

The importance of understanding the legacy effects of soil ameliorants to optimise nitrogen fixation in the Vietnamese Mekong River Delta

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Biography: Sarah Fraser is an Agricultural Science Honours graduate from Charles Sturt University. Sarah's Honours research project looked at the influence of biochar and mulch application on nodulation and nitrogen fixation of cowpea in the Vietnamese Mekong River Delta. Sarah grew up in the Monaro region helping on the family farm working with mostly sheep and cattle. Sarah is currently working as a soil scientist at the Cool Soil Initiative that supports on-farm emission reporting.

The need for alternative crops in the Mekong River Delta (MRD) has arisen from the pressures of climate change that has increased saline intrusion leading to rice crop failure. Use of alternative crops is needed to increase farming systems resilience. Cowpea (*Vigna unguiculata*) is a viable alternative crop as it fits within the environmental parameters of salt tolerance, heat tolerance, duration to harvest and water use efficiency. Cowpea is a legume that can biologically fix nitrogen from the atmosphere via a symbiotic relationship with soil bacteria. Quality commercial inoculation of legumes is not available in Vietnam so there is a dependence on inoculation with native background Rhizobia in the soil. Soil salinity amelioration using biochar, a product comprised of pyrolysed carbon, and mulching, a common technique used to limit the impact of salinity by increasing soil water content and diffusing salts within the soil can be used to promote Rhizobia and plant growth. This study aimed to determine the impact of biochar application rate (applied at pot equivalent rates of 5, 10 and 20 t/ha) on cowpea nodulation and nitrogen fixation under controlled conditions and to determine the interaction effect of mulch rate and biochar application on cowpea nodulation and nitrogen fixation under MRD field conditions. Root nodules per plant were manually counted at 22 and 60 DAS for the controlled and field experiments respectively. Mineral nitrogen concentrations were colourmetrically analysed. Higher biochar application rates increased nodulation and soil mineral nitrogen. In field conditions, nodulation and mineral N were impacted by mulch rate, yet biochar application only showed significance under non mulched conditions. Legacy effects of treatments were visually observed via nodulation from native inoculation 12 months on from the initial experiment, highlighting the importance of understanding the legacy effects and interactions of soil amendments and legumes in the MRD