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Nitrogen supplying capacity assessment in temperate pasture soils

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Nitrogen (N) is one of the key nutrients applied as fertiliser to meet the production goals of intensively grazed temperate pasture systems. However, injudicious use of N on pastoral soils decreases the N efficiency of the production system, with increased risk of loss of N to water and to air. There are currently no field calibrated N tests in use for pasture soils to predict N responses, therefore, farmers tend to apply a uniform rate of N across the farm without realising that areas of their farms could have significant variation in N response. This "hit and miss" approach by farmers can result in a significant waste of money and risk of environmental damage. AgResearch has conducted a number of laboratory and field evaluations and tested various pools of soil N as better predictors of N fertiliser response by pastures.

Total N in New Zealand pasture soils at 0-7.5 cm depth varies between 0.2 to 1.5% (w/w). Approximately 97-99% of the total N in soils is present in the organic forms as part of the soil organic matter. Approximately 8 to 10% of the organic N in these soils is present in an easily mineralisable form ("extractable organic N"). The rate of release of N from the easily mineralisable pools is dependent on factors that affect microbial activity in soils such as temperature, moisture, soil nutrients and C:N ratio. A number of replicated plot trials across the country were conducted over the last 10-15 years where various pools of soil N (total N, 2 M KCl extractable mineral N, hot-water extractable total N and microbial N) were evaluated to predict yield responses to added fertiliser N. The most promising soil indicator of dry matter response was obtained by using total N pool in soils. There was an inverse relationship between total N in soils and N fertiliser response (extra kg DM produced per kg N applied). Generally the greater the total N, the lower the response per unit N applied. Even so, application of fertiliser N even at higher levels of soil total N was economically profitable. However, use of soil total N offers potential to increase N fertiliser use efficiency by better targeting of fertiliser to more responsive paddocks; especially where there is spatial variation in soil total N across a farm - or where N fertiliser use is capped through environmental regulation.