Glyphosate biochar interactions on Australian soils of different composition

PhD Research Scholar Aman Sharma[1], Professor Balwant Singh[1], Principal Scientist Rai Kookana[2], Associate Professor Feike Dijkstra[1]
[1]University Of Sydney, [2]CSIRO

Glyphosate (GPS) is a broad spectrum herbicide used for controlling weeds but that can be leached from the soil into aquatic environments. The application of biochar may reduce leaching of GPS due to its sorption capacity of organic compounds, although the effectiveness may depend on soil type. Here, we examined sorption of GPS in contrasting soils amended with and without 0.25-5 g kg-1 biochar. We hypothesized that application of biochar would enhance glyphosate sorption but the effect would depend on GPS-biochar-soil interactions. Batch experiments with 14C labelled glyphosate and liquid scintillation counting (LSC) were used to construct adsorption isotherms. GPS sorption data fitted well to the Freundlich model. The overall pattern of GPS sorption behaviour was Oxisol >Vertisol>Entisol>Inceptisol. The Oxisol adsorbed the maximum amount of GPS likely due to the presence of iron-aluminium oxides while the Inceptisol adsorbed the least, possibly because of the presence of kaolinite which, due to its fixed structure, has limited capacity to sorb GPS. Biochar enhanced GPS sorption in the Oxisol, Entisol and Inceptisol, but not in the Vertisol. The effect of aged biochar was less in the Vertisol soil system, possibly because of the presence of smectite as the predominant clay mineral exhibiting permanent charge. In contrast, biochar enhanced GPS sorption in the Oxisol, likely because of positive biochar interactions with iron-aluminum oxides. We conclude that Inceptisol soil systems are the most vulnerable systems towards GPS toxicity and biochar can act as an effective sorbent in these systems with respect to glyphosate.