University Belfast the student will be trained on analytical methods for feed biochemical profile, in vitro gas production techniques, metataxonomic and metagenomic sample processing, sequencing and downstream analysis. At the University of Reading, the student will be trained for gas chromatography techniques to analyse fatty acid profile of milk and rumen fluid; and NMR-based metabolomics including chemometrics. At AFBI (during a 6-month placement), the student will be trained on data and sample collection in animal metabolism trials and operation of calorimetric chambers. QUB offer a Careers Development Programme where student can participate in a range of interactive workshops covering communicating postgraduate research skills to employers, effective academic applications, preparing for job interviews and research student can drop in at the Graduate School with a draft CV or application and get advice on how best to present relevant skills and experience.

Student profile: This project would be suitable for candidates who have an upper second class degree in a related science (e.g. animal science, veterinary, food science, biology), and a keen interest in animal nutrition/physiology, dairy science, laboratory analyses, -omics technologies and/or bioinformatics. Good skills on reviewing literature, attention to detail, time-management, organisation, teamwork and independent learning, are also required. An MSc in relevant science would be advantageous, but not essential.