Can soil N tests accurately predict N mineralisation in grassland soils?

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Current nitrogen (N) recommendations used for Irish grassland are based on various factors such as production intensity (i.e. animal stocking rates), enterprise type, manure history and manure management levels, but do not fully acknowledge the capacity of various soil types to supply plant available N through the mineralisation process. Biological indices such as anaerobic incubations of the soil have been consistent and reliable for predicting N mineralisation, however such incubation methods are considered too time consuming. A reliable, repeatable and economically viable chemical soil-N test, would provide a basis for the management of fertilizer N applications to grassland production systems, helping to increase fertilizer N use efficiency while reducing the associated input costs and limiting losses of N to the environment

The objective of this study is to evaluate the ability of a range of soil N tests to differentiate soils and quantify soil N mineralisation for grass production in Ireland. Soils were sampled to a depth of 10cm from 37 sites representing typical agricultural soils that had received no chemical or organic N amendments in at least the previous 1 to 3 months. The N mineralisation potential of each soil was determined using the biological standard 7 day anaerobic incubation (AI-7) method on air-dried soil. The soils were also analysed using a selection of candidate chemical soil N testing methods which were: (1) Cold and (2) Hot (100oC 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.

At the time of sampling, the 37 soils showed large differences in their mineral N contents, with NO_3-N concentrations ranging from 0.96 to 76.9 mg kg-l and NH_4-N concentrations ranging from 0 to 11.3 mg kg-l. The ISNT had the strongest relationship (R^2 0.69) with the AI-7 method, although the 2M hot KCl method and UV absorbance at 210nm were also highly significant. Further analysis is needed to explore these relationships with the inclusion of other soil parameters (e.g. organic matter) and to validate these findings in field studies. The initial results from this study of N release from Irish soils show that large differences exist between soils in their capacity to mineralise N. This highlights the need to differentiate and manage soils based on their N supply capacities and this will be discussed further in this paper.