Working with industry to improve soil health in agriculture

Current and previous strategic research programme funded work has been applied to assess soil health within arable systems across Scotland. From 2023-2025 we have been working with Diageo, Scottish Agronomy, and SAC to assess soil health within a network of farms across Scotland. In addition to the measurement of soil physical, chemical, and biological indicators, results have been linked to agronomic practice.

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Introduction

Through Diageo funding from 2023-2025 we undertook soil health testing across Scotland (20 farms and 80 fields) utilising biological, chemical and physical indicators of soil health. Ongoing and historic research within the strategic research programme supported the development of these agricultural soil health indicators and guided sampling. Developed indicators have been validated on our research platforms (for example the Centre for Sustainable Cropping and organic amendment platform) and at plot scales, supporting the deployment of robust indicators at farm and field scales. Data is now being used by the supply chain to strategically deploy agronomic practices to improve soil health.

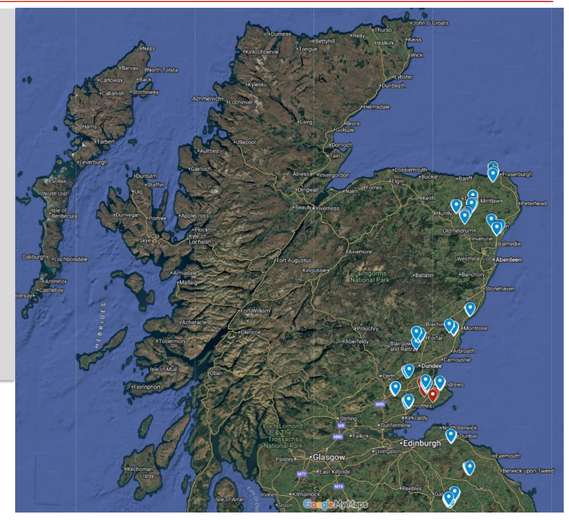

Figure 1: Farm and field locations: A total of 20 farms and 80 fields sampled across Scotland for a range of soil health Indicators.

Methods

Samples were collected from 20 farms (80 fields) across Scotland (***Figure 1.***). The 'National Soil Map of Scotland' (***Figure 2. (A)***) and 'Soil Erosion Risk' maps (***Figure 2. (B)***) were used to stratify sampling of data points within each of the fields within the farm network. A total of 80 fields were sampled with both composite samples and intact soil cores collected for laboratory assessment. Farms and fields were categorised into 3 regions, South, Central and North.

Indicators were selected to deliver an overview of soil health with 7 chemical, 8 physical and a biological indicator selected. Indicators were selected based on work within the *Healthy Soils for a Green Recovery project* supported by the ENRA Strategic Research Programme. Indicators shown to be sensitive to changes in agronomic practices and previously tested at the Centre for Sustainable Cropping (CSC), a long-term amendment trial (Lower Pilmore) and the SUMO Square crop rotation platform, all James Hutton Institute research platforms. In addition to soil indicator data, information on agronomic practices adopted by farmers over the previous 5 years (including crop history, tillage practice etc.) was all also collected to link practice to soil health.

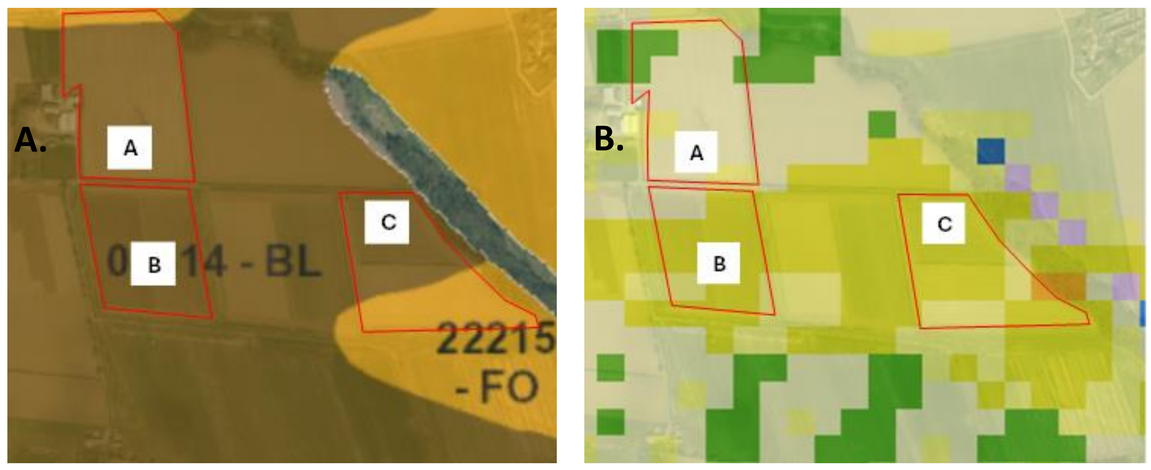

Figure 2: National Soil Map of Scotland (A) and Soil Erosion Risk map (B) used to support sample stratification: Example shown is from 3 fields at the James Hutton Institute's Balruddery Farm highlighting potential in-field variability. **A:** Field A: Small 'mineral podzol' on northern boundary; Field B: Uniform 'brown soil'; Field C: 2 key soils, 'brown soil' and 'mineral podzol'; **B:** Soil erosion risk map highlighting variability in fields B and C.

Results

A number of indicators highlighted significant variability and differences between both fields and regions. Some indicator values were also significantly influenced by soil texture. When investigating the impact of agronomy practice, over wintering approaches and cultivation were found to significantly drive a number of metrics. A reduced number of metrics were influenced by Livestock integration history and also straw incorporation.

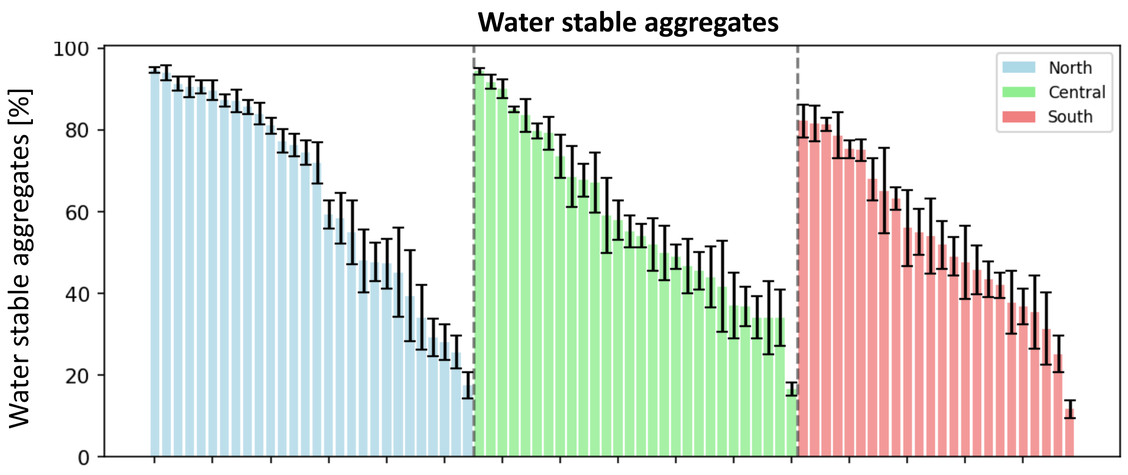

Figure 3. Water stable aggregates from 80 fields across Scotland, Significant differences found between fields (p‹0.001) and regions (p‹0.001).

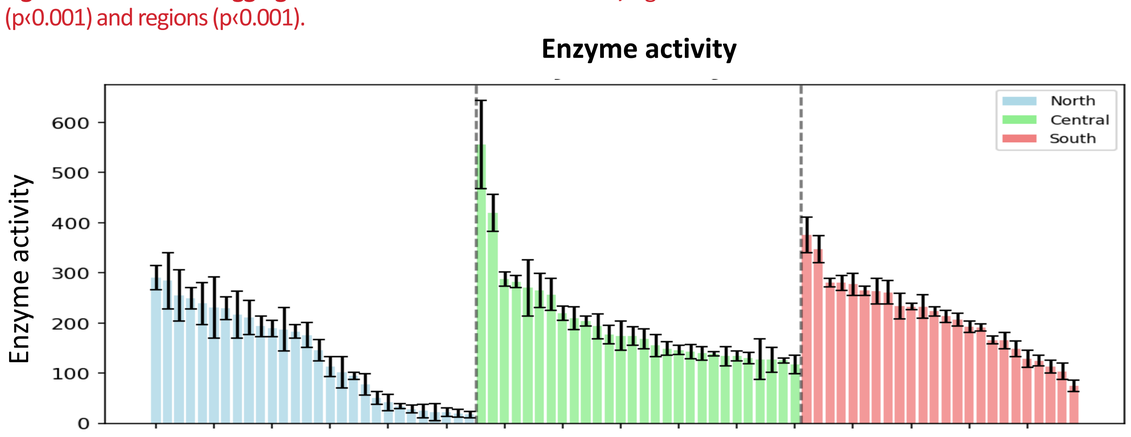

Figure 4. Enzyme activity from 80 fields across Scotland, Significant differences found between fields (p‹0.001) and regions (p‹0.001).

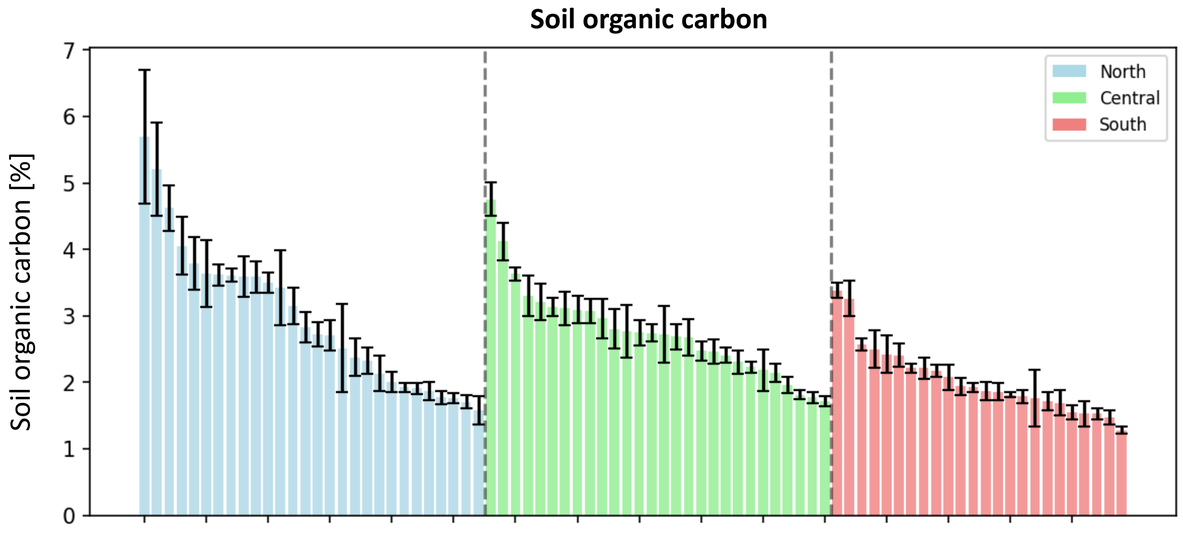

Figure 5. Soil Organic Carbon at 0-15cm aggregates from 80 fields across Scotland, Significant differences found between fields (p‹0.001) and regions (p‹0.001).

Conclusions

- Scottish Government funded research (current and historic) demonstrably informing industry and farmers of soil health
- Results help inform current status of soils and where improvements can be made
- Significant differences in indicators both between fields and between regions, North, Central and Southern Scotland.
- Indicators selected have highlighted differences associated with agronomic practice (such as cultivation and over-wintering history)
- Diageo supporting a programme to apply intervention practices for soil improvement
- High value intervention practices (in terms of cost and benefit) being tested at a plot scale in parallel to field scale assessments
- Re-sampling planned to quantify changes in soil health in response to interventions

Acknowledgement

Special thanks go to all the farmers within the network for there support, interest and desire to improve their soil quality.