N2O-SSA: IMPROVING NITROUS OXIDE EMISSIONS ACCOUNTING IN KENYA: INSIGHTS AND RESULTS FROM FERTILIZER PRACTICES, ENVIRONMENTAL DRIVERS, AND N_2O ISOTOPIC COMPOSITION

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1 INTRODUCTION

Fertilization in sub-Saharan Africa is expected to rise, potentially increasing N_2O emissions.

Limited accurate data on nitrous oxide (N_2O) emissions hinders investment in sustainable agriculture.

Better understanding could reduce uncertainty and attract more investment.

FIG 1: N_2O isotopes pivotal for understanding N_2O sources.

Aims

(1) Conduct the first online measurements of N_2O fluxes and isotopic composition from agricultural soils in sub-Saharan Africa

(2) Use data science approaches to understand drivers of N_2O emission pathways.

2 MATERIALS AND METHODS

Where: At the University of Eldoret campus in Eldoret, Uasin Gishu

Set up: Measurements of N_2O fluxes are done using an automated chamber system in 2 maize and 2 potato plots. Fertilizer treatments (50 kg N ha^{-1} and 100 kg N ha^{-1}) were applied to each crop.

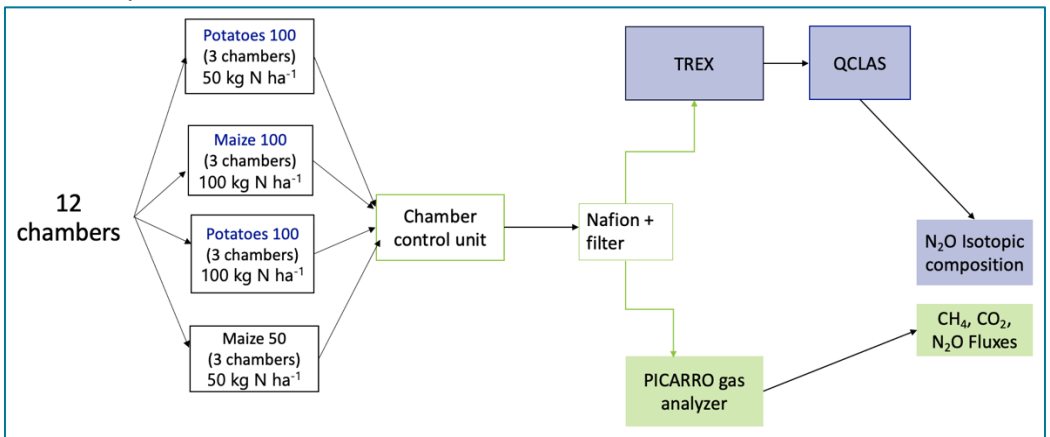

FIG 2: Automated chamber system and gas analysis set-up

Data collection period: Feb 2024 to Feb 2025

Variables:
(1) Greenhouse gas emissions (N_2O, CO_2, CH_4), (2) N_2O isotopic composition, (3) Microclimate, (4) Soil (nitrate, ammonium, DNA, isotopes)

3. PRELIMINARY FINDINGS

Results show that nitrogen availability, especially following fertilization events, leads to increased N_2O emissions. Higher fertilization levels, particularly in maize (100 kg N/ha), correspond with increased N_2O emissions, indicating that fertilization rates significantly impact emissions. Potato plots also show increased emissions, but the response to fertilization levels appears more variable compared to maize.

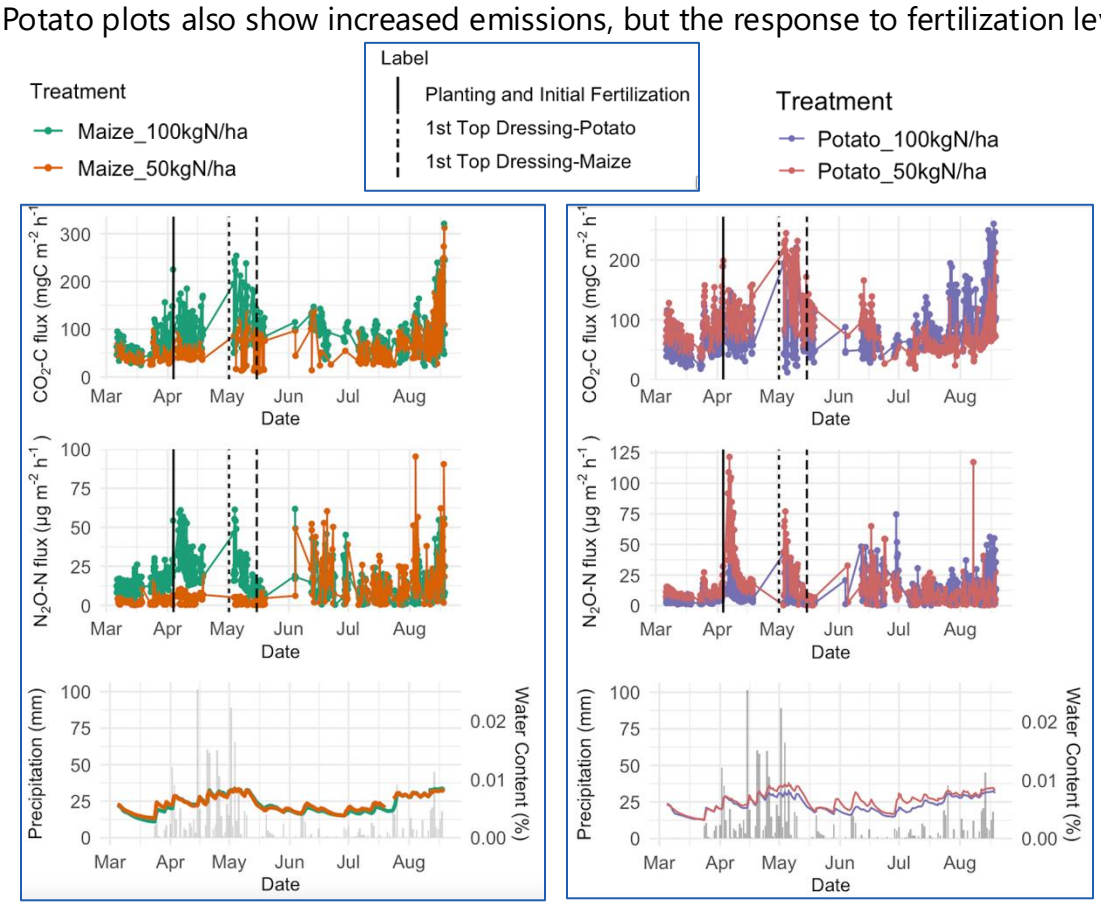

FIG 3: Soil N_2O emissions from maize and potato plots under different fertilization levels

Precipitation and soil moisture levels appeared to correlate with flux variability. Notably, periods of heavy rainfall were often followed by increased N_2O emissions, likely due to enhanced microbial activity and denitrification in wetter soil conditions.

(a) Experimental set-up with the 3 chambers per plot and the trailer that houses the gas analyzers, (b) maize plot, (c) potato plot

The timing of nitrogen application plays a crucial role in enhancing N_2O emissions, with the most substantial emissions occurring shortly after fertilization.

4. CONCLUSIONS

This study examines the effect of inorganic fertilizers on N_2O emissions. The preliminary findings highlight the importance of understanding crop-specific and treatment-specific emission patterns in Sub-Saharan Africa. As we continue to analyze the data, including N_2O isotopic composition we aim to refine emission factors for different crop systems and fertilization practices. This will be crucial for developing region-specific guidelines to mitigate greenhouse gas emissions from agricultural activities in the region.

5. ACKNOWLEDGEMENTS

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