Carbon sequestration and footprints in conventional and conservation agriculture under maize-wheat sequence in coarse-textured soils of subtropical climate

Abstract

Intensive tillage often contributes to yield gains but there is a tradeoff with emission of greenhouse gases (GHGs) challenging agricultural and environmental sustainability. Studies in the past examined the effect of tillage practices on one or two of the metrics viz., crop productivity or carbon footprint (CF) or C sequestration and a comprehensive evaluation of the three in a single study to identify cleaner and climate-smart production practice is generally lacking. No-tillage with residue retention (NTM) curtailed CF by 155% compared to conventional tillage with residue retention (CTM). Per tonne of grain production, GHG intensity for the whole cropping sequence was highest (88.4 kg CE Mg^{-1}) in CT without residue retention (CTM_0) and lowest (13.5 kg CE Mg^{-1}) in NTM plots. After 4-years of tillage and residue retention, the NTM resulted in gain of 0.15 t C ha^{-1} yr^{-1} while the CTM_0 resulted in loss of 0.84 t C ha^{-1} yr^{-1}. Minimum C equivalent emissions and maximum gain in soil organic C in NTM lowered the CF resulting in highest C efficient and sustainable management. Minimal GHGI without yield penalty was achieved by adopting NT with mulching. Carbon budgeting revealed that NT coupled with mulching is the most C efficient practice and CT without residue retention is the least efficient management practice for intensively cultivated maize-wheat system in coarse-textured soils of subtropical climate.

Key words; No-tillage, residue retention, soil organic C, greenhouse gas intensity

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