The soil beneath our feet

Good soil structure accounts for at least 20% of yield. The GrassVESS tool will assist you in evaluating your soil's health

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Healthy soil is the foundation for food, feed, fibre, fuel crops on agricultural land and enhanced biodiversity on non-farmed areas. Soil-based plant production also delivers other important ecosystem services, such as carbon sequestration (capture), climate regulation, oxygen production and nutrient cycling.

A reciprocal, and somewhat symbiotic, relationship exists between the soil and vegetation; as fertile soils promote plant growth by providing nutrients, water and a substrate in which to sink the roots. In return, vegetation cover protects the soil, recycling water and nutrients, and reducing wind and water erosion.

The nutritional content of plant tissue is directly related to the availability of soil nutrients and the soil's capacity to supply nutrients and water to the plant's roots. Similarly, root growth is influenced by the physical properties of the soil, such as soil structure and permeability. What is soil's structural quality?

In recent years we have begun to talk more in terms of soil 'health' rather than soil 'quality'. The difference is that the former is more associated with the soil's biological community as the key driver of soil functionality.

Under poor management, the intensification of farming practices can put soil health at risk by exhausting nutrients, altering soil structure and reducing soil water retention capacity. Most importantly, poor management can reduce soil biodiversity.

Soil biodiversity is crucial for nutrient mineralisation, decomposition of organic matter and fixation of nitrogen. The variety of the microbial community is supported by good soil structure.

Soil structure is the physical construction of the soil or the arrangement of soil aggregates. These soil aggregates are clumps of soil formed by solid, individual particles of sand, silt and clay sticking together with occasional empty spaces between them.

The arrangement of aggregates and pores directly controls the movement of water and air within the soil, which indirectly impacts soil temperature. These properties affect all life in the soil, such as plant roots, macro and meso fauna, along with millions of microrganisms.

It is important to remember that farmers are the "architects" of the "house for living organisms" which is soil structure, and that they are largely controlling it through management. Because it is not a top priority on a day-to-day basis, many farmers tend to underestimate the importance of monitoring and maintaining soil structure.

While farmers routinely apply fertiliser nutrients to achieve high crop yields, the management of soil structural quality and the habitat for micro- and meso-organisms is potentially more important for achieving effective plant rooting, nutrient and water cycling, and preventing plant diseases and pests.

Ongoing soil research

The Soil Quality Research Group at Teagasc Johnstown Castle has developed a method to visually evaluate soil structural quality in grasslands: the GrassVESS method. This method represents a version of the VESS method developed in Scotland for soil

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structure assessment in tillage sites.

The method was tested and optimised for grasslands in Ireland during a national campaign focused on more than 180 sites.

It is a quick, simple and user-friendly method which requires only very basic equipment and gives an immediate result.

This decision-support tool is a flowchart which guides the farmer or advise, through a series of questions and observable features related to a cube of soil that they have retrieved from the field.

This tool helps the operators describe the soil until they arrive at a final score of its structural quality. The main soil features being observed during the assessment are soil aggregate size, shape and strength; aggregates porosity; aggregates colour; root growth. The test should be carried out across different locations within a field to identify where and what, if any, soil structural issues may exist.

To learn more about the GrassVESS method, contact your local Teagasc adviser, or you can download the GrassVESS flowchart and soil structure ABC on the Teagasc website at www.teagasc.ie/environment/soil/research/square/support-material/

Knowledge Transfer

Working with Teagasc advisory colleagues has enabled me to engage directly with farmers in discussion groups. On numerous occasions I've worked with groups, getting our hands dirty in the field breaking down samples of soil into aggregates to identify signs of soil damage or health. The subsequent discussion is usually dedicated to potential methods for remediation of soil structural problems, such as severe compaction.

A general rule is that heavy machinery and livestock traffic on wet soils should be avoided at all costs, because soil structure is weaker and prone to damage when wet. Where soil compaction is moderate, the soil should be allowed to recover naturally over time by avoiding management which may damage it further.

Soil organic matter build up is very important to enhance soil resilience because it helps to glue soil particles together into aggregates and acts as a shock absorber between these particles, preventing compaction.

In grasslands, reseeding or ploughing can be a remediation option where shallow compaction is identified, but extreme caution should be taken when considering interventions with sub-soilers, as soil smearing at depth can lead to even greater long-term soil structural problems.

In all cases, being more familiar with the soil beneath our feet and being able to identify the signs of soil structural problems makes decisions on soil management practices more effective, and facilitates early intervention before any severe and long-lasting damage occurs.