FoodBioSystems DTP - PhD Project Advertisement Text

Project Title: FOODBIOSYSTEMS - Variation in forages for improved micronutrient nutrition in livestock.

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Research Group: FOODBIOSYSTEMS BBSRC DTP
Project ID: FBS2020-16

Application Deadline: 6 March 2020

Project Description: Milk is a rich source of protein, calcium, iodine, magnesium and manganese, and is seen as a key mechanism via which health and nutrition can be improved in many countries, developed and developing alike. In the UK, milk and milk products provide 55, 40 and 34% of the iodine intake by children, adolescents and adults, and 20, 11 and 9% of magnesium intake respectively. Of considerable concern is that 30% of adolescent females have intakes of iodine below the Lower Reference Nutrient recommendations (LRNR) and 50% below the magnesium LRNR respectively, which contribute to NCDs in later life (Roberts et al., 2018). As well as being essential to consumers, these micronutrients are also critical to animal health in the prevention of hypomagnesaemia (staggers) and sound fertility, not to mention, determining factors in product processing such as cheese making. Milk and meat from forage-fed animals has higher levels of fatty acids (FA) and is healthier for consumers than that from non-grass-fed (Coppa et al., 2015). Furthermore, home-grown forage is the cheapest form of feed for dairy herds and farm business economics demonstrate that effective forage production and utilisation underpins business as well as environmental sustainability (Foskolos & Moorby, 2018). Some dairy companies in Europe are now paying a price premium for high FA milk, and future bonuses could be negotiated for micronutrient content especially seeing these elements are supplemented to milk.

UK and Irish diary sectors rely heavily on leys dominant in perennial ryegrass (Lolium perenne) and clover (Trifolium repens) pastures for grazed and conserved feed, though there is increasing adoption of herbs and other legume and grass species in recent years. The Public Good Plant Breeding Group at IBERS, Aberystwyth University, has a legacy of breeding forages for added value traits (forage quality for improved farm nitrogen utilisation for example). Nutrient use efficiency (NUE) is a high breeding priority across all species but has tended to focus on the macronutrients for which fertilisation costs are high and we would welcome the new initiative to drive objectives toward forage products that could contributes to a wholly healthier food system. Diversification into forage products including under-represented species may be a faster route to providing the desired nutrition and new breeding programs are being considered in response to these demands.

Hypothesis: Forage options (species or/and varieties) can be used to provide essential micronutrients needed for healthy animals and healthy dairy products for consumers.

Objectives:

1. Determination of micronutrient accumulation between forage species.
2. A rapid, cost effective screening method for micronutrient estimation (NIRS or simple lab assay)
3. Screen breeding germplasm of L. perenne and L. boucheanum and make crosses to determine inheritance of micronutrient accumulation.
4. Genome wide selection training for Iodine, Magnesium and Manganese content/accumulation in diploid L. perenne.

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 is a CASE studentship co-funded by Germinal Holdings Limited.

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:
Specific training opportunities that this project will provide to the student will include:

- Researcher Development Programme at Aberystwyth University; 45+ credits of research skills training including statistics, scientific writing skills, etc.
- AgriFood Training Partnership, Plant Breeding online course to provide essential training in the principles and theory of plant breeding. The student will be encouraged to make their case study on breeding for micronutrient accumulation in an existing breeding program or a new species for this purpose.
- Practical skills in plant breeding taught by working alongside the IBERS grass breeding team, including emasculated pair crossing (for hybrid grass and Festulolium crosses with high Magnesium accumulating Italian ryegrasses), design and analysis of selection nurseries and field experiments (for project sample collection), as well as creation of varieties in forage grasses and their pipeline to market.
- Field experiments based at Gogerddan campus, Aberystwyth will include breeding plot trials (for analysis of yield and forage quality) and spaced plant trials (for distinctness uniformity and stability traits).
- Micronutrient analysis by ICP-MS at the University of Reading and calibration of NIRS for future high-throughput screening.
- Genome Wide Association Study for micronutrient accumulation and publication of this research.
- Experience of forage seed marketing with GHL.

Student profile: The ideal candidate will have a degree in biological or agricultural science and interest in

pursuing plant breeding as a future career path. Training or/and experience in genetics, plant nutrition, grassland systems, plant biology, plant breeding are highly desirable. The candidate must be self-motivated and have excellent observation and communication skills. A full driver's license, clear of convictions, is also essential. An ambition to learn/interact with the commercial side of the diary and livestock sectors would be very beneficial.

References:

Coppa, M. et al. (2015). Effect of phenological stage and proportion of fresh herbage in cow diets on milk fatty acid composition. Animal Feed Science and Technology 208: 66-78.

Foskolos A, Moorby JM (2018) Evaluating lifetime nitrogen use efficiency of dairy cattle: A modelling approach. PLoS ONE 13(8): e0201638.

Roberts, C., T. Steer, N. Maplethorpe, L. Cox, S. Meadows, S. Nicholson, P. Page, and G. Swan. 2018. National Diet and Nutrition Survey. Results from Years 7-8 (combined) of the Rolling Programme (2014/15 to 2015/16). PHE Publication gateway number: 2017851 Public Health England, London.