Alternative Methods for Measuring Inorganic, Organic, and Total Dissolved Nitrogen in Soil

There are numerous methods for measuring inorganic, dissolved organic, and microbial N in soils, although many of these are complex or require expensive equipment. We have modified methods for the measurement of NH4+, NO3-, total dissolved N (TDN), and soil microbial biomass N (SMBN) in soils. The methods are based on a microtiter plate format and are rapid and simple to perform. Ammonium is quantified by a colorimetric method based on the Berthelot reaction. Total dissolved N and SMBN (by CH3Cl fumigation-extraction) are quantified as NO3- after alkaline persulfate oxidation. Nitrate is estimated directly or after persulfate oxidation by reduction of NO3- to NO2- by VCl3 and subsequent colorimetric determination of NO2- by acidic Griess reaction. The new suite of methods was compared with conventional methods such as high-performance anion-exchange chromatography for NO3- and high-temperature catalytic oxidation for TDN. Our methods produced comparable detection limits, linealities, and precisions compared with the conventional methods.

Limits of quantification were 7 μg NH4+-N L^-1, 55 μg NO3+-N L^-1, and 0.275 mg TDN L^-1. The accuracy of the proposed methods was excellent, with recoveries of added NH4+, NO3-, and glycine ranging between 96 and 99%. Linearities of the respective calibrations were high (R^2 > 0.99), and precisions for NH4+ (CV = 2.1%), NO3- (CV = 3.5%), and TDN (CV = 3.9%) were comparable to the reference methods. The simplicity, rapidity, and low cost of the proposed methods therefore allow an expansion of the scope and range of N cycle studies where sophisticated instrumentation is not available.