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PrecisionGrazing: Modelling for increased grazing management precision on Irish grassland farms

Description of Work

This project will develop precision grazing management technologies that will facilitate increases in milk and meat output from sustainable grass-based systems of animal production. An analysis of Irish National Farm Survey data has indicated that net profit per hectare is increased by €162/ha for each additional one tonne of grass utilised on Irish dairy farms, with the figure for beef farms being in the region of €90/ha. The average level of grass utilisation on Irish dairy and beef farms at present is approximately 6.5 and 4.8 tonnes/ha, respectively. Information from research and technically efficient commercial farms has indicated that this can be increased to 11 to 13 tonnes DM/ha through the adoption of modern grazing technologies. The Food Harvest 2020 Report proposes a significant increase in both milk and meat output using smart green technologies. Internationally there is an abundance of indoor feeding systems for dairy cows (Feed into Milk, UFL, VEM, NRC, AFRC); however, there is a lack of feeding systems designed for grazing dairy cows. A Grass Growth Predictor model will be developed, allowing better synchronisation of grass supply with grass demand for grass budgeting on grassland farms. The model will be evaluated using data from Teagasc grazing experiments. Ultimately, the Grass Growth Predictor will use forecasted meteorological data in combination with current grazing management to predict grass growth. Similarly a Grass Intake Animal Performance model will be developed to simulate grass DM intake and animal performance from easily obtainable animal, sward, grazing management and supplementation variables. Following evaluation and testing, these two models will be combined with a Grass Quality predictor Model to form an integrated Grazing Management Animal Performance Model. These technologies will be developed into a decision support system and made available to grassland farmers and advisers through web based applications.

International Context

Many grass growth models have been developed for perennial ryegrass, varying from simple empirical (e.g. Brereton et al., 1996) to more complex mechanistic models (e.g. Jouven et al., 2006; Johnson and Thornley 1983; STICS, Brisson et al., 2003). These models have been developed for cut swards and therefore cannot take into account the influence of the grazing animal on the sward. Similarly, there are a small number of models available that predict dairy cow DMI at grazing (Freer et al., 1997; Heard et al., 2004; Delagarde et al., 2011a,b). Internationally there is no model describing grass growth and using that as an input to a milk production model. Similarly, decision support tools in the area of grass growth, grazing management and animal performance from grazed grass are limited. This project is developing a grass growth model that can describe grass growth across individual paddocks at a 2 m^2 level which will allow us describe the heterogeneity of grass growth in grazed swards as influenced by the deposition of urine by the grazing animal. N losses from the paddock at the 2 m^2 level will also be possible. The grass growth model will be combined with a Grass Intake Animal Performance Model and a Grass Quality predictor Model to form an integrated Grazing Management Animal Performance Model. These technologies will be developed into a decision support system and made available to grassland farmers and advisers through web based applications.

We will be leaders in the area of decision support tools and research models for grass based milk production systems on the completion of the model development in this project.

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Opportunities

Opportunities:

- The development of models and DSS in this project will allow us to apply for funding, both national (e.g. RSF) and international (e.g. Horizon 2020) as we will bring unique tools to any project.
- These models can form the basis of or components of future integrated farm and research DSTs.
- These models will allow researchers to test potential future milk production systems to make informed decisions in the selection of treatments for future research projects.
- A DSS for grass based feed systems will help to increase grass utilisation on grassland farms by allowing farmers and advisors to make informed decisions.

Gaps:

- The main gap that this project is highlighting is the lack of critical mass in terms of biological modelling in Teagasc. The model development is primarily being undertaken by a three year post-doctoral researcher who is developing the models in the programming language C and C++ in collaboration with the project research team. While the research team (grassland scientists, nutritionists, etc.) know what needs to be done, they do not have the modelling and programming skills. Longterm, to exploit the models and further develop them and integrate them into other models/DSSs, Teagasc needs to have a biological modeller who can understand grass based systems and develop models in suitable programming languages.