Geophysical Research Abstracts,
Vol. 11, EGU2009-3450, 2009
EGU General Assembly 2009

Soil 13C dynamics in aggregates across a soil profile under an established Miscanthus system

M. Dondini and M. Jones
Trnity College Dublin, Ireland (dondinim@tcd.ie)

Soils are the largest pool of terrestrial organic carbon (C), containing nearly three times the amount of C as the atmosphere. Environmental changes that affect soil C dynamics could slow down the rise in atmospheric CO2 and associated warming by promoting soil C storage. Our capacity to predict the consequences for global change therefore depends on a better understanding of the distribution and controls of soil organic C (SOC) and how vegetation change may affect SOC distributions. One land cover change of particular interest involves the establishment of bio-energy crop stands. The full mitigation potential of bio-energy crops cannot be considered without taking into account their effect on soil C dynamics.
Miscanthus, a perennial C4 grass from Eastern Asia, has recently received considerable interest as a bio-energy crop. For that reason, we analyzed the C content and the 13C signatures across the soil profile in a 14 year old Miscanthus system, established on former arable land. Combining SOM fractionation techniques with the 13C natural abundance technique, allows us to investigate small shifts in soil C stores that would be significant in the long term, but that might not be detected by conventional methodologies. The 13C signal of the various SOM fractions allowed us to distinguish between C4- vs. C3-derived soil organic C.
Almost 87% of the total C content under Miscanthus was found in the upper 30 cm. The soil organic C content in this layer was statistically higher under Miscanthus compared to the arable land.
Macroaggregates under Miscanthus contain more than twice as much C compared to arable land, showing a decrease in soil C content with decreasing aggregate size. C4-derived C accounts for 44% of the total C content in the 0-15 cm layer, in the 15-30 cm layer values declined to 37% whereas C4-derived C accounted for only 9% in both the 30-45 cm and 45-60 cm layers. These differences are largely caused by soil C storage in the microaggregate within macroaggregates fraction (mM). Under Miscanthus, this fraction contains 31g C/kg aggregates and 22g/Kg aggregates at 0-15 cm and 15-30 cm, respectively. Moreover, about 55% (0-15 cm soil layer) and 59% (15-30 cm soil layer) of the C4-derived C found within the intra-macroaggregates is located in the mM.
Our data suggest a large potential for soil C storage under Miscanthus in the upper 30 cm. Moreover, we determined that after 14 years of Miscanthus plantation, differences in soil C contents can mainly be attributed to soil C storage in the microaggregate within macroaggregates fraction.