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Ochre amendments as a means of increasing carbon sequestration in soil

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As the climate emergency gathers pace there is a growing imperative to reduce carbon emissions and move to a low carbon economy. Such shifts in global economics and politics will inevitably take time and therefore there is also a pressing need to identify immediate actions that can help limit or reduce carbon emissions.

Soils store large quantities of carbon. However, chemical, physical and biological properties limit the amount of carbon that any particular soil can store. It may be possible to alter soil properties such that the carbon sequestration potential of a soil is increased without causing a reduction in (or even increasing) other important ecosystem services delivered by the soil.

Soil aggregates are widely acknowledged to play an important role in the storage of carbon in soil. One limiting factor for aggregate formation in some soils is the amount of iron oxide present; the iron oxide is an important binding agent, holding aggregates together.

Ochres comprise a variety of poorly crystalline iron (III) oxides and form in a number of environments such as mine drainage when water moves to increasingly oxygenated environments and dissolved iron (II) is oxidised and precipitates from solution. In many countries these ochres are treated as wastes and are landfilled.

In batch experiments in which soil was amended with 0, 0.5 or 5% by mass ochre and shaken with water in a ratio of c. 1:5 (g:mL) ochre amendments reduced the concentration of dissolved organic carbon released into solution by almost a factor of 2. In experiments that are more realistic of field deployment of ochre amendments to increase soil carbon sequestration in which soils were amended with 0, 0.5 or 5% by mass ochre and kept moist for c. 9 weeks with treatments comprising presence/absence wheat and presence/absence earthworms, ochre amendments reduced the concentration of cold water extractable carbon by a factor of 2 and hot water

extractable carbon by a factor of 1.3.

In this presentation the above results together with additional results relating to impacts on other soil properties will be presented. The data confirm the potential of waste iron ochres as a soil amendment to increase soil carbon sequestration though further work with more soil types and a variety of ochres is needed and the carbon footpring of applying the amendments needs to be calculated. Whilst methods such as these may provide vital time to transition to low carbon lifestyles, it is the move to such lifestyles that must be the ultimate solution to the climate emergency.