**Food Futures: a data and science driven tool to enhance farm sustainability**

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**Application.** This unique tool, co-created with scientists, policy and industry partners, can enhance farm sustainability by facilitating the dissemination and uptake of research findings, as well as supporting positive behaviour change and evidence-based policy development. Commercial application is a key aspect of this work, by including it into farm quality assurance schemes that can be used by the industry and consumers to drive higher integrity and trust food systems.

**Introduction.** Quantifying and enhancing the sustainability of agri-food production is key to protecting existing markets and securing new ones. Economic, social and environmental sustainability have to be quantified, meaning a large set of varied data are required. As part of the Agri-Food Quest ‘Food Futures’ project, a holistic, data-driven tool has been developed to measure, verify and report whole farm sustainability. This paper presents findings from the application of the tool to Northern Ireland (NI) farms.

**Materials and Methods.** Scientifically robust indicators and metrics of sustainability were developed to measure economic, social, (i.e. farm family wellbeing) and environmental sustainability at farm level. Importantly, the latest research findings were incorporated in the Food Futures tool, to inform the selection and definition of more than 100 indicators and their sustainability scoring system. Specifically, responses to each indicator (eg slurry application methods, % of soils at optimum pH) are scored on a scale of 0 to 10, with 10 representing either best practice, the optimum status or the most efficient farms.

Data were then collected from 30 ambassador dairy, beef and sheep farms in NI since 2019 using a comprehensive questionnaire to inform the Food Futures tool. In 2022, an interactive dashboard was created to facilitate the use of the tool by (a) optimising data capture, (b) providing quantified feedback on the level of performance using graphics and traffic light systems and (c) providing targeted advice and practical options to improve on-farm sustainability. In 2022, Food Futures worked with the Livestock and Meat Commission (LMC) to successfully test a bolt-on tool (shorter than the full Food Futures tool) on more than 160 randomly selected Farm Quality Assured (FQA) beef and sheep farms in NI. The purpose of the bolt-on exercise was to run a second pilot for the Food Futures programme to 1) obtain more data from a wider range of farming conditions across NI, 2) seek feedback from participants (both assessors and farmers) and 3) further test the digital dashboard.

**Results.** Initial results indicated that there was clear potential to enhance further the sustainability at farm level. For example, among all 162 farms surveyed as part of the FQA scheme (mostly beef and sheep enterprises), less than 50% of the farms surveyed had assessed their soil health by taking regular soil samples across the farm. Using splash plates was still the most common method to apply slurry (>80%). Only 55% of the study farms had a succession plan in place and more than 35% felt that they were unable to take regular time off. The level of uptake from these FQA farms, done on a voluntary basis, was lower than among the ambassador farms; nevertheless, the quality of the answers provided was excellent, with very few issues or missing observations. Since the initial group of 30 ambassador farms completed the full survey from the start of the programme, their active participation in both the development and use of the data-driven tool has already resulted in positive behavioural change to further improve their sustainability credentials. For example, 33% of these farms planted more trees and hedgerows, 22% adopted lower emission slurry spreading techniques and more than 20% of them increased the frequency and extent of their soil sampling regime to inform fertiliser application on-farm.

**Conclusions.** The platform developed in this project enables users to visualise key strengths and weaknesses, set up realistic targets, identify and implement actions and explore relationships among key metrics. Building on the successful proof of concept developed as part of this project, there is now a need to further automate data entry requirements by establishing further links with existing dataflows and schemes. Continued transparency, scientific robustness and partnership with industry and government will facilitate a smarter use of on-farm data to deliver improved sustainability credentials.

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