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Carbon and nitrogen estimation in soils : Standardizing methods and internal standards for C/N analyzer

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Abstract : It has been found that soil organic carbon (SOC) is very easily oxidized in the oven during analysis through C/N analyzer. There is no literatures on the relative effects of CaCO₃ in the determination of total C in soils. To avoid, effects, if any, we have developed separate methods for calcareous and non-calcareous soils. It is hoped that, with a prior knowledge of soil-site, a suitable method can be chosen for both these types of soils to determine C and N in soils.

Keywords : Soil organic carbon (SOC), calcareous soils, non-calcareous soils, C/N analyzer.

Introduction

The importance of the level of carbon in soils is important from the ecological and agricultural point of view. Since organic form of carbon forms the major source of nitrogen in soils for plant growth, the efforts to measure carbon in soils also necessitates knowledge of nitrogen in soils. Quantitative understanding of a scientific principle that governs carbon and nitrogen balance in a given ecosystem is essential for development of strategy to increase the carbon sequestration. So far as soils are concerned such attempts evolve accumulation of quantified carbon and nitrogen data set for a host of soils. Carbon occurs in soils in both the forms of mineral and organic matter viz. (i) carbonate mineral forms, chiefly as CaCO₃ and (MgCO₃, CaCO₃); small amount of carbon also occurs as CO₂ and HCO₃⁻ and CO₃²⁻ ions of more soluble salts, (ii) highly condensed, nearly elemental organic carbon (charcoal, graphite, coal), (iii) altered and resistant organic residues of plants, animals and microorganisms such as humus and (iv) slightly altered organic residues of plant and animals and living and dead microorganisms. The total carbon of soils includes all the above four forms while the organic carbon includes the last three forms.

Organic carbon in soils has been traditionally deter-

mined in laboratory using the method of Walkley and Black¹. Inorganic form of carbon in soils contributed largely by CaCO₃ is determined by acid-base titration^{2,3}. In spite of serious efforts made by soil researchers complete recovery of both organic and inorganic forms of carbon remains difficult; and more so for organic carbon. Organic carbon determination in soils may be carried out (after removal of carbonate, usually by acid) by (a) dry combustion in a furnace and/or, (b) chromic acid oxidation, followed by measurement of CO₂ evolved. Organic carbon content of soil may be reported directly as percentage C or calculated as organic matter. The conventional organic carbon to organic matter factor is 1.724 based on the assumption that soil organic matter consists of 58 percent C. However, such factor for a conversion of the carbon content of many surface soils to organic matter content has been found to be 1.9 and the factor for many types of subsoil is about 2.5⁴⁻⁶. The total organic matter content of soils is determined by (a) oxidation with H₂O₂, (b) ignition at moderate temperature, or (c) ignition after decomposition of silicates with HF-HCl. Soil organic matter exhibits correlation with (a) total nitrogen content, (b) climate and (c) clay content. Multiplication of total soil nitrogen content by 20 roughly ap-