

## PhD Project Advertisement

**Project Title:** Food for Feed: Valorisation of agro industry by- products in animal feed

**Project Number:** FBS2022-63-Theodoridou-qr

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### Agro-industrial by products



Apple pomace



Mushroom compost

+



Distillery by-products



Dairy Cow



Improve Nutritional value



Reduce  
Greenhouse Gas Emissions

### Project Description:

#### Problem

There is a global recognition of the imperative need to address environmental impacts of contemporary agricultural systems and enhance food/ feed security. An urgent challenge facing the planet is the competition between the food produced for humans and the feed for animals. In EU the Waste Framework Directive 2008/98/EC proposed the following waste management hierarchy: prevention, processing for reuse, recycling, energy recovery and disposal.

#### Solution

This project will response in these challenges with the valorisation of agro industrial by-products associated with the local industry in N. Ireland, and focus on apple pomace, distillery by-products (whisky production) and mushroom waste compost, as few data exist. Apple pomace is a rich source of nutrients phytochemicals, (carbohydrates, vitamins, minerals). Mushroom waste compost has high mycelium content may improve animal health by increasing antioxidant capacity. Distillery production by-products are generally favoured due to their high protein/fibre content and found to have positive effects on the animal performance and methane emissions. These by-products may already being used in animal feed, however, more accurate information is needed on their nutritional value and conservation methods.

#### Aim

Evaluate the nutritive value of different agro industrial by-products and assess their potential to 1) improve nitrogen use efficiency in dairy cows; 2) improve milk quality and b) reduce methane emissions.

The objectives of this PhD are:

1. **Evaluate the nutritive value of different by-products.** Samples will be collected and analysed for chemical composition (i.e. antioxidants, vitamins) and profiling and biological activity of their bioactive compounds. This study will take place at Queen's University Belfast.
2. **Assess *in vitro* their effect in rumen fermentation.** Samples be screened using the ANKOM Gas Production System. Measurements include: gas production/composition and fermentation end products. This study will take place at Queen's University Belfast.
3. **Optimize the ensiling process.** The selected by-products will be ensiled in experimental silos with or without additives or associated with other conventional animal feeds. Silage quality will be evaluated. The most efficient ensiling method will be used to prepare silage for the animal trials. This study will take place at Queen's University Belfast.
4. **Access their inclusion effect in the diet of dairy cattle** on feed intake, milk production, nutrient digestibility, energy and nitrogen utilization efficiency and methane emissions. This animal trial that will take place at Agri-Food and Biosciences Institute (AFBI) in N. Ireland.
5. **Reveal how rumen microbes influence metabolic pathways related to N use efficiency and milk quality.** This study includes, milk composition analysis, fatty acid profiling of the milk which will take place at University of Reading and metagenomics at Queen's university. Belfast.
6. **Assess the overall environmental consequences** of increasing the use of co-products in diets of ruminants by developing an improved life cycle assessment (LCA). This study will take place at University of Reading.

### Skills Training

Student will get a unique multidisciplinary training.

#### *Scientific skills*

##### **Queen's University Belfast:**

1) Analytical methods for feed biochemical profile; 2) *in vitro* gas production techniques; 3) metataxonomic and metagenomic sample processing; 4) Sequencing and downstream analysis.

##### **University of Reading (6-month visit):**

- 1) Gas chromatography techniques for fatty acid profile of milk, feed and rumen fluid;
- 2) metabolomics analyses of the NMR spectral data by supervised OPLS-DA, cross validation and response permutation tests to assess predictive accuracy (SIMCA), and metabolite annotation; 3) correlation of metabolites on metabolic pathways (KEGG).
- 3) training at LCA modelling, using the SIMCA software.

##### **Agri-Food and Biosciences Institute (6-month placement):**

Animal Trials experience. Data and sample collection in animal metabolism trials and operation of calorimetric chambers.

#### *Soft skills*

##### **Queen's University Belfast:**

Careers Development Programme include interactive workshops-communicating research skills to employers, effective academic applications, preparing for job interviews-.

### Student profile

This project would be suitable for students who have an honours 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.

### Funding

This project has co-sponsorship the Agri-Food and Biosciences Institute in N. Ireland.

For up to date information on funding eligibility, studentship rates and part time registration, please visit the [FoodBioSystems website](#).