

Soil Analyses for Farmers

Soil health and fertility are key to successful farming. Good soil management depends on assessing the soil's physical condition and interpreting soil analyses effectively. Regular soil analysis can show the effects of farming practices on soil fertility and is used to keep nutrients at an optimum level for crop growth. Two approaches to soil analysis are outlined below.

The Defra RB209 "Sufficiency" method is widely adopted in the UK. Soil pH, indices of available P, K and Mg and crop offtake are used to determine the inputs of animal manures and fertilisers required to maintain soil nutrient contents at a sufficient level to support the optimum economic yield while minimising losses. The RB209 publication is the basis of decision tools like PLANET and MANNER and is based on results from many years of UK research.

'Mineral balancing' - Base Cation Saturation Ratio (BCSR)

Developed by Prof. Albrecht in the USA, the BCSR theory looks at nutrient cations and their balance in the soil and is based on an understanding of cation exchange capacity (CEC).

- The total CEC of a soil is a measure of the maximum number of negatively-charged sites able to bind positively-charged cations in an exchangeable form. CEC (expressed as milli-equivalents/100g of soil) is a characteristic of the soil type (e.g. clay soils have a higher CEC than sandy soils) and is not significantly altered by normal management practices.
- These exchangeable ions are an important reserve of plant nutrients. Roots excrete hydrogen ions (H^+) which can displace the nutrient cations from soil exchange sites into the soil solution where they are available for uptake.
- The BCSR theory states that there is an ideal ratio of the different exchangeable cations in the soil that is optimal for plant growth. Fertiliser recommendations based on this theory are designed to adjust the proportions of exchangeable cations to this optimum ratio.
- The four key elements are the base cations - calcium (Ca), magnesium (Mg), potassium (K) and sodium (Na), together with hydrogen (H) and other (mainly assumed to be aluminium) which determine soil pH.
- Fertiliser recommendations for other nutrients, such as P and S, are determined separately and are based on threshold levels rather than ratios.

Albrecht determined the optimal BCSR for crops in US soils. In UK soils, the ideal balance for optimum production (expressed as percentages of total CEC) is thought to be:

Calcium 68%; Magnesium 12%; Potassium 5%; Sodium 1%; Hydrogen 8%; Other 6% (from J. Johnson, 2011)

Soils from the Commercial Development Farms in the PROSOIL project varied in how closely they matched the 'ideal' balance, as seen in the chart below.

