Soil – its role and some new DARD-funded E&I projects involving arable crops and soils

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The soil is a thin layer on the earth's land surface on which all life depends. It is being continually formed from the parent rock below, from plant/crop roots and residues and other materials added to or left on its surface. We usually think of the soil mainly as a source of nutrients for our crops, grassland, forests and 'natural' habitats. So we are familiar with the transformations of e.g. nitrogen in the N cycle, as these affect the supply to our crops and losses to environment. Water and air in the soil are both vital for crop growth but when present in super-abundance or in short-supply lead to stress in crops. Soil structure on both large and small scales – aggregates and cracks, pores and particles – affects the chemical cycles and the presence and movement of air and water. But arguably the most important 'part' of the soil is its fauna and flora, from microscopic bacteria and other microbial organisms to the largest soil-dwelling animals, earthworms, on the island of Ireland at least. It is the myriad numbers of these living in complex relationships with one another which transform the parent rock and the plant material growing on and in the soil into soil. They are integral to the N cycle and to the availability of other nutrients. They help create and maintain soil structure. In short, they are the foundation of all that makes soil healthy, enabling plant growth to be productive. We're only beginning to understand their value as we work with the soil.

The soil changes over time and varies across a field in all directions and it changes with depth. Some of these patterns of variation are more familiar, e.g. the changes in texture and organic matter with depth, the effect of temperature on the N cycle as the seasons cycle. Technological developments and new measuring equipment are allowing us to collect lots more data on other aspects, for example changes in soil strength with depth and across a field. Some examples are shown below.

Some current projects being conducted by AFBI are contributing to our developing picture of the soil, how it varies in space and time, how our crop management affects not only nutrient availabilities but also soil structure and soil biology. Some of the arable related projects are:

DARD E&I project 13/4/07 **Impact of organic manure application on soil quality and nutrient availability for sustainable and profitable cereal crop production in Northern Ireland** (Cereal, Organic Manures and Soil (COMS) project).

Overall objectives:

- To determine the impact of organic manures on (1) in-season and over-season availability of N, P and K to cereal crops, (2) earthworm populations and activity, and (3) soil quality indicators such as total C and N, compaction, soil aggregate stability, and porosity.
- To quantify how all these effects can be integrated to develop fertiliser and organic manure application guidelines for sustainable and therefore environmentally-responsible crop production.
- To provide evidence encouraging all farmers to exploit the potential of organic manures so that inorganic fertilisers are used more effectively, N losses are reduced and output per unit input is increased, reducing carbon per unit production and improving profitability, for the benefit of the whole agri-food industry in NI.

DARD E&I project 13/1/11 **Impact of compaction on soil quality and nutrient availability for sustainable and competitive production in grassland and arable farming systems in Northern Ireland.**

Overall objective: To evaluate the extent of surface compaction in agricultural soils in Northern Ireland (survey) and provide underpinning scientific information to aid management decision support in avoidance and alleviation of compaction (literature review, risk map and multi-site plot experiment).

Examples of soil strength data showing variation with depth, across a field and over time