

APPENDIX 1 - METHODS OF SOIL ANALYSIS

All results are expressed in terms of the oven-dry soil passing a 2 mm sieve (fine earth) except that of gravel, which is expressed as a percentage of the air-dry field sample.

Particle size analysis – the plummet balance method of Hutton (1955) was employed, with organic matter and carbonate removal where necessary. The hand decantation method of Piper (1942) was used to separate the sand from the finer fractions.

Electrical Conductivity (E.C. 25°C) – A 1:5 soil-water suspension was shaken for one hour, and the conductivity was measured with a “Philips” conductivity bridge and dip cell.

Soil reaction (pH) - the above suspension was used, with measurements being made with a “Jones” glass electrode pH meter.

Chloride (Cl) - The electronic silver nitrate titration technique of R. J. Best was used, as detailed in Piper (1942).

Organic Carbon (Org C) – the method used was the wet combustion technique of Walkley and Black, as in Piper (1942). No recovery factor has been applied to the results listed, but carbon/nitrogen ratios were calculated with the factor 1.3 C/N.

Total nitrogen (N)- Nitrogen was determined by the semi-micro method described by Metson (1956), in which a finely ground sample of soil weighing 0.2 to 0.5 grams is digested in concentrated sulphuric acid, and the ammonia recovered by distillation of the digest in a Markham still.

Free iron oxide (Fe₂O₃) – The method of Haldane (1956) was employed, in which a ground sample of soil is extracted with an oxalic acid-ammonium oxide buffer and powdered zinc, and the ferrous iron in the treated extract titrated with potassium dichromate.

Available phosphorous (Av. P) – The extraction solution used was that of Troug, with a 1: 100 soil-solution ration, and with subsequent colorimetric determination of phosphorous in the filtered extract by the molybdenum blue) with ascorbic acid as the reducing agent (Hutton *et. al.*, priv. Comm). Absorbance measurements were made with a Unicam” SP600 spectrophotometer at wavelength 825 nm. Potassium was determined by flaming a portion of the extract, suitably diluted, in a “Lange” flame photometer.

Carbonate (CaCO₃%) – The manometric method described by Martin and Reeve (1953) was used.

Exchangeable cations – Non-calcareous samples were treated by the method of Hutton and Bond (unpublished data) in which N/1 ammonium chloride is used as the leaching agent for the individual cations, and cation exchange capacity is determined by subsequent leaching of the ammonium-ion saturated soils with N/1 sodium sulphate.

Sodium and potassium were determined by direct flaming of the ammonium chloride leachate in the Lange: flame photometer, and the calcium and magnesium by titration with E. D. T. A. with Eriochrome Black T as a visual indicator for calcium plus magnesium and Murexide as indicator in the colorimetric titration for calcium, in an “Eel Titrator”. Ammonium ion in the sodium sulphate leachate was determined by the Nessler method, and chloride ion by electrometric titration. The difference between these two gave the cation exchange capacity.