Effect of soil management practices on soil carbon dynamics under maize cultivation

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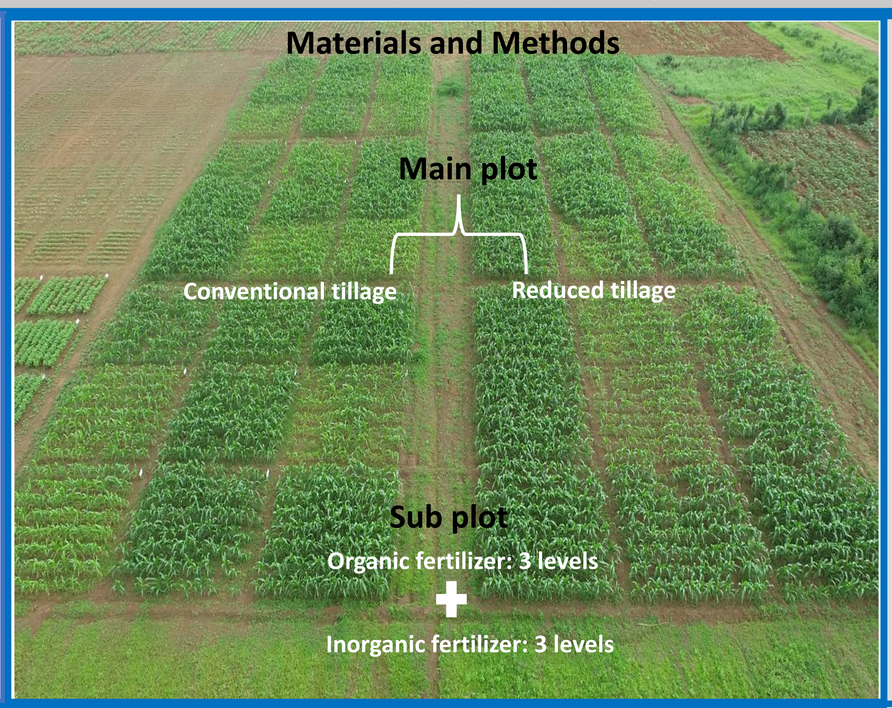
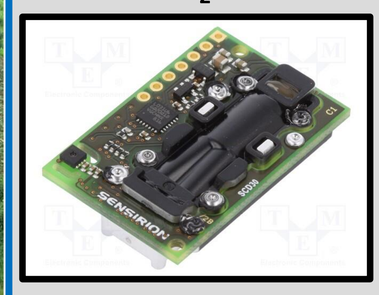
Introduction

An increasing world population and change in consumer preferences necessitate the need to increase food production to meet the demand of a changing world. Intensified agriculture and an accelerated climate crisis with increasing weather extremes threaten the resource base needed to improve crop production. Maize yield obtained by farmers in the Guinea Savannah zone of Ghana is generally low due to low soil fertility status resulting from continuous cropping coupled with low use of external inputs. Integrated Soil Fertility Management (ISFM) practices have proven to sustainably increase maize yield. However, majority of the farmers practicing ISFM till their land conventionally and fertilizer addition potentially results in substantial greenhouse gases (GHG) emissions that contribute to global climate change. We studied the impact of different tillage practices and ISFM applied to sustain maize yield, on net CO_2 or ecosystem exchange (NEE).

Materials and Methods



NDIR-CO_2 sensors



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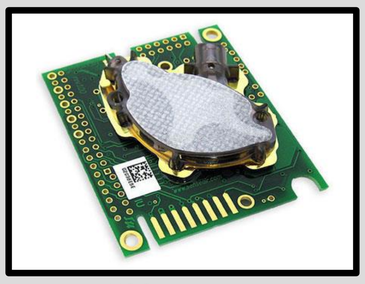

K30-FR

Minions

Bullock plough (Reduced tillage)

Tractor plough (conventional tillage)

Maize field showing treatment effect

Conclusion

- Sole application of inorganic fertilizers had the highest CO_2 fluxes in both tillage practices
- Sole application of 90-60-60 kg NPK ha^{-1} increased CO_2 fluxes by about 20% and 30% in reduced tillage and conventional tillage respectively
- Combined application of organic and inorganic fertilizers enhanced growth and yield of maize under both tillage practices
- Combined application of Farmyard manure and 90-60-60 kg NPK ha^{-1} produced the highest yield of 4.3 t ha^{-1} under reduced tillage practice

Transparent chamber (measures net ecosystem exchange)

Opaque chamber (measures ecosystem respiration)

Measurement of soil respiration

Preliminary results

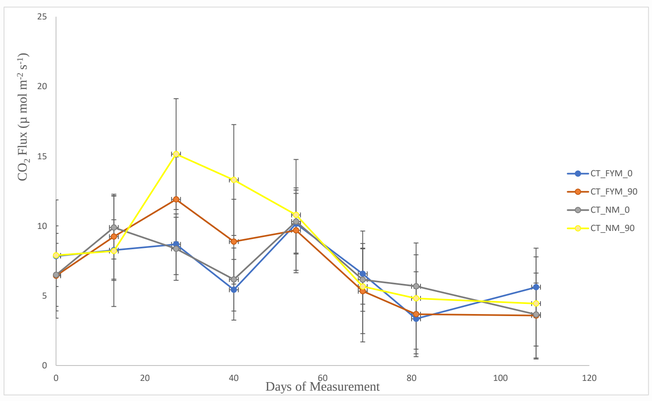

Figure 1: CO_2 fluxes under conventional tillage

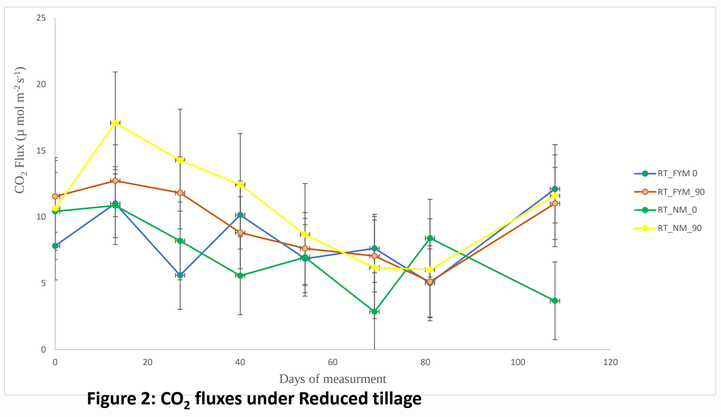

Figure 2: CO_2 fluxes under Reduced tillage

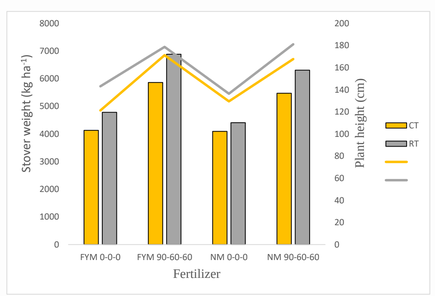

Figure 3: biomass and plant height affected by tillage and ISFM

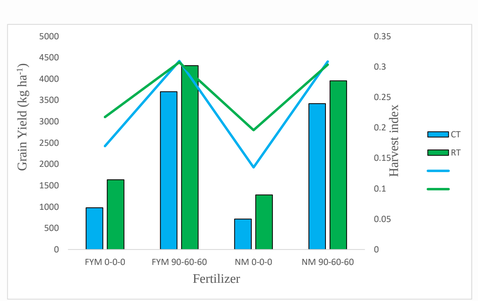

Figure 4: influence of tillage and ISFM on Grain yield

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We acknowledge the support of WASCAL and Prince Albert II foundation