Soil and Nutrient Network

Helping farmers improve soil and nutrient management

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Case study -
East Balhalgardy, Aberdeenshire

East Balhalgardy and the nearby unit of Auchencleith, farmed by brothers Bill and Alan Maitland, is a predominantly arable farm extending to 216 hectares on the outskirts of Inverurie, Aberdeenshire. The cropping enterprise includes spring barley and winter wheat, spring and winter oats and winter oilseed rape, while 22 hectares of permanent grassland supports a small suckler herd of 26 cows.

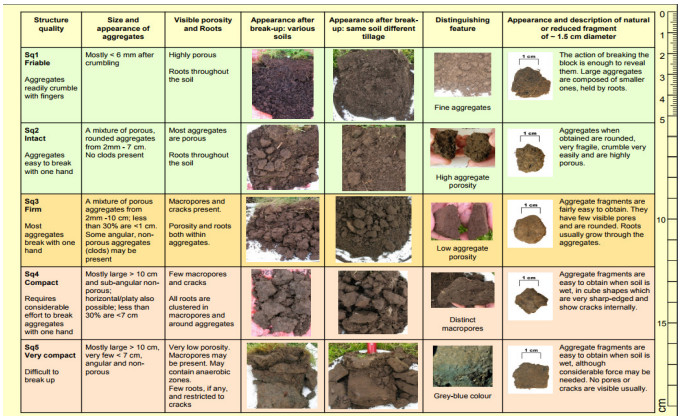
The majority of the farm lies on alluvial soil or brown forest soil of the Insch soil series. There are a few small areas subject to gleying and there is a small area of basin peat at Auchencleith that supports wetland habitat. Under the Land Capability for Agriculture system most of the farm is classified as 3.1 land with small areas of 3.2 and 4.2 land, particularly in wetter, low-lying areas, which includes part of the flood-plain of the River Urie. The whole farm lies within a Nitrate Vulnerable Zone and is in the River Don catchment, which has recently been designated a priority catchment by SEPA.

Soil Structure

The Maitlands have used minimum tillage across the farm for several years, using a Claydon drill. At the first nutrient network meeting in February 2017, SAC Consulting's Gavin Elrick examined the soil structure in a deep soil pit.

Although there was a hint of a compaction layer quite deep in the soil (probably as a result of many years of machinery travelling over the field), the top 50cm of soil, which is most important for root development, showed a good structure for growing crops.

Using the Visual Evaluation of Soil Structure (VESS) guide, the deep topsoil scored 1-2, being friable and at worst, breaking into small, rounded aggregates very easily. There was therefore no need to take action to improve the structure. of the soil.



Structure quality	Size and appearance of aggregates	Visible porosity and Roots	Appearance after break-up: various soils	Appearance after break-up: same soil different tillage	Distinguishing feature	Appearance and description of natural or reduced fragment of ~ 1.5 cm diameter
Sq1 Friable Aggregates readily crumble with fingers	Mostly < 6 mm after crumbling	Highly porous Roots throughout the soil			Fine aggregates	The action of breaking the block is enough to reveal them. Large aggregates are composed of smaller ones, held by roots.
Sq2 Intact Aggregates easy to break with one hand	A mixture of porous, rounded aggregates from 2mm - 7 cm. No clods present	Most aggregates are porous Roots throughout the soil			High aggregate porosity	Aggregates when obtained are rounded, very fragile, crumble very easily and are highly porous.
Sq3 Firm Most aggregates break with one hand	A mixture of porous aggregates from 2mm -10 cm; less than 30% are <1 cm. Some angular, non-porous aggregates (clods) may be present	Macropores and cracks present. Porosity and roots both within aggregates.			Low aggregate porosity	Aggregate fragments are fairly easy to obtain. They have few visible pores and are rounded. Roots usually grow through the aggregates.
Sq4 Compact Requires considerable effort to break aggregates with one hand	Mostly large > 10 cm and sub-angular non-porous; horizontal/platy also possible; less than 30% are <7 cm	Few macropores and cracks All roots are clustered in macropores and around aggregates			Distinct macropores	Aggregate fragments are easy to obtain when soil is wet, in cube shapes which are very sharp-edged and show cracks internally.
Sq5 Very compact Difficult to break up	Mostly large > 10 cm, very few < 7 cm, angular and non-porous	Very low porosity. Macropores may be present. May contain anaerobic zones. Few roots, if any, and restricted to cracks			Grey-blue colour	Aggregate fragments are easy to obtain when soil is wet, although considerable force may be needed. No pores or cracks are visible usually.

Visual Evaluation of Soil Structure Score Sheet

Useful Resources

- Valuing Your Soils Booklet - www.fas.scot/?p=4323
- Practical Guide: Managing Soil Phosphorus - www.fas.scot/?p=7258
- Technical Note (TN650): Optimising the application of bulky organic manures
- Technical Note (TN652): Fertiliser recommendations for grassland
- Technical Note (656) Soil information, texture & liming recommendations

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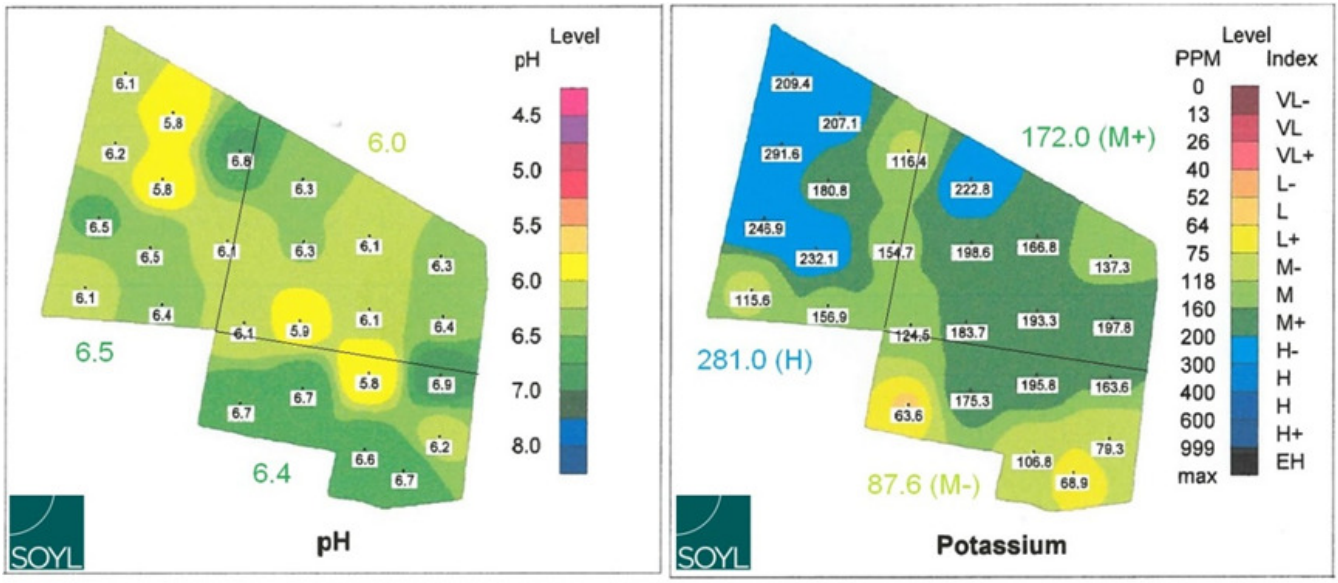
GPS Soil Analysis

East Balhalgardy uses SOYL Precision Farming to carry out GPS soil conductivity testing in order to set variable seed rates for crop establishment. We were interested to look at the benefits of GPS soil mapping for nutrients and pH, compared with traditional analysis. In one large (27ha) field we carried out traditional routine soil analysis on a sample from each of three sections of the field, collecting an aggregated sample from 20 points along a zigzag path within each block. We then asked SOYL Precision Farming to carry out GPS soil analysis on the same field, using their standard sampling rate of 1 sample per hectare.



GPS maps of pH (left) and K (right) in a 27ha field with results of traditional soil sampling shown around the edge for each of three subdivisions of the field

Maps of pH and Potassium levels are shown above. Although there was broad agreement in the general pattern and values produced by both methods, the GPS sampling showed greater variability within the field. For pH, the traditional sampling method with three blocks showed a range of 6.0 to 6.5 while the GPS sampling showed a range of 5.8 to 6.9. For potash, the traditional method showed a range of 87.6 (M-) to 281.0 (H) while the GPS sampling showed a range of 63.6 (L) to 291.6 (H).

Key Findings

- Minimum tillage can help to maintain soil structure on arable farms
- Download your copy of the Valuing Your Soils book to learn more about VESS & assessing your soil structure
- Find out the phosphorus sorption capacity (PSC) of your soil to ensure optimum application rates for phosphorus fertiliser
- Consider GPS soil sampling to show variability within your fields and to potentially reduce your lime bill.

For more information on the Soil and Nutrient Network see www.farmingandwaterscotland.org, For dates of SNN events, find us on Facebook or follow us on Twitter @FarmWaterScot.

Maintaining Soil Phosphorus

The concept of soil phosphorus sorption capacity (PSC) is not well known among farmers, but SAC Consulting's soil specialist, Dr. Alex Sinclair, was keen to draw attention to the subject, which is highly relevant to East Balhalgardy. The concept, explained in detail in SRUC Technical Note 668, is that different soils vary in their capacity to bind with phosphorus from fertiliser applications, which makes the nutrient temporarily unavailable to the growing crop. Soils can be classified on a scale of 1 (low) to 3 (high) for PSC and unfortunately the Insch soil series which predominates at East Balhalgardy is one of those classified as PSC 3.

To allow for the fact that phosphorus binds more effectively to this soil, the target phosphorus status to ensure that sufficient soluble phosphorus is available to the crop must be higher than for PSC 1 and 2 soils. While farmers should aim to maintain M- status (4.5-9.4mg P/l) on PSC 1 and 2 soils, they should aim for M+ status (9.5-13.4mg p/l) on PSC 3 soils. Building up from M- to M+ on PSC 3 soils would require an additional 20kg $P_2 0_5$/ha/year, over and above the maintenance allowance for crop offtake.