

## Publication

## Accumulation of C4-carbon from Miscanthus in organic-matter-rich soils

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To evaluate the sustainability of biomass plantations, effects on soil organic carbon (SOC) need to be quantified. *Miscanthus* *× giganteus* is increasingly used as a bioenergy plant, and it has been hypothesized that, after conversion from cropland, *Miscanthus* cropping increases SOC storage, whereas conversion from grassland to *Miscanthus* provides, on average, no sequestration. All field studies hitherto were carried out on mineral soils with topsoil SOC contents of below 3.3%. Here, we analyze in the temperate zone of Switzerland five sites that have been cultivated with *Miscanthus* for 19–24 years and of which four sites are higher in topsoil SOC content (4.7%–16.2%) and storage (188–262 t SOC) than any previously studied *Miscanthus* plantation in Europe. We used the difference in carbon isotopic signature between C4 (*Miscanthus*) and neighboring plots with C3 vegetation (grassland) to quantify the accumulation of new SOC from *Miscanthus* down to 0.75 m. Annual C4-C accumulation rates were 1.66 (standard error  $\pm$  0.14) t C4-C ha<sup>-1</sup> year<sup>-1</sup> (range: 1.26–2.01) in the upper 0.3 m of soil and 1.96 ( $\pm$ 0.18) t C4-C ha<sup>-1</sup> year<sup>-1</sup> (1.40–2.38) in 0–0.75 m. Average rates for 0–0.3 m were higher than those of mineral soils (n = 37) published previously (0.96 [ $\pm$ 0.10] t C4-C ha<sup>-1</sup> year<sup>-1</sup>). However, high rates of C4-C accumulation were also reported previously for some mineral soils. Nevertheless, the one mineral soil in our study did not reveal a systematically different accumulation of *Miscanthus*-derived carbon compared with the four carbon-rich soils. We therefore conclude that soils rich in organic matter do not show a different C4-C accumulation pattern as compared with mineral soils. However, their C4-C accumulation rates are at the upper end of the data ensemble. Our results further underpin that conversion to *Miscanthus*, despite C4-C accumulation, provides no means to increase soil carbon stocks relative to grassland management.

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