Manure happens: re-examining mitigation potential from waste-to-resource in agricultural ecosystems

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Using animal waste (manure) for soil amendments have been recognized as an efficient strategy for farm management, as well as for soil preservation and greenhouse gas (GHG) emissions mitigation. It is believed that manure can improve soil quality, increase soil organic carbon (SOC) level and therefore potentially mitigate GHG emissions. However, recent studies reported that use of manure in the field can cause large amount of nitrous oxide (N\textsubscript{2}O) emissions which in many cases offset the amount of SOC sequestered in agricultural ecosystems and eventually lead to net GHG emissions. In this report, we intended to investigate this management related mitigation option holistically, by modeling the full GHG budgets from a life cycle perspective. GHG emissions and some reactive gases (e.g., VOCs, NO) were specifically included in the manure life cycle. By re-examining the system boundary in previous studies, we show that use of manure does not necessarily cause large GHG emissions as previously reported. Net GHG emissions or mitigation potentials depend on not only SOC and N\textsubscript{2}O emissions \textit{in situ}, but also emissions and reactive gases beyond the farmgate and those would have been released anyway.