Soil carbon loss from drained agricultural peatland after coverage with mineral soil

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Drainage for agriculture has turned peatlands from a net sink to a net source of carbon (C). In order to reduce the environmental footprint of agricultural peatland drainage, and to counteract soil subsidence, mineral soil coverage is becoming an increasingly used practice in Switzerland. To explore the effect of mineral soil coverage on soil C loss and the source of CO2 from peatland drained for agriculture, we utilized the radiocarbon signature (F14C) of soil C and emitted CO2 in the field. The experiment, located in the Swiss Rhine Valley, was carried out on two adjacent drained organic soils, either without mineral soil cover (reference 'Ref'), or covered with mineral soil (thickness 40 cm) (coverage 'Cov') 13 years ago. Drainage already commenced 130 years ago and the site was managed as meadow since the 1970ies. Drainage induced 41-75 kg C m^{-2} loss, which is equivalent to annual C loss rates of 0.49-0.58 kg C m^{-2} yr^{-1} and 0.31-0.63 kg C m^{-2} yr^{-1} for Cov and Ref, respectively. Mineral soil coverage had no significant effect on the amount of heterotrophic respiration, however, at Cov, the radiocarbon signature of heterotrophic CO2 was significantly ($p < 0.01$) younger than at Ref, indicating that mineral soil coverage moved the source of decomposition of soil organic carbon (SOC) from a higher share of old peat towards a higher share of relatively younger material. In summary, our study lends support to the hypothesis that mineral soil coverage might reduce the decomposition of old peat underneath, and may therefore be a promising peatland management technique for the future use of drained peatland for agriculture.
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