

Irrigating grazed pasture decreases soil carbon and nitrogen stocks

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The sustainability of using irrigation to produce food depends not only on the availability of sufficient water, but also on the soils 'response' to irrigation. Stocks of carbon (C) and nitrogen (N) are key components of soil organic matter (SOM), which is considered to support sustainable agricultural production.

While there is some information about the effects of irrigation on soil C stocks in cropping systems, there is a paucity of such studies in pastoral food production systems. For this study, we sampled soils from 34 paired, irrigated and unirrigated pasture sites across New Zealand (NZ) and analysed these for total C and N. On average, irrigated pastures had significantly ($P < 0.05$) less soil carbon (C) and nitrogen (N) than adjacent unirrigated pastures, with differences of 6.99 t C ha^{-1} and 0.58 t N ha^{-1} in the uppermost 0.3 m. Differences in C and N tended to occur throughout the soil profile, so the cumulative differences increased with depth, and the proportion of the soil C lost from deeper horizons was large. There were no relationships between differences in soil C and N stocks and the length of time under irrigation.

This study suggests SOM will decrease when pastures under a temperate climate are irrigated. On this basis, increasing the area of temperate pasture land under irrigation would result in more CO₂ in the atmosphere, and may directly and indirectly increase N leaching to groundwater. Given the large and increasing area of land being irrigated both in NZ and on a global scale, there is an urgent need to determine whether the results found in this study are also applicable in other regions and under different land management systems (e.g. arable).