Greater contribution of belowground than aboveground maize biomass to the stable soil organic carbon pool

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Crop residues return organic matter and nutrients to agricultural soil, but they could be potential resources for other uses, such as e.g. renewable energy production. Multiple field experiments have proven that belowground biomass contributes twice more than aboveground crop residues in buildup and preservation of soil organic carbon (SOC) in the long term. Alongside, a consensus has emerged that current biogeochemical models are particularly ill-parameterized for amount and degradability of belowground biomass. The mechanism explaining this *in situ* relative stability of belowground-derived SOC is, however, still poorly understood.

We used ^{13}C natural abundances to compare the relative stability of root- and shoot-derived SOC in two field trials with maize-based crop rotations (after C_3-C_4 crop transition). Our hypothesis was that root-derived C is more likely to accumulate in microaggregates due to the intimate contact of maize roots, promoting physical occlusion and stabilization during growing season. We also evaluated the effects of maize variety versus field (as affected by soil texture and field management history) on maize roots. We found that removal or incorporation of aboveground residues had but a minor impact on SOC accumulation. Belowground biomass was more efficient than aboveground residues in maintaining SOC, although root-derived C did not preferentially stored in microaggregates. Moreover, only the site significantly impacted belowground biomass, although both maize variety and field effects existed on aboveground biomass. The factor field also determined root system architectural 2D and 3D traits. Again no effects of variety were observed. Our results confirm the previous research about relative stability of belowground biomass and refute the hypothesis that occlusion in micro-aggregates would explain this stability. Maize root biomass and root system architecture to some extent depend on soil type and field history and is not necessarily in line with aboveground biomass.