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# Effect of clay amendment of sand on nitrogen, phosphorus and cations in soil solution and in leachate

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Nutrient leaching in sands decreases fertiliser use efficiency and may depress plant production. Application of high cation exchange capacity (CEC) materials (e.g. high activity clay minerals) is hypothesised to reduce nutrient leaching and increase plant nutrient uptake in sands. A column experiment was established to determine nutrient ($NH_4^+$, $NO_3^-$, K, Na, Ca, Mg and P) concentrations in soil solution extracted by Rhizon samplers and in leachate from a Badgingarra sand (1.4 % clay) with three soil amendments (nil, clay-rich soil, bentonite clay) and three fertiliser rates (nil, 38 N 18 P 50 K kg $ha^{-1}$ and 76 N 36 P 100 K kg $ha^{-1}$). Soil amendments were applied at the rate of 50 Mg $ha^{-1}$. The soil columns were leached with de-ionised water equivalent to 50 mm rainfall every 4 days. Leaching loss of soil solution $NH_4^+$ was decreased 38-43 % by bentonite addition but little of the soil solution N was in $NO_3^-$ form and bentonite had no effect on leaching of this form of N. The application of bentonite was able to increase $NH_4^+$ in soil solution of top soil and delay leaching of $NH_4^+$ by 15 days after fertiliser application. The application of bentonite and clay decreased K leaching by 26-28 %. However, increased amounts of Na and Mg were leached from bentonite-amended sand. The soil solution indicated that there was a decrease and delay in leaching of $NH_4^+$, and K in clay-amended sand which can be attributed to its cation exchange capacity but may also involve decreases in macropore abundance. By contrast the decrease in P leaching with clay-rich soil addition suggest that this amendment have significant P sorption that was lacking on bentonite. The clay amendments had different effects on nutrient leaching that were related to their mineralogy, effects on solution pH and probably on changes in surface area and pore size distribution.