Rapid assays to predict nitrogen mineralisation potential of agricultural soils

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A realistic estimate of a soil's potential to mineralise N from organic matter is essential to optimize fertiliser N use and minimize impacts of excessive N on the environment. A large-scale study (130 soils) was conducted to identify laboratory assays that may enable the N mineralisation potential of New Zealand soils to be estimated reliably and rapidly. To ensure that the study delivered robust conclusions, samples were collected from a wide range of soils types in both the North and South Islands. The 130 paddocks sampled (0-15 cm sampling depth) represented different soil Orders (sedimentary and allophanic soils), management histories (dairy, sheep/beef, arable cropping and vegetable production), and textural classes. Based on a literature search and previous experience, candidate assays were selected. These included biological assays: N mineralised in a 7-day anaerobic incubation at either 40 or 25^{o}C; CO_2-C evolved in 24-h following re-wetting of air-dry soil ("CO_2 burst test"); and N mineralised in a two-week aerobic incubation. Extractable organic matter was determined using "mild" extractants: cold and hot water and 0.01 M sodium bicarbonate. Particulate organic matter was included as it is known to be labile and can be rapidly quantified (e.g., using mid-infrared spectroscopy). These assays were evaluated against mineralisation potential measured in a 14-week aerobic incubation at 25^{o}C, with soil moisture maintained at -10 kPa. The assays that correlated closely with mineralisation potential included anaerobically mineralisable N and CO_2 burst test values. Particularly strong correlations were obtained for hot water extractable N, suggesting that this easily-measured organic N fraction can be used to predict N supply potential across the range of soil types and land uses found in New Zealand.