

## Foreword: New Directions for Phosphorus Management in Australian Soils and Farming Systems

This Special Issue is the outcome of a workshop which examined the case for a new and more sustainable approach to phosphorus (P) management on Australian farms. Soluble phosphate fertilisers have been a cornerstone of agricultural development because of the inherently low P status of most soils in southern Australia. P fertiliser application in Australia peaked 10 years ago and since then has averaged 460 kt of P/year (FIFA<sup>1</sup>). The annual cost of P fertiliser to Australian farmers in 2007 was around AU\$1.4 billion, and rising steeply. Grain producers alone spend over \$1 billion per year on P fertiliser. P is a major part of production costs for most farmers.

Phosphorus inputs to agriculture also incur an environmental cost. The National Land and Water Audit linked rising nutrient concentrations in soil to an increasing risk of nutrient leakage to the off-farm environment. P inputs in fertiliser have commonly exceeded outputs, not only in intensive agricultural systems, but also in broad-area production where low fertiliser efficiency has required inputs to exceed outputs. Nutrient balances at landscape scale identify south-west and south-east Australia as regions where sizeable soil-P reserves are likely to have accumulated. The areas of highest P accumulation are also the areas of greatest environmental concern, at least in irrigated systems (especially dairy) and in landscapes with the potential for high runoff, or deep drainage on sandy soils in the case of SW Australia. Strong evidence links P fertiliser use to nutrient enrichment of surface waters. Reduced fertiliser use should help to address these concerns. The challenge is to reduce P inputs without compromising profitability.

The economic and environmental pressures to reduce soluble P inputs are opposed by rising 'critical' soil P concentrations and fertiliser rates needed for maximum productivity as other constraints to growth are removed and yield potential increases. As soil P concentrations rise to meet P demand, so do the environmental risks.

Despite a long history of good P research in Australia, both economic and environmental considerations demand a new approach to P management. Past fertiliser practise has been essentially based on the premise that loss of fertiliser-P to 'unavailable' forms in soil is unavoidable. Fertiliser rates have been determined empirically and soil P testing has allowed the results of research on fertiliser rates to be applied widely.

The emerging paradigm for P management is that much, or sometimes all, of the P requirement of plants will be drawn from the valuable bank of accumulated soil P that is currently thought to be unavailable or at best slowly available. There is also growing emphasis on recycling P and renewed interest in the use of less soluble forms of fertiliser. This new generation of P research is gathering pace, especially as the price of rock phosphate continues to escalate.

Future approaches to P management may parallel the requirements of organic agriculture. Organic farmers advocate reduced inputs of P and the use of organic and insoluble inorganic sources with increased cycling of P within farms. Australian studies have identified organic farms that have been managed profitably for many years despite the absence of soluble P inputs, pointing to the possibility of useful approaches to P management that are not yet fully understood. Recent prominence has also been given to farmers seeking an alternative low-input approach to mixed farming, one example being 'pasture cropping'.

In order to determine where significant advances are, or could be made, in reducing inputs of soluble fertiliser P, by making better use of the bank of soil P or non-traditional sources of P, Rural Industries Research and Development Corporation (RIRDC) sponsored a workshop of Australia's leading researchers on soil and plant P and organic systems, who provided reviews of their subject areas, together with leading organic and low-input farmers who provided farm case studies. The workshop proceedings are published along with one additional paper in this Special Issue of *Crop & Pasture Science*. The workshop identified promising areas of research offering significant benefits to farmers who need to cease or reduce further inputs of soluble P fertiliser. These include farmers for whom cost reduction is an imperative, organic farmers, and farmers with a high potential environmental P risk, such as dairy farmers and intensive vegetable producers.

P. S. Cornish and D. Millar  
Workshop organisers

<sup>1</sup>Fertiliser Industry Federation of Australia, 2005.