Enhanced rock weathering results in higher crop yields and improved crop health, study shows

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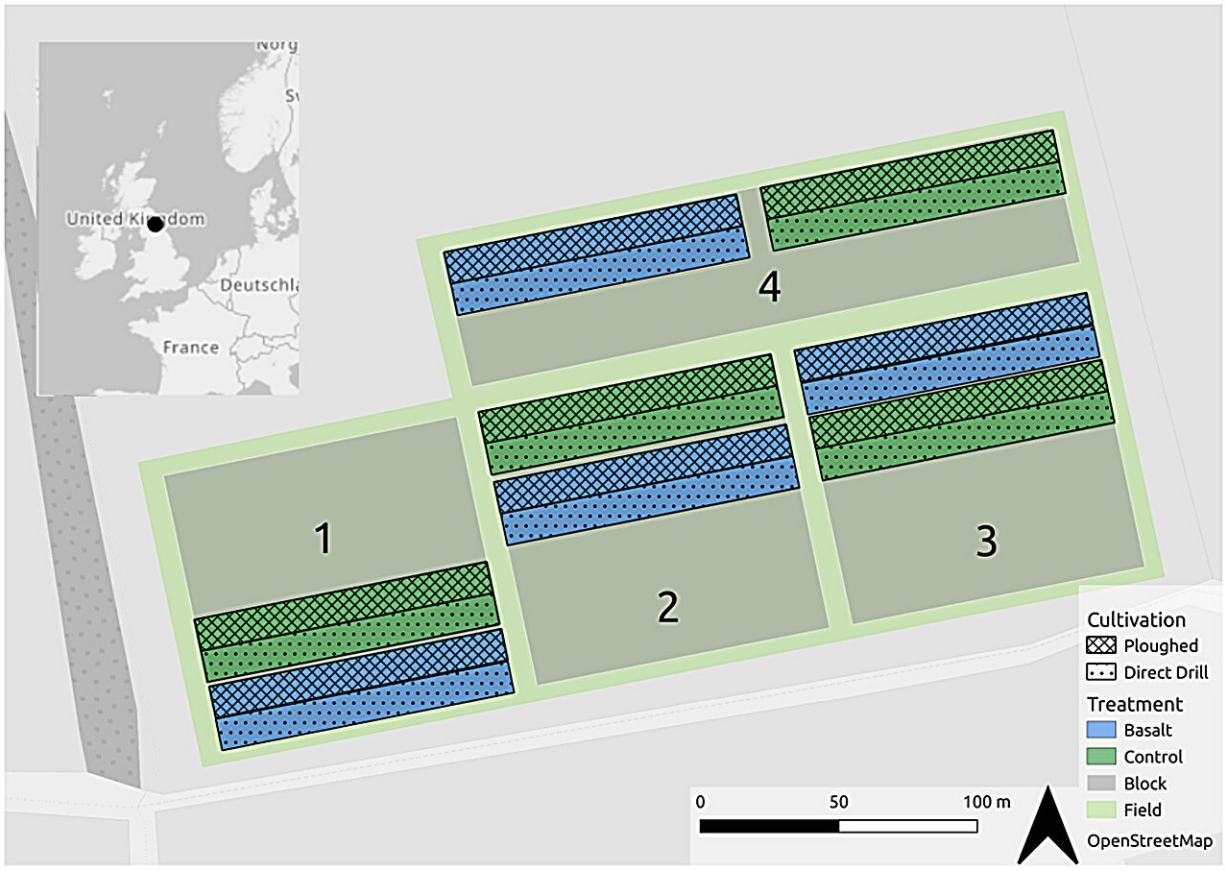

Experimental plot design. The site includes four blocks (transparent gray), each 96 x 96 meters. Within each block there are two treatments: Control (green) and

basalt-amended plots (blue). For each treatment there are two cultivation types: no-till/direct drill (dotted) and ploughed (hashed). Each cultivation plot is 12 x 96 meters. Background: OpenStreetMap. Inset: location of the Nafferton Research Farm in NE England, overlaid OpenStreetMap. Credit: *PLOS ONE* (2024). DOI: 10.1371/journal.pone.0295031

Enhanced rock weathering—a nature-based carbon dioxide removal process that accelerates natural weathering—results in significantly higher first year crop yields, improved soil pH, and higher nutrient uptake, according to a paper, published in *PLOS ONE* on 27 March.

Enhanced rock weathering (ERW) involves spreading finely crushed silicate rock such as basalt on agricultural land. It is a scalable and permanent climate technology with the potential to sequester gigatons of carbon dioxide from the atmosphere.

Co-authored by scientists at UNDO, a leading enhanced rock weathering project developer, and Newcastle University, the article is the latest enhanced rock weathering (ERW) study assessing the impact on crops in a temperate climate.

Benefits of enhanced rock weathering

Professor David Manning, Professor of Soil Science, Newcastle University School of Natural and Environmental Sciences, and co-author of the paper, commented, "The results of this trial give further scientific credibility for enhanced rock weathering and greatly improve its value proposition to farmers. Newcastle University is pleased to partner with UNDO. Our joint research into the co-benefits for farmers of basalt

amendment is helping to pave the way for the widespread adoption of enhanced rock weathering in the agricultural community."

Yit Arn Teh, Professor of Soil Science, Newcastle University, and co-author of the paper, said, "Independent bodies, such as the IPCC and UK Committee for Climate Change, have repeatedly highlighted the urgent need for climate action in the agriculture and land use sector to counter the effects of dangerous climate change. At the same time, the agricultural sector is under increasing pressure to meet key sustainability and environmental targets, against a backdrop of rising farm operating costs, driven by the cost of living crisis.

"Use of enhanced rock weathering to remove carbon dioxide and naturally enhance soil health represents a potential win–win for farmers and climate as this technology is able to capture carbon dioxide while simultaneously supplying some of the key nutrients that crops require for successful growth. By using locally sourced rocks, rather than inputs (e.g., fertilizers) obtained from overseas, supply chains are also shortened, further reducing the overall carbon footprint of food production.

"Crucially, enhanced rock weathering is a technology that can be readily adopted by the agricultural sector because it does not require farmers to invest in new equipment, technology or training, but simply utilizes the existing equipment and infrastructure for spreading fertilizer or other soil amendments."

Dr. XinRan Liu, Head of Science and Research at UNDO and co-author of the paper, commented, "Nutrient limitations in agricultural soils are a major concern for farmers in relation to sustaining and increasing crop yields. This latest study highlights how the spreading of basalt rock on farmland can lead to higher crop yields and can be effective in a temperate climate. This research demonstrates the potential for

enhanced rock weathering to contribute to improved farmer livelihoods and food production, while also removing CO_2 from the atmosphere."

Positive results

The results from the ongoing trial's first year demonstrate that the crop yield was on average 15% higher (9.3% and 20.5% between plowed and direct drill amended plots respectively) across two different cultivation techniques.

The trial results also showed a stabilizing effect on the soil pH, with the soil pH being on average 0.2 and 0.29 pH units higher in the basalt-amended plots, compared to the control plots. This change is a result of alkaline products generated as the rock minerals dissolve. The effect of silicate mineral dissolution on the soil pH could represent an attractive agronomic benefit for farmers as an elevated soil pH allows crops to access more nutrients in the soil.

Basalt rock is rich in minerals that slowly release nutrients during dissolution. These nutrients act as a natural soil amendment and are essential for plant growth. The study found higher nutrient concentrations in the crops grown in the basalt-amended soil, including tissue calcium, grain and tissue potassium, suggesting that ERW can boost nutrient availability for plants and, as a result, may improve crop yield.

Taking account of the unusually dry growing season conditions in 2022, these findings indicate that basalt amendment could enhance productivity and crop yields, contributing to more sustainable and resilient food production systems in the face of future changes in growing season weather as a result of global warming.

The trial results also show no additional toxic elements taken up by crops

in the plots where basalt had been spread. There was no negative impact on the natural environment in this trial, which indicates the food produced from it is safe for consumption. UNDO's basalt has been approved for use in organic farming systems by respected certification bodies such as the Soil Association.

The authors of the paper hope that the agronomic co-benefits of enhanced rock weathering will further incentivize farmers across the U.K. and worldwide to take advantage of this nature-based carbon removal solution.

More information: Kirstine Skov et al, Initial agronomic benefits of enhanced weathering using basalt: A study of spring oat in a temperate climate, *PLOS ONE* (2024). DOI: 10.1371/journal.pone.0295031

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