Effectiveness of combined organic amendments and lime in ameliorating acid soils

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Acidic subsoils (pH < 5.5) that occur in high rainfall areas of southern Australia severely limit agricultural productivity. These acidic soil layers (10-30 cm) which are often associated with Al^{3}+ and Mn^{2}+ toxicities are difficult to ameliorate via traditional broadcasting of lime. The slow movement of surface-applied lime can be overcome by its direct application deeper within the soil profile. However, this process is more expensive in the short-term and requires access to specially designed equipment. Combined incorporation of organic amendments with lime could accentuate the efficacy of subsurface amelioration and hence improve its feasibility. In addition to generating alkalinity, organic amendments provide essential crop nutrients and can improve the physical and biological properties of these acidic subsurface soil layers. Here we evaluate the effectiveness of promising organic amendments (poultry litter, mature dairy compost, lucerne pellets and sheep manure) added at four different rates (2, 4, 8 and 16 g/kg soil) to two acid soils with and without lime ($CaCO_3$, added to achieve pH 6.5). The two contrasting soils were a Sodosol (pH 4.18) with moderate extractable Al (5.3 mg/kg soil) and low pH buffer capacity (pHBC) (22 mmolc/kg soil/pH unit) and an experimental soil (pH 4.12) consisting of a 60/40 mix of Ferrosol/Dermosol with high extractable Al (26.1 mg/kg) and pHBC (133 mmolc/kg soil/pH unit). The growth and nutrient acquisition of an Al-sensitive wheat genotype (ES8) and concomitant changes in soil chemical properties will be presented. This research will elucidate the mechanisms by which organic amendments ameliorate the negative effects of soil acidity on wheat and assess whether low rates of these materials can accentuate the benefits of lime. This work is part of a larger project investigating innovative approaches to managing subsoil acidic in the southern grain region of Australia.