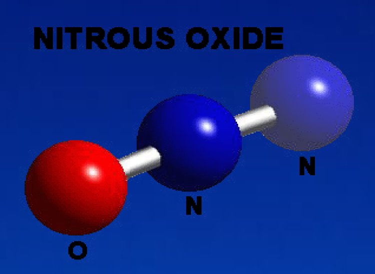
# Response of N2O emissions to irrigation and fertigation methods

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## Objective

- Identify differences in $N_2O$ emission rates and distributions between two irrigation systems
- Upscale $N_2O$ emissions to the orchard level
- Determine fertigation management effects on annual $N_2O$ emissions

## Introduction

Almonds are considered to be nitrogen (N) intensive crops with up to 426 Kg ha-1 of N applied per year and planted area of over 380,000 ha which increases every year. With an estimated 0.9% of applied N lost as $N_2O$, these orchards represent a major contributor to greenhouse gas (GHG) emissions.

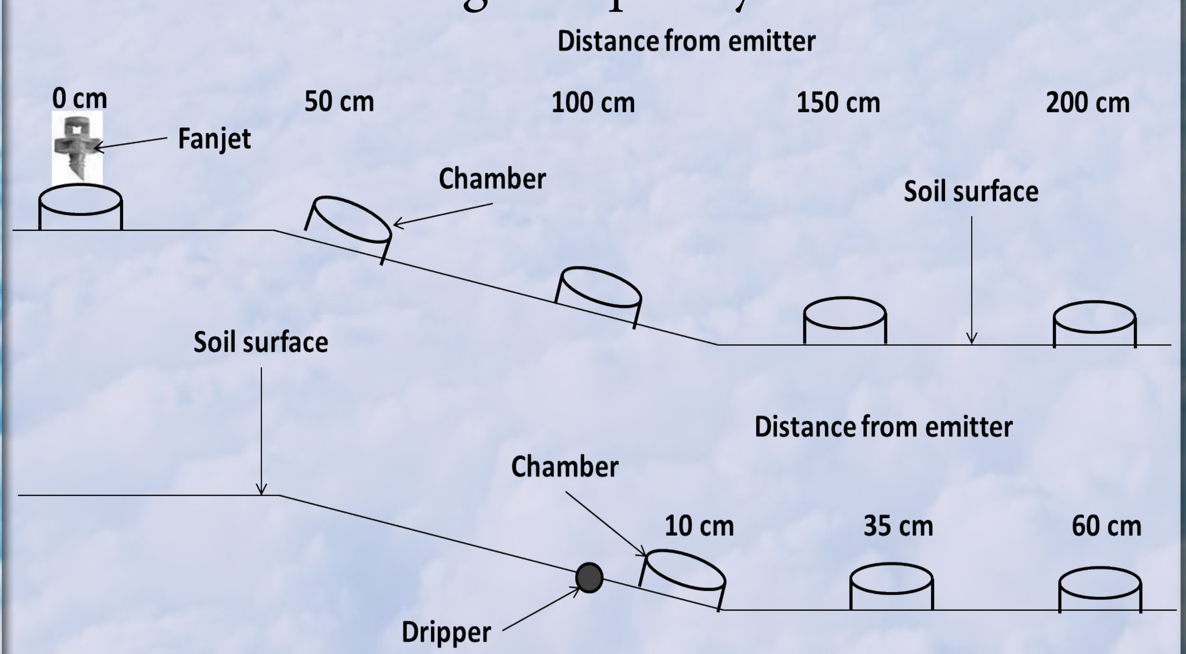
Most of California almond orchards are irrigated by micro-irrigation systems with fertilizer applied using fertigation. Best management practices for fertilizer application involve splitting applications into three or four events to optimize N uptake by the trees. Both the type of irrigation system and fertigation management have effects on magnitude and distribution of $N_2O$ emissions.

## Methods

*Treatments*

Two irrigation systems:
- Drip & micro-sprinkler (FJ)

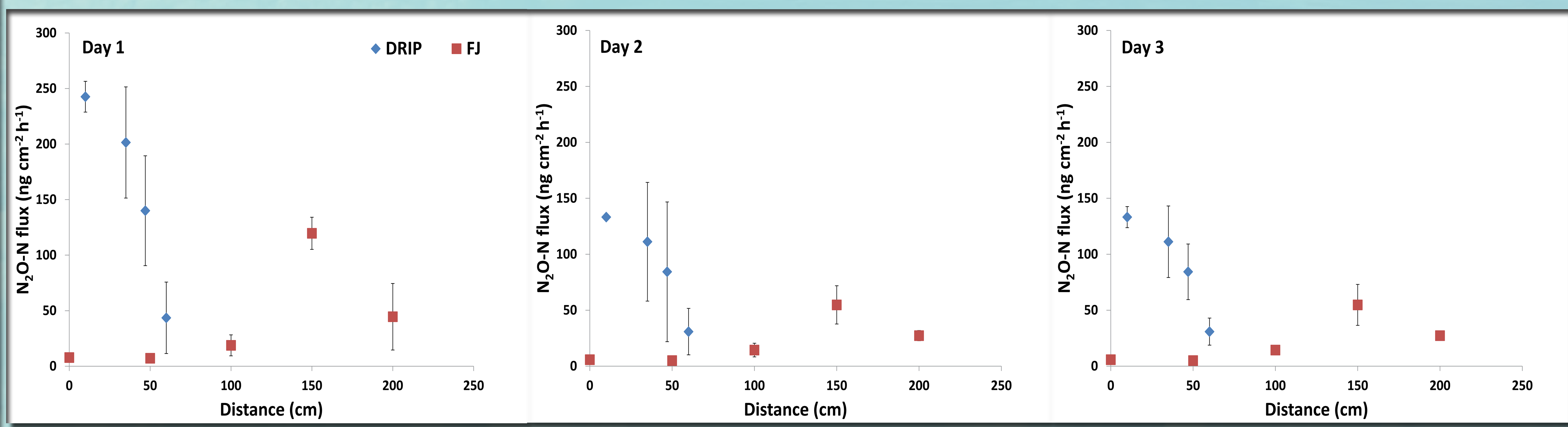
Three fertigation management schemes:
- AGP – Advance grower practice
- P&F – Pump and fertigate
- HFLN – High frequency low N




Schematic of sampling locations around the drip and micro-sprinkler

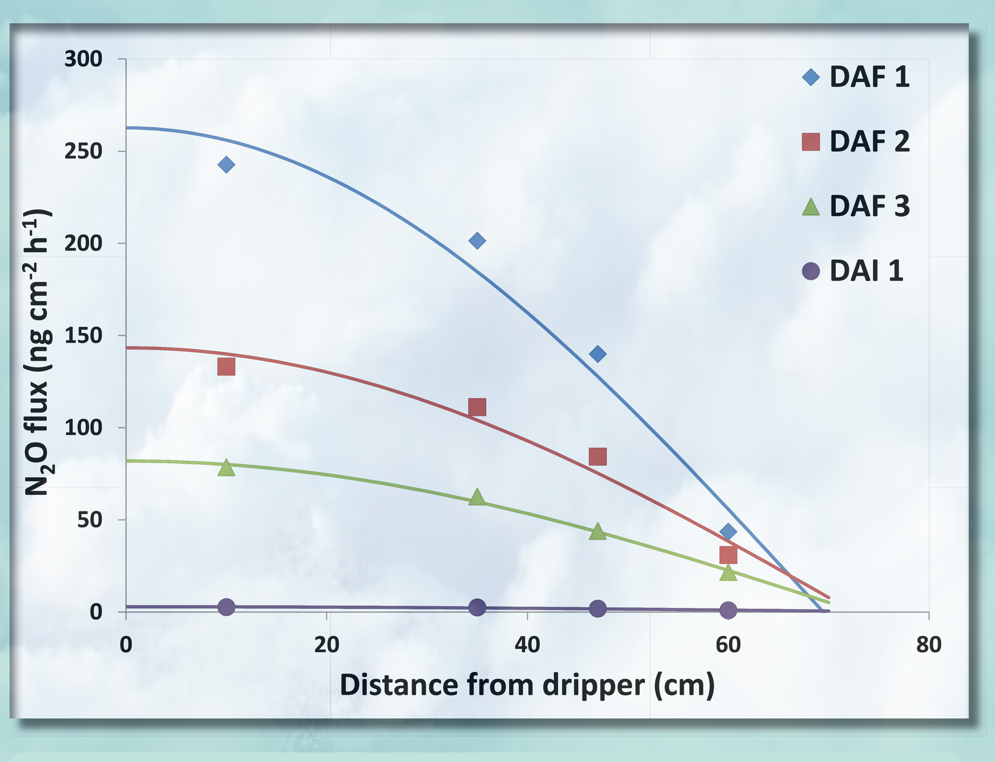
## Results

### Irrigation Treatments




Spatial patterns of $N_2O$ emissions around drip and micro-sprinkler emitters during 3 days after a fertigation event

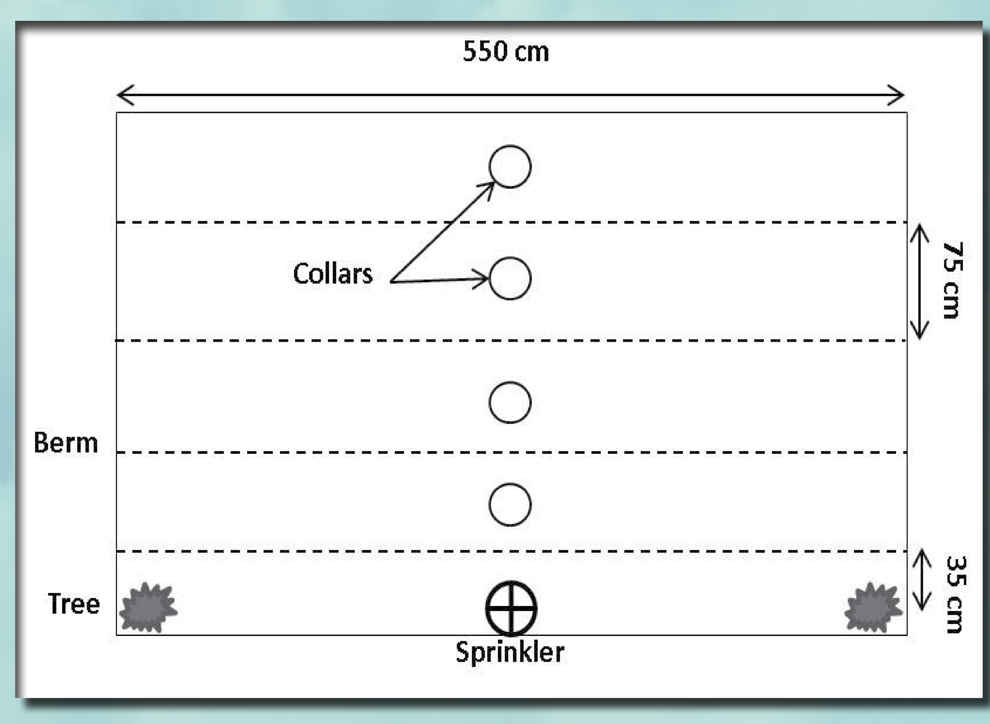
### Upscaling Emissions - Drip




$$q(r) = q_{max} \sin\left[\frac{\pi}{2}\left(\frac{r}{r_{max}} + 1\right)\right]$$

Spatial modeling of $N_2O$ emissions around a dripper compared with measured emissions

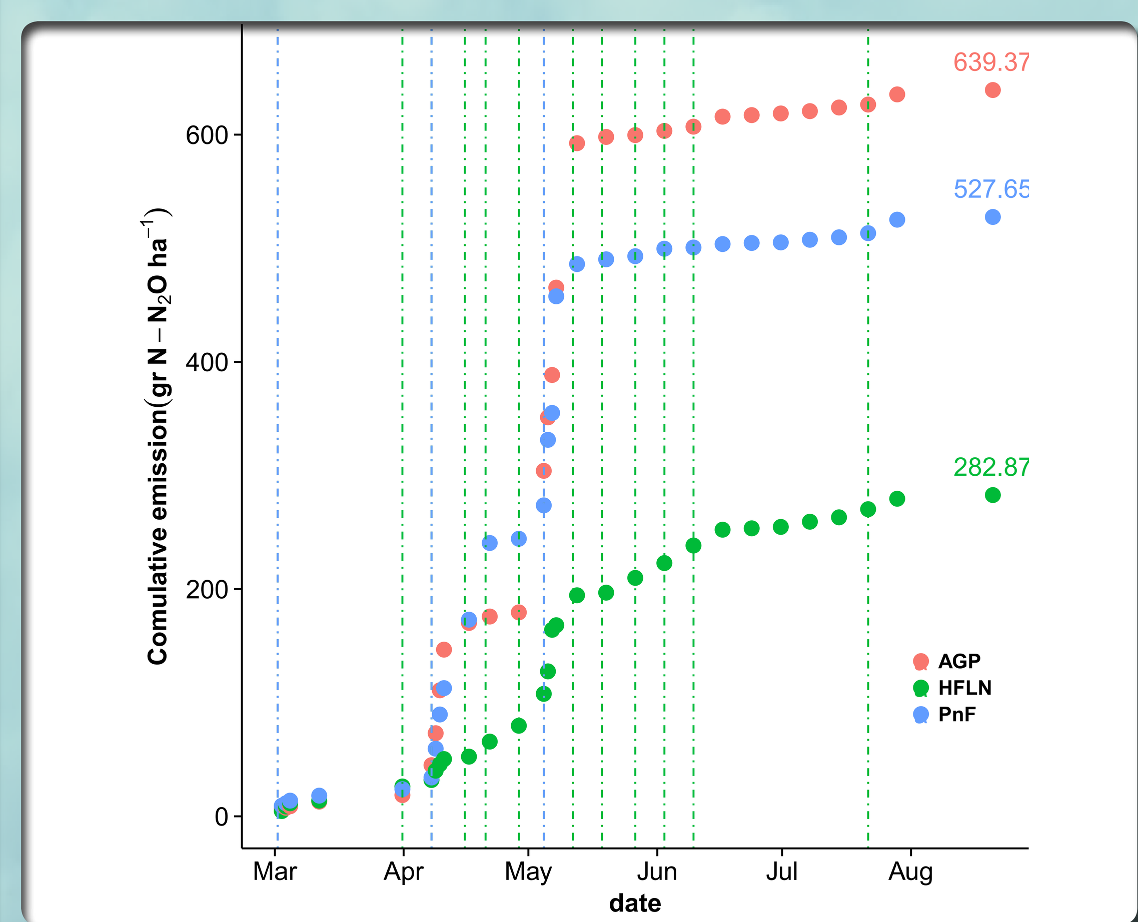
### Upscaling Emissions - FJ




$$Q_{Tree} = 2 \times \left(25 \times 640 \times q_1 + \sum_{i=2}^{5} 50 \times 640 \times q_i\right)$$

Spatial modeling of $N_2O$ emissions around a micro-sprinkler (FJ)

### Fertigation Management




Cumulative annual $N_2O$ emissions in an almond orchard using three fertigation management practices. The lines represent fertigation events

## Conclusions

- $N_2O$ fluxes are higher around drip emitter than around micro-sprinkler
- Only one measurement of peak $N_2O$ flux is needed in order to upsacle emissions to the orchard level using drip irrigation
- Spatial pattern of $N_2O$ emissions around micro-sprinkler depends heavily on its water distribution pattern and more samples are needed to correctly upscale measured fluxes to the orchard level
- Using high frequency low N fertigation management decreases $N_2O$ emissions significantly without reducing N rate and almond yields

## Acknowledgments

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