Subsoil Constraints and Their Management: Overview from Five Years of R&D

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Subsoil constraints cost the grains industry more than $1.6b in lost production each year. Diagnosing and mapping subsoil constraints (SSC) was achieved at a shire scale using the DPIRD soils database and historic surveys. Diagnosing and mapping SSC at a paddock scale was difficult using remotely sensed geophysical data. Poor correlations were found between SSCs and combinations of EM and Gamma irrespective of whether the data was collected by intensive ground surveys or extensive aerial surveys. Significant progress was made in correlating ground based geophysics with soil profile textural properties which are often related to specific constraints. Similarly, using additional soil texture data from the DPIRD soils database, soil texture maps were developed giving farm scale resolution across the wheatbelt. Field and laboratory experiments were conducted to increase grain yields on deep water repellent sands, acidic sands, deep gravels, alkaline loams and sodic clays. Most of the trials investigated combinations of tillage and amendments that included gypsum, liming materials, acid sand, composted chicken litter (CCL) and elemental sulphur (ES). In terms of compaction yield responses to deep tillage decreased in order of the pale deep sands ≥ deep acidic sands > shallow duplex > clays and loams. Crop yield responses to deep tillage and inversion tillage in deep sands were found to last for more than 5 seasons. Natural recompaction was observed in deep sands. Crop production on acidic subsoils was improved through the incorporation of limes and, native (Morrel) liming materials and through gypsum application. Sodic soils were the most challenging to remediate. Yield responses to gypsum were confined to highly sodic (ESP > 15) clays and loams. Shallow mounding and water harvesting technology for sodic soils has been shown to increase crop yields while acidification using elemental S reduced pH and dispersion. Adding nutrient rich CCL increased crop yields on sodic soils in medium rainfall regions. However, in low rainfall areas the additional nutrients resulted in early biomass production with no yield benefit. The CCL and ES amendments, while not currently profitable, enabled a greater understanding of how soils respond when changed chemically. The development of the ROSA economic model for ranking soil amelioration treatments across a wide range of soil types and climates is a key outcome for this and contributing projects. Soil water information has also benefited from this project through additional ApSoil profiles and improvements to the hosting and display of GRDCs network of soil water probes through http:/mylivefarm.

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