Soil research infrastructure

TEAGASC research is helping to build a new understanding of the soils beneath our feet.

The importance of soils for crop and livestock production is well understood, as 95 % of food, feed and fibre production required by humans is literally based on soils. However, in addition to food production, soils provide a range of critical ecosystem services, such as: nutrient cycling and supply; water regulation and purification; carbon sequestration and climate regulation; and, a habitat for biodiversity, to name but a few. The role of soils and the key functions they provide is increasingly recognised, and there is a new impetus from all soil users for enhanced protection of this key natural resource. Research at Teagasc Johnstown Castle has focused on many different aspects of soils for over seven decades. In this time, expertise and understanding of the soils that exist in Ireland has been developed and passed on. Maintaining our soils in good condition is as critical now as it ever has been, and farmers and decision makers need science-based, easy-to-apply and cost-effective tools and advice to assess changes in soil health and function to enable them to manage soil resources optimally to achieve sustainable production, economic and environmental goals.

Irish Soil Information System

Critical to the successful management of our soil resource is knowledge on the location of our soils, and their associated properties. The Irish Soil Information System (http://gis.teagasc.ie/soils/) brings together existing information and data from previous soil survey work in Ireland and augments it with a new field campaign (2007-2013), leading to the production of a new national soil map at a scale of 1:250,000, as well as a collection of tools to access and interact with the data. A national soil database has been developed and maintained at Teagasc Johnstown Castle, which is utilised for soils and environmental research. This national soil database is used to satisfy the information required for both soils management and effective policy implementation, and is a resource to look at changes in soil chemical health.

Long-term field experiments

Long-term field experiments, akin to living laboratories, are of critical importance for developing a new understanding of the role of soils in regulating climate change, and have been highlighted in the EU Mission on Soil Health and Food. Long-term field experiments provide an opportunity to look into the past and to help predict future implications of changing management and climate conditions over time. Teagasc has established a range of long-term field experiments, which encompass management of soil fertility, grassland swards (including clover and multispecies swards), organic amendments, tillage type, and crop rotation (including cover cropping), to name but a few. For example, the Cowlands grazed grassland phosphorus (P) experiment, established in 1968 at Johnstown Castle Research Farm, is the oldest long-term field experiment in Ireland. Recently, this experiment has been used to identify the role of P in regulating carbon and nitrogen (N) cycles, and its importance for reducing greenhouse gas (GHG) emissions in managed grasslands. The Controlled Environment Research Facility at Johnstown Castle also enables researchers to investigate the effects of environmental conditions on various soil and plant interactions, and their agronomic and environmental outcomes.

Soils and environment research laboratories

As research into soils has developed over the years, so too have the methods and equipment employed for investigation and experimentation. State-of-the-art research equipment at Teagasc soils and environment research laboratories is in place to cover the breadth of

analysis related to soil health, nutrient efficiency, water quality, gaseous emissions, soil microbiology, agro-ecology and biodiversity, and the Agricultural Catchments Programme. In recent years, laboratory infrastructure has been used to conduct analysis of stable isotope tracers in soils, plants and gases, spectroscopic measurements of soils, plants and other materials, analysis of residues and pesticides, and microbiological analysis of soils. Intensification of research efforts to understand the biological health of soils has taken place in recent years, as the technological restraints of the past have been overcome. A suite of soil biology laboratories, fully equipped with the latest molecular and next-generation sequencing approaches that facilitate a wide range of novel and exploratory analysis on soil microbiological communities, are now in place at the laboratories at Johnstown Castle. These include a range of DNA and RNA methods that enable quantification of microbial communities and their functional activity. Microscopy facilities also facilitate identification of microfauna and other components of the living soil.

National Agricultural Soil Carbon Observatory

Information on changes in soil carbon stocks across organic and mineral soils in Ireland is required to accurately reflect GHG emissions and carbon sequestration from agricultural land. The National Agricultural Soil Carbon Observatory (NASCO) is a network of flux towers, which measure gaseous emissions at high resolution across different farming systems and soil types. The network enables the targeting of mitigation measures to increase carbon sequestration to be included in the national inventory. The longest-established flux tower has been making emissions measurements on the dairy farm platform at Teagasc Johnstown Castle since 2003. The NASCO will also add value to the soil carbon sampling campaign in the new Teagasc SignPost farms and the Agricultural Catchments Programme, as they work with farmers and the wider industry to understand and mitigate GHG emissions through implementation of best management of their agricultural soils and farming systems. It also places Ireland at the forefront of EU carbon sequestration research and will enable Ireland to participate in the EU Integrated Carbon Observation System (ICOS) network. The data generated will allow Ireland to count the carbon that is sequestered from the atmosphere and stored in agricultural soils, and to benefit from the EU Effort Sharing Regulation.

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