

THE EFFECT OF PHOSPHORUS ON GLYPHOSATE ADSORPTION-DESORPTION IN NEW ZEALAND SOILS

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Glyphosate is a broad-spectrum systemic herbicide and is the most widely used agrochemical worldwide. The active ingredient carries a negative charge across a soil pH range of 5 to 9, and thus competes with phosphate for adsorption sites on soil surfaces. However, phosphate has greater affinity for Al–Fe oxy-hydroxide surfaces than glyphosate, and P accumulation in soil may enhance glyphosate solubilisation. The aim of this work was to elucidate the antagonistic effect between phosphate and glyphosate in Pallic, Brown and Allophanic soils of New Zealand using an adsorption-desorption batch experiment. Soils were saturated with KH_2PO_4 solution (1,000 mg P/L) at pH 4.5, using a soil:solution ratio 1:10 (w/v) by shaking overnight (16 hrs). The P-saturated soils were then re-suspended with 10 mg glyphosate/L solution at pH 5 and again shaken overnight (16 hrs). The supernatant of the glyphosate equilibrium solution was collected, then glyphosate was desorbed from the solid phase using an alkaline extractant. The concentration of residual glyphosate in the supernatant and in the extraction was quantified using RP-HPLC with FMOC-Cl pre-column derivatisation.

The results showed that P saturation reduced glyphosate adsorption in the soils. The Allophanic soil with control treatment had the greatest glyphosate adsorption of 99%; however, P saturation reduced glyphosate adsorption by 14%. The P saturated Pallic soil had the lowest glyphosate adsorption of 59%, compared to 87.12% of glyphosate adsorbed in the control soil. Glyphosate adsorption in P saturated soils was positively correlated ($P < 0.0001$) with the dithionate extractable Fe content, suggesting that the previously adsorbed phosphate could be exchanged by glyphosate in the Fe oxy-hydroxides, due to the high Fe reactivity. Findings from this study may help in the assessment of potential glyphosate solubilisation risk according to soil characteristics and P status.

Editor's Note: An extended manuscript has not been submitted for this presentation.