

## APPENDIX II - METHODS OF SOIL ANALYSIS

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All results are expressed in terms of oven-dry soil passing a 2 mm round-hole sieve, except gravel, which is reported as a percentage of the air-dry field sample.

**Particle-size analysis** — plummet balance method of Hutton (1956), with sand separation by hand decantation. The ISSS size fractions were separated: i.e., coarse sand 2 - 0.2 mm; fine sand 0.2 - 0.02 mm; silt 0.02 - 0.002 mm; and clay <0.002 mm.

**Electrolytic conductivity (EC 25°C)** — a 1:5 soil:water suspension was shaken for 1 hour and, after temperature equilibration, conductivity was measured with a dip cell and direct-reading meter. Results are reported as microsiemens per centimetre ( $\mu\text{Scm}^{-1}$ ).

**Soil reaction (pH)** — by glass electrode and pH meter on the above suspension.

**Chloride (Cl<sup>-</sup>)** — by the electrometric silver nitrate titration of R.J. Best, as described by Piper (1942).

**Organic carbon (Org. C)** — wet-combustion technique of Walkley and Black, described by Piper (1942). No recovery factor was applied, but the factor 1.3 C:N was used to calculate carbon : nitrogen ratios.

**Total nitrogen (N)** — Metson (1956). Semimicro Kjeldahl method, using a Markham still.

**Free iron oxide (Fe<sub>2</sub>O<sub>3</sub>)** — Haldane (1956). Finely ground soil was extracted with powdered zinc in ammonium chloride-oxalic acid buffer. Ferrous ion in the treated extract was titrated with potassium dichromate.

**Hydrochloric acid extract for phosphorus and potassium (P,K)** — 4 g soil was refluxed for 4 hours with 20 mL 6M hydrochloric acid, with subsequent filtration and dilution of the filtrate to 200 mL. Phosphorus was determined by a colorimetric method using molybdenum blue (Hutton, private communication) and potassium by atomic absorption.

**Available phosphorus (P avail.)** — Colwell (1963). 1 g soil was shaken with 100 mL 0.5 M sodium bicarbonate at pH 8.5 for 16 hours. Phosphorus was determined in the clarified extract by a colorimetric method (molybdenum blue).

**Available potassium (K avail.)** — 2.5 g soil was shaken for 1 hour with 50 mL 0.05 M hydrochloric acid. After settling overnight to clear, an aliquot was diluted for potassium determination by an atomic absorption method.

**Exchangeable cations** — by method of Hutton and Bond (unpublished data). Synopsis: Soil leached with molar ammonium chloride solution (pH = 7.0) to displace exchangeable cations. Potassium and sodium in leachate determined by flame-emission techniques. Calcium and magnesium, determined by EDTA titration. Adsorbed ammonium ion was leached from the soil with sodium sulphate solution, and cation ex-change capacity was determined from the excess of ammonium ion over chloride ion in the leachate.