Reducing/omitting phosphorus fertiliser inputs to reduce Australian dairy pasture soil phosphorous concentrations

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Excessive soil phosphorus (P) is an international problem. Many soils of the United States and Europe contain P concentrations above crop requirement, due to application of P-rich manures. The majority of Australian dairy pasture soils contain high (>25 mg/kg Olsen P) soil P concentrations (National Land and Water Resources Audit 2001), primarily due to fertiliser use. Considering the strong link between soil test P (STP) and P in surface runoff (Sharpley and Rekolainen 1997), strategies are required to reduce soil P. One such strategy is to eliminate further P additions. However, the rate of soil P decline of intensive pasture systems when P fertiliser inputs are reduced or omitted is poorly defined, yet this information is essential to allow land managers to make informed decisions.

We investigated the effect of soil extractable P concentration, soil P buffering properties and P fertiliser input on the rate of extractable P decline across 6 pasture soils. Agronomic (Olsen) and environmental ($CaCl_2$) measures of soil P were monitored. At each site, four Olsen P categories were established to represent typical paddock concentrations ('low' ≤ 15 mg/kg, 'medium' 16–30 mg/kg, 'high' 31–40 mg/kg, and 'very high' ≥ 41 mg/kg). In a fully factorial design, four P fertiliser rates were applied every six months since establishment in May 2005. The P fertiliser treatments were 0, 0.5, 1 and 2 times estimated soil P maintenance requirements, according to site P buffering properties, with maximum rates ranging between 20 and 50 kg P/ha/yr.

Preliminary results suggest that soils with high STP concentrations have a greater initial rate of decline. Very low P buffered soils also had faster rates of P decline than other soils, especially at high and very high initial STP concentrations. Further modeling will aim to define the soil characteristics which influence the rate of decline, as this information will allow extrapolation of the current findings to other soil types.

National Land and Water Resources Audit (2001) Nutrient balance in regional farming systems and soil nutrient status. Commonwealth of Australia, Canberra.

Sharpley AN, Rekolainen S (1997) Phosphorus in agriculture and its environmental implications. In 'Phosphorus Loss from Soil to Water'. (Eds H Tunney, OT Carton, PC Brookes, AE Johnston). (CAB International: Oxon, UK).