Greenhouse gas emissions and global warming potential associated with furrow-irrigated rice from a silt-loam soil in east-central Arkansas

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Introduction

Rice in Arkansas

- 45.6% of the entire US production
- Conventional tillage: ~ 51% of rice area
- Delayed-flood system: 60% of rice fields
- Furrow-irrigation: 10.5% of rice fields
- Management practices can reduce GHG emissions from rice fields by 20 to 50%

Justification

- Groundwater depletion in the Delta region of eastern Arkansas
- Furrow-irrigated practices

- Environmental sustainability of the furrow-irrigated system and spatial variability of GHG emissions

Objective

- Evaluate GHG fluxes and season-long emissions (CO_2, CH_4, N_2O) and global warming potential under different tillage treatments (CT and NT) and at different site positions (up-, mid-, down-slope) of a production-scale, furrow-irrigated rice field on a silt-loam soil in east-central Arkansas

Site Description

- Rice Research and Extension Center east of Stuttgart, AR

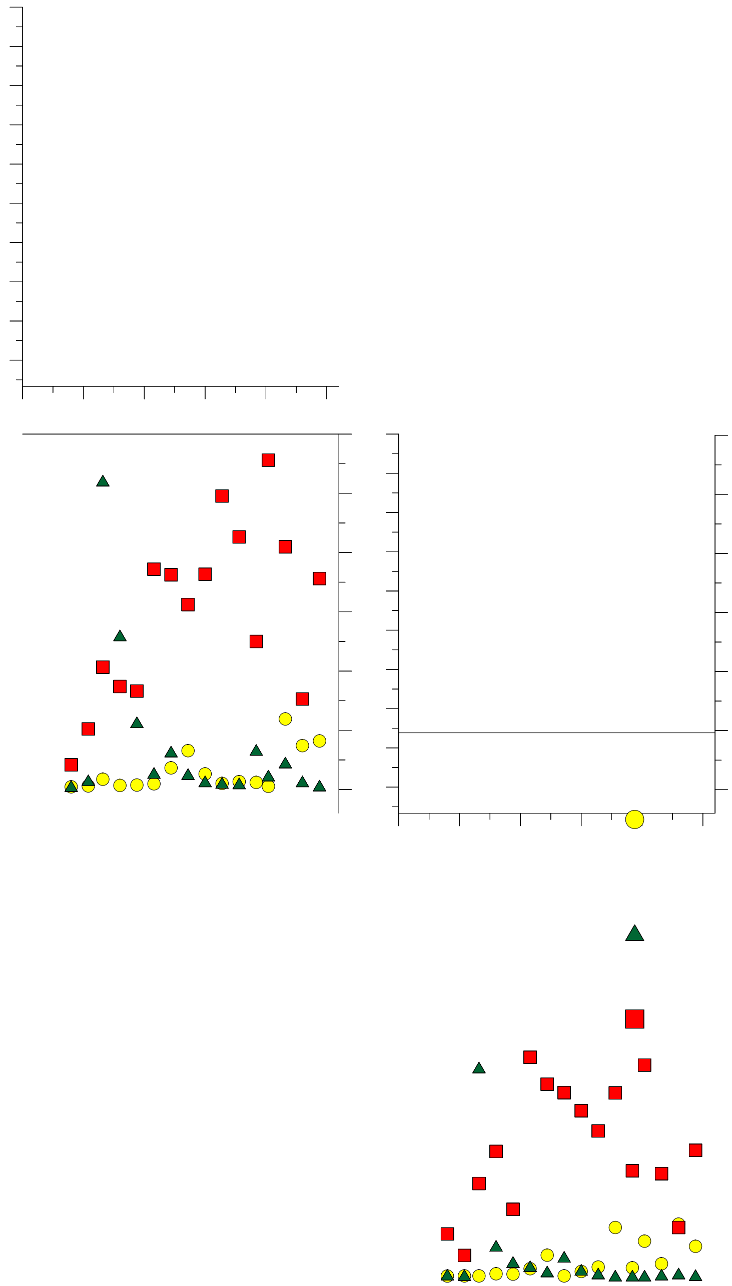
Materials and Methods

- Vented, non-flow-through, non-steady-state chambers

Statistical Analyses

- Strip-plot design
- Analysis of variance (ANOVA)
- Fixed effects
  - GHG fluxes
    - Site position, tillage, date, and their interactions
  - GHG emissions
    - Site position, tillage, and their interaction
- Significance judged at $P < 0.05$

GHG Fluxes 2018



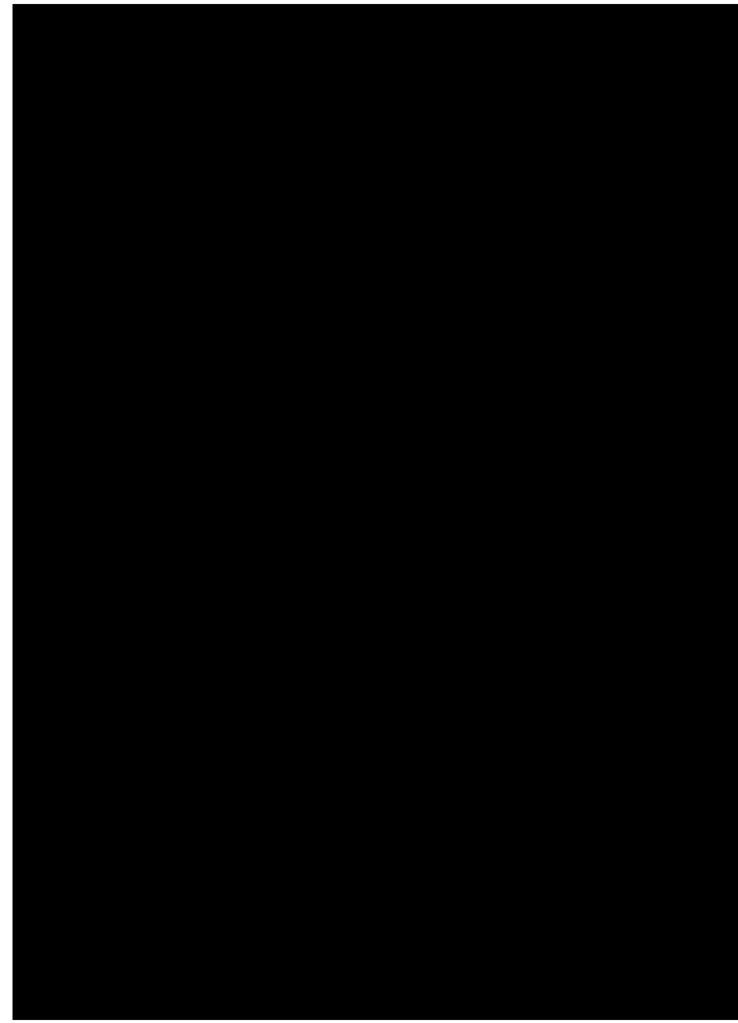
Emissions

Property	Tillage (T)	Site position (SP)	T x SP
	P		
CO_2			
2018 emissions	0.053	0.002	0.531
2019 emissions	0.463	0.348	0.041
CH_4			
2018 emissions	0.601	< 0.001	0.367
2019 emissions	0.147	< 0.001	0.400
N_2O			
2018 emissions	0.087	0080	0.206
2019 emissions	< 0.001	0.200	0.248
GWP			
2018 emissions	0.029	< 0.001	0.208
2019 emissions	0.133	0.113	0.363
GWP*			
2018 emissions	0.103	0.009	0.137
2019 emissions	0.007	0.018	0.025

Emissions

2018

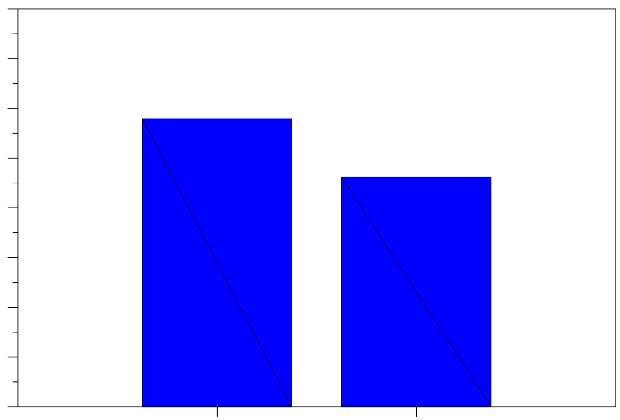
2019

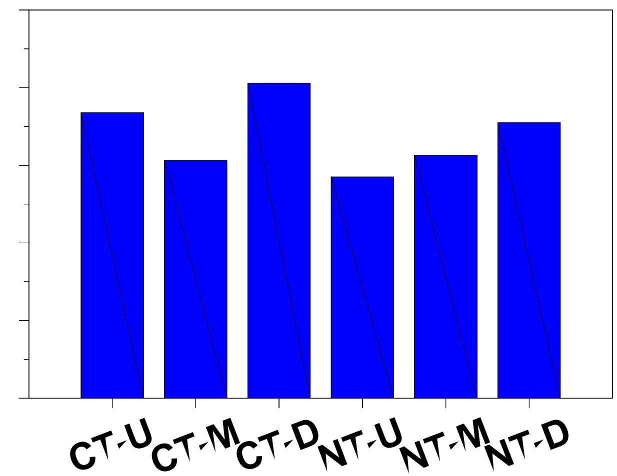


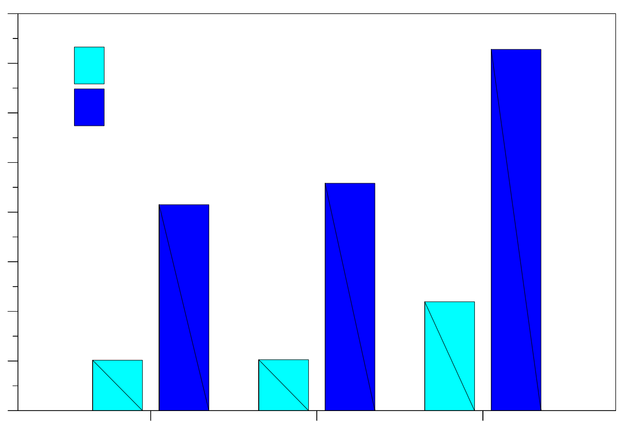
Global Warming Potential

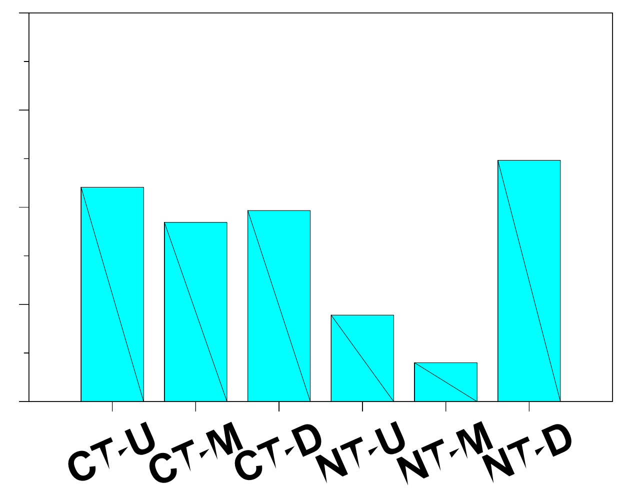
2018

2019

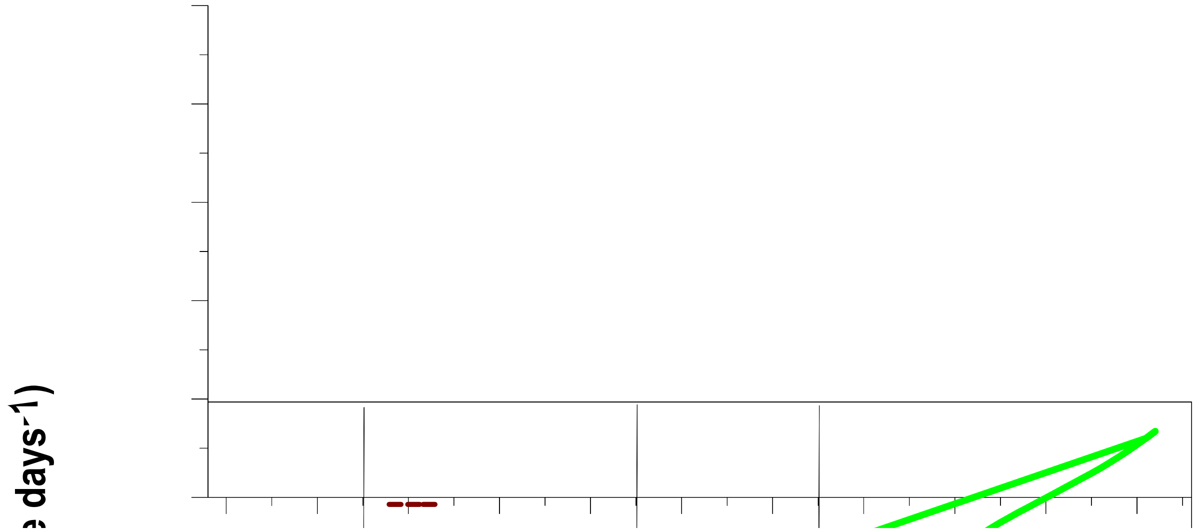


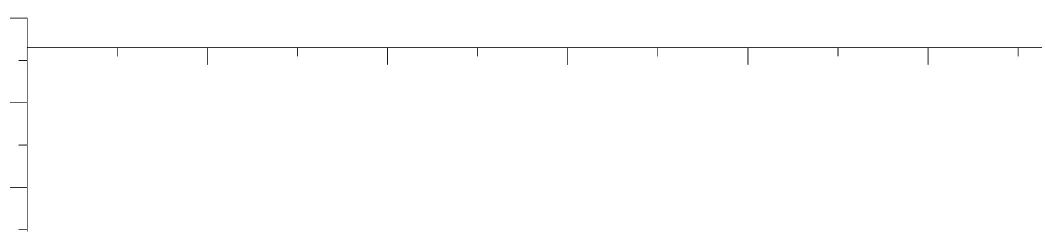






Cumulative Emissions





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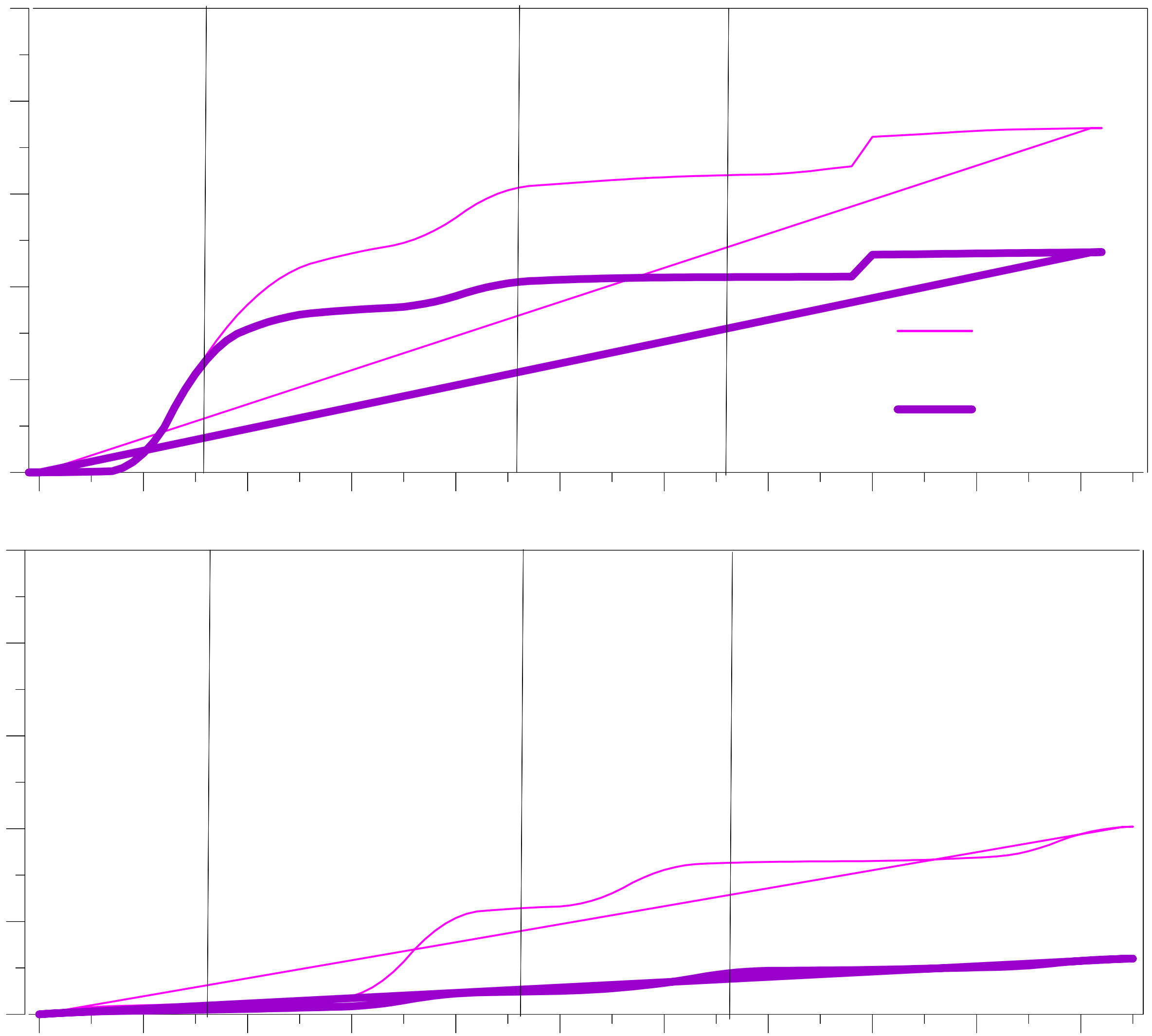

Conclusions

- CT had greater N_2O emissions than NT in both years
- Down-slope generally had greater GHGs emissions in both years

GWP

Similar trends as for CO_2

ability

Implications

- Importance of fluxes
- Site-specific BMPs
- Future research

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Questions?