Fertiliser responses and soil test calibrations for grazed pastures in Australia

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Introduction On-farm management of fertiliser is of major economic significance to the Australian grazing industries, based on expenditure on fertiliser and higher farm productivity that fertiliser use supports. However the application of fertiliser has traditionally been an inexact and inefficient process (Peverill *et al.* 1999) and there is increasing pressure for nutrient losses from agriculture to be minimised. The improved adoption and application of tools like soil testing can make substantial improvements in nutrient use efficiency but interpretation needs to be based on the best available information. This paper reports on the collation of current and historical experimental data relating to pasture production - fertiliser response relationships (nitrogen, phosphorus, potassium and sulphur) for various pasture types, climatic zones and soils across Australia.

Materials and methods A national team of scientists and fertiliser agronomists from all states of Australia has contributed to the collation of a comprehensive set of pasture production-fertiliser response data from field studies. This has involved identifying and collating previous reviews, published papers, departmental reports and where available, unpublished material. These data sets have been integrated using a relational database to derive the most appropriate response relationships available for the grazing industries in Australia. The national database has been used to provide regionally specific and scientifically validated soil test calibrations for improved pastures.

Results More than 350 experimental data sets have been collated consisting of circa 2600 sites and >3800 experimental trial years. The number of sites is made up of around 479 N, 662 P, 692 K and 810 S trials, with a total of 615 N, 1313 P, 933 K and 974 S experimental trial year. Not surprisingly, experimental data sets ranged in quality, scope and complexity. Less than 33% had enough statistical rigour to enable nutrient response curves to be generated. Only a few studies involved a number of sites in various regions with different soil types and climatic zones. Most studies provided simpler data sets, mostly at a single field site with a single nutrient applied at only 2 or 3 rates. Such data sets could not be used to establish nutrient response curves. There was a limited capacity to combine experimental data sets as methodologies often differed markedly and site data was inadequate. In some single site studies, soil test levels were strongly related to pasture response to fertiliser applications (variance accounted for (VAF) > 0.9), but when applied to a range of soils and environments, they invariably lack precision (VAF ranging from 0.0-0.5). The addition of other variables such as soil type and climatic zones only marginally improved these relationships.

Conclusions More than 50 years of experimental data relating to the response of pasture to soil nutrient availability has been compiled and analysed across the pasture-based grazing industries of Australia. This extensive exercise has highlighted the lack of precision in many response relationships for N, P, K and S and the difficulty in combining historical data sets to assist in extrapolating across soil types and regions. It is proposed that appropriate soil tests may still require regional calibration and further research should adopt standard experimental methodologies.

References

Peverill K.I., L.A. Sparrow & D.J. Reuter eds. (1999) "Soil Analysis; an interpretation manual" CSIRO Publishing, Australia.