

Assessment of soil nitrogen (N) tests to predict N mineralisation potential in grassland soils.

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There is no reliable, repeatable and economically viable test for soil nitrogen (N) in Ireland. Current N recommendations for Irish grassland are based on various factors such as production intensity, manure history and other management factors. However, the recommendations do not account for potential variability in mineralisable N (N_o) supplied from various soil types. A reliable N testing procedure capable of quantifying potential N_o would help to improve efficient N fertiliser management and reduce input costs and losses of N to the environment. Biological N tests (e.g. incubations) have been highlighted by many studies as being reliable standards for predicting N_o , but are noted as been too time consuming (requiring from 1 up to 30 weeks) for practical testing. The objective of this study is to evaluate the ability of range of more rapid soil N tests to differentiate between soils and quantify N_o supply for a range of Irish grassland soils, by comparison with a standard 7 day anaerobic incubation method (AI-7).

A total of 37 grassland soils from a range of contrasting sites in Ireland were sampled to a depth of 10 cm. Selected sites received no chemical or organic fertilizers in at least one month prior to application. The biological standard test AI-7, was carried out for each soil to determine their N mineralisation potential. The rapid N tests evaluated in this study included: (1) Cold and (2) Hot (100°C water bath for 4 hours) 2M KCl extractable nitrate, nitrite and ammonium-N; (3) Mild acid-oxidation yielding NH_4^+ -N; (4) the recently developed Illinois soil N test (ISNT), measuring amino sugars & NH_4^+ -N concentrations; and (5&6) Ultraviolet (UV) absorbance of 1M KCl filtered soil extract at 260nm and 210nm, respectively. Due to supplementary factors influencing on N_o additional soil parameters e.g. soil organic matter (SOM), total carbon (C) & N were also analysed for all soils.

A large variation in mineral N contents was evident for all 37 soils at the time of sampling (May –June 2010), as concentrations of NO_3^- -N ranged from 0.96 to 76.9 mg kg⁻¹ and NH_4^+ -N concentrations ranged from 0 to 11.3 mg kg⁻¹. There was also a wide range in SOM (5.48% to 25.88%; \bar{X} , 12.19%) ‡, There was a poor correlation between the level of SOM and mineral N content, showing that SOM alone was not a reliable indicator of the N_o potential of a soil. Comparisons with the AI-7 method indicated that the ISNT method had the strongest relationship (R^2 0.82), although 2M hot KCl and UV absorbance at 210nm were also highly significant (R^2 0.44 and 0.39, respectively). Further analysis will explore these relationships in further detail.

‡ Mean estimate