REDUCING NITROUS OXIDE EMISSIONS FROM AGRICULTURE

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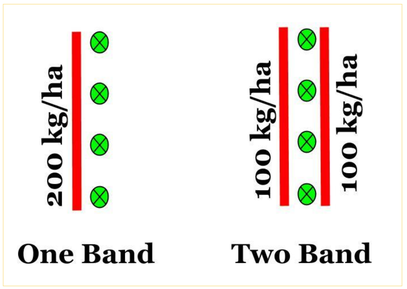
Introduction

- **Nitrous oxide (N_2O) emissions contribute about 1/3 of the total greenhouse gas (GHG) emissions from California's agricultural sector.**
- **Environmental and Economic Concern**
  - Global warming potential 300 times greater than CO_2
  - N_2O represents a decrease in fertilizer use efficiency potentially leading to less N taken up by the crop and decreased yields

Objectives

- **Big Picture Objectives**
  - Identifying agricultural management practices that reduce N_2O emissions while maintaining yields
- **Experimental Objectives:**
  - Drip irrigation vs. furrow irrigation
  - One fertilizer band vs. two fertilizer bands

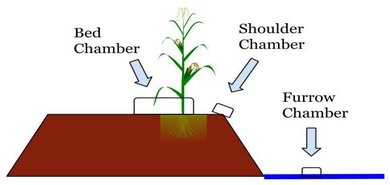


- Fertilizer efficiency enhancer - Agrotain
- Monitor seasonal fluxes and yields

Site Description

- 0-100cm: 48% clay
- K sat 3.3 mm/hr for first 100cm
- CEC 52.5 cmol/kg soil
- Organic matter = 3.5% in upper 76cm
- Vertisol – shrink swell
- Plant density: ~82,000 Plants/ha

Methods



- Daily fluxes were measured using the static chamber method at 0, 20, and 40 min
- Samples were analyzed by gas chromatography
- A linear regression was used to find the daily flux
- Daily fluxes were integrated to calculate the seasonal N_2O-N flux

Results

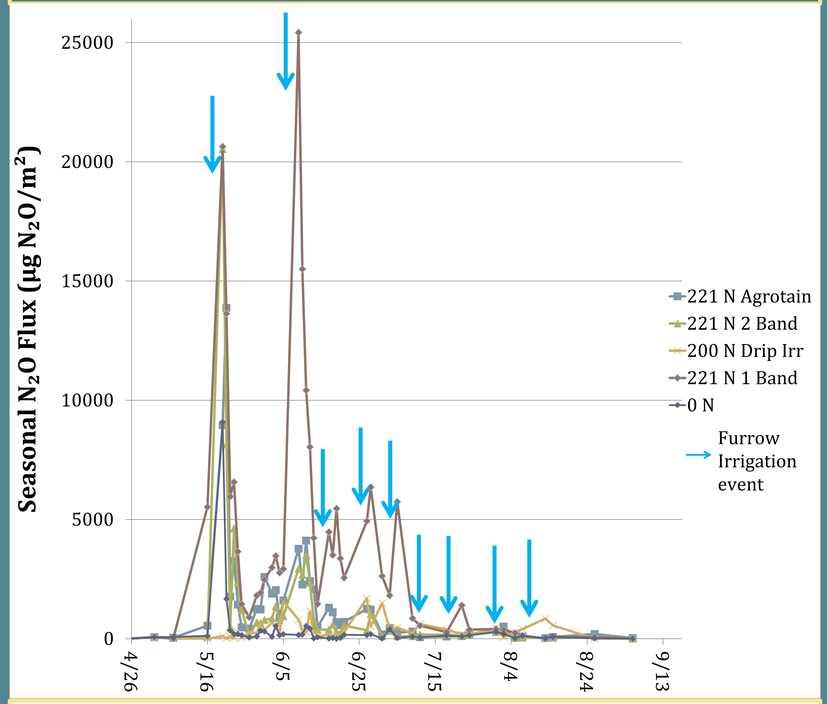
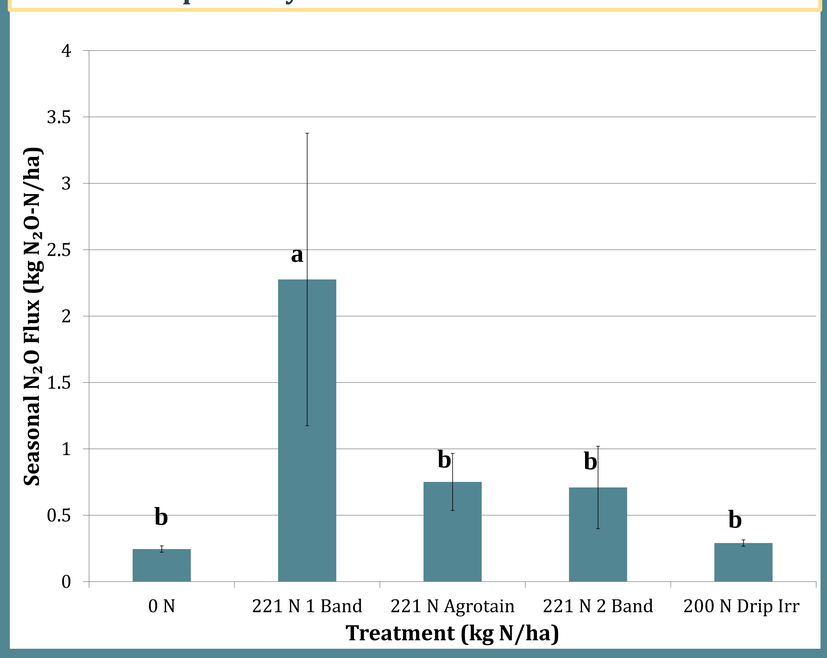


Figure 1: Daily fluxes of N_2O -N (kg N2O-N/ha) from 4/25/2013 to 9/5/2013 for 0N, 221N 1 band, Drip Irrigation, 221N 2 band, 221N with Agrotain treatments. Fluxes at each plot were calculated by weighting the bed, shoulder, and furrow chambers 65%, 25%, and 10% of the total flux respectively.



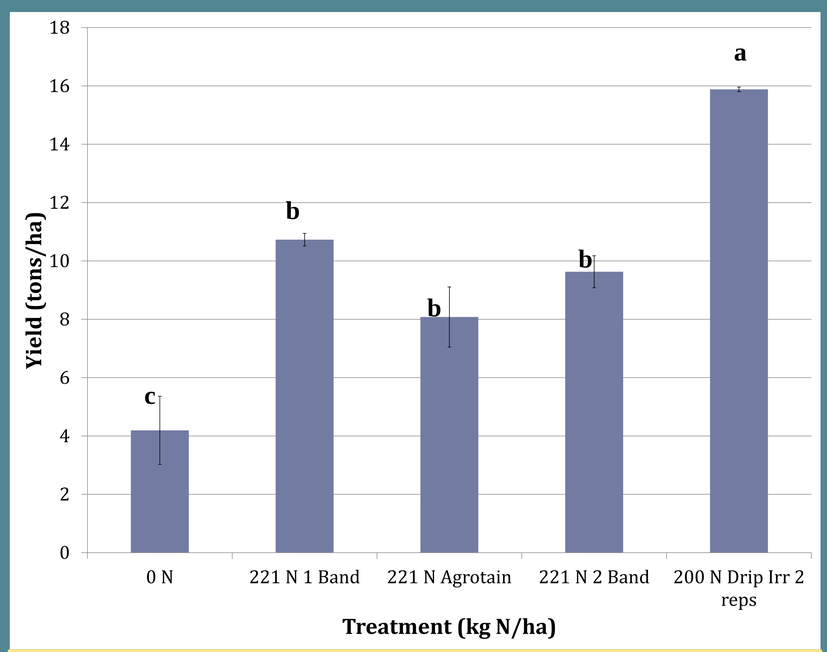


Figure 2: Seasonal N_2O -N fluxes (kg N2O-N/ha) and yields (tons/ha) per treatment

Discussion

- The one banded fertilizer treatment had statistically higher seasonal N_2O emissions compared to all other treatments (~1.5 kg N_2O-N/ha more). The daily flux values not only show higher peak fluxes after irrigations, but also those peaks persisting longer throughout the season compared to the other treatments
- While no statistical difference was found between the drip irrigated treatments and the 2 banded furrow irrigated treatments, average emissions from the drip were ~0.5 kg N_2O-N/ha lower. Additionally, yields from the drip corn were statistically higher than the furrow irrigated treatment
- The fertilizer efficiency enhancer showed no difference in emissions compared to the 2 banded treatment (same treatment without the efficiency enhancer)

Conclusions

- **Dividing the nitrogen fertilizer application rate across two bands next to the plant, rather than concentrating the fertilizer into one band, can reduce N_2O emissions**
- **Subsurface drip irrigation in corn is not a common practice, however adopting this practice could increase yields while emissions remain comparable to those in the furrow irrigated treatment**
- **Fertilizer efficiency enhancers do not seem to be an effective management practice to reduce emissions at this site**

Future Research

- Data loggers at each plot measuring temperature, moisture, O_2?, Eh?
- Particle size distribution and N_2O emissions?
- CEC and N_2O emissions?
- Eddy Covariance Towers?
- N_2O Sinks?

Acknowledgements

- Horwath Lab at UC Davis
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- California Soil Resource Web: http://casoilresource.lawr.ucdavis.edu/soilweb/