

**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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**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 (NH<sub>3</sub>) 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 NH<sub>3</sub>. CT are able to shift the N excretion from urine to faeces. The excreted urea can be hydrolysed and is susceptible to NH<sub>3</sub> 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.