

Potential of selected soil and water conservation and fertility management practices to mitigate greenhouse gas intensity in sub-humid agro-ecozones of Kenya

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Introduction

- Soil management practices contribute to greenhouse gas (GHG) emissions
- Limited field-evidence on CH_4 , CO_2 and N_2O constrained updating GHG inventories and subsequent mitigation options
- Empirical studies in sub-Saharan Africa reported GHG without linking to farmgate income- Greenhouse Gas Intensity under on-farm
- Soil and water conservation practices (mulching and tied ridges) increase yields and reduce fertilizer-induced N_2O emissions and GHGI
- **Objective:** Determine net global warming potential and GHGI of different SWCPs of farm systems in Kenya

Materials and Methods

- Study area: Muranga'a county, Kenya, Upper midland zone 2
- Climate: 600-900mm, Temperature 26-30 °C
- Split plot with SWCPS (mulching and tied ridging) as main treatments
- Soil fertility management practices (Conventional, Intergrated and Organic) as sub treatments

Greenhouse gas collection and analysis

- A static chamber per plot for GHG collection (CO_2 , CH_4 and N_2O)
- Analysis using SRI 8610C gas chromatography
- Auxiliary measurements (Chamber and soil temperature, moisture, precipitation)



Figure 1: Chamber for greenhouse gas collection

Data analysis

- Data analysis; R software using linear mixed-effects models (*lme4*, *lmerTest*)
- Means compared using *emmeans*, *multcompView*.

Results and Discussion

Net GWP and GHGI under different SWCPs and soil fertility management practices

- Integrated systems recorded highest net global warming potential due to reduced soil carbon stocks
- Tied ridging showed low GHGI sinks attributable to low farmgate

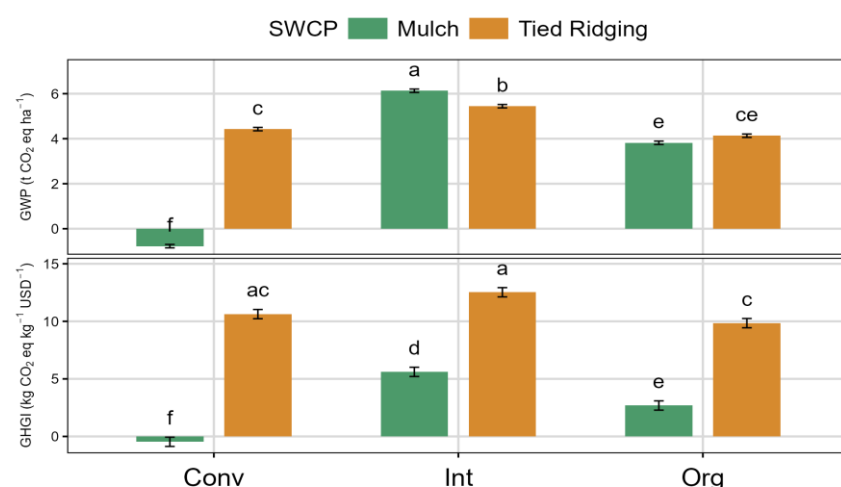


Figure 2: GWP and GHGI as affected by SWCP (Mulch, Tied Ridging) and fertility management practices (Conv, Int, Org)

N₂O emission factors (EF)

- Mean N₂O emission factors (EF) was lower than IPCC default values across all SWPs and soil fertility management
- Organic systems showed low EF attributable to high nitrification rates due to use of compost

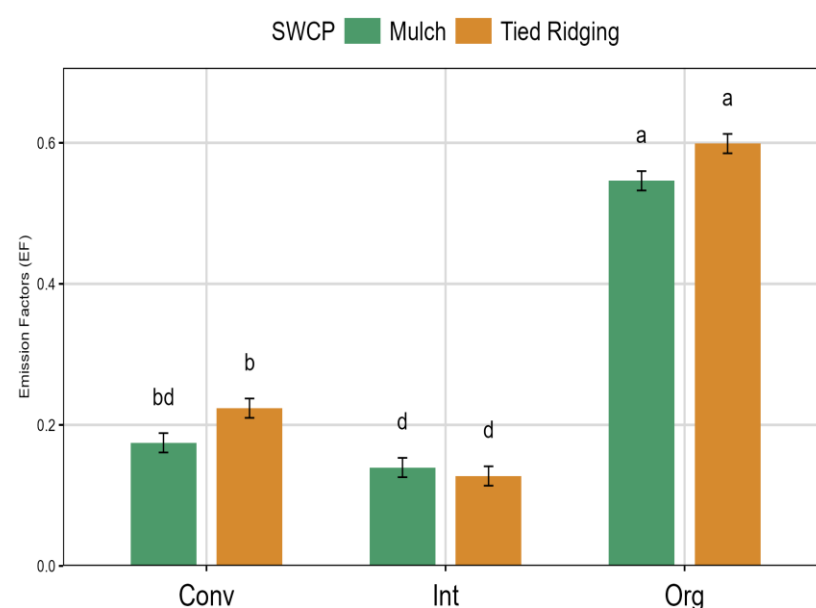


Figure 3: Mean N₂O emission factors as affected by SWCP (Mulch, Tied Ridging) and fertility management practices (Conv, Int, Org)

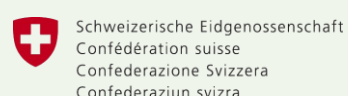
Conclusion

- Mulching recorded high GHGI sinks compared to Tied ridges
- Findings aid in updating GHG inventories to reduce overestimation by using IPCC Tier I default values

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