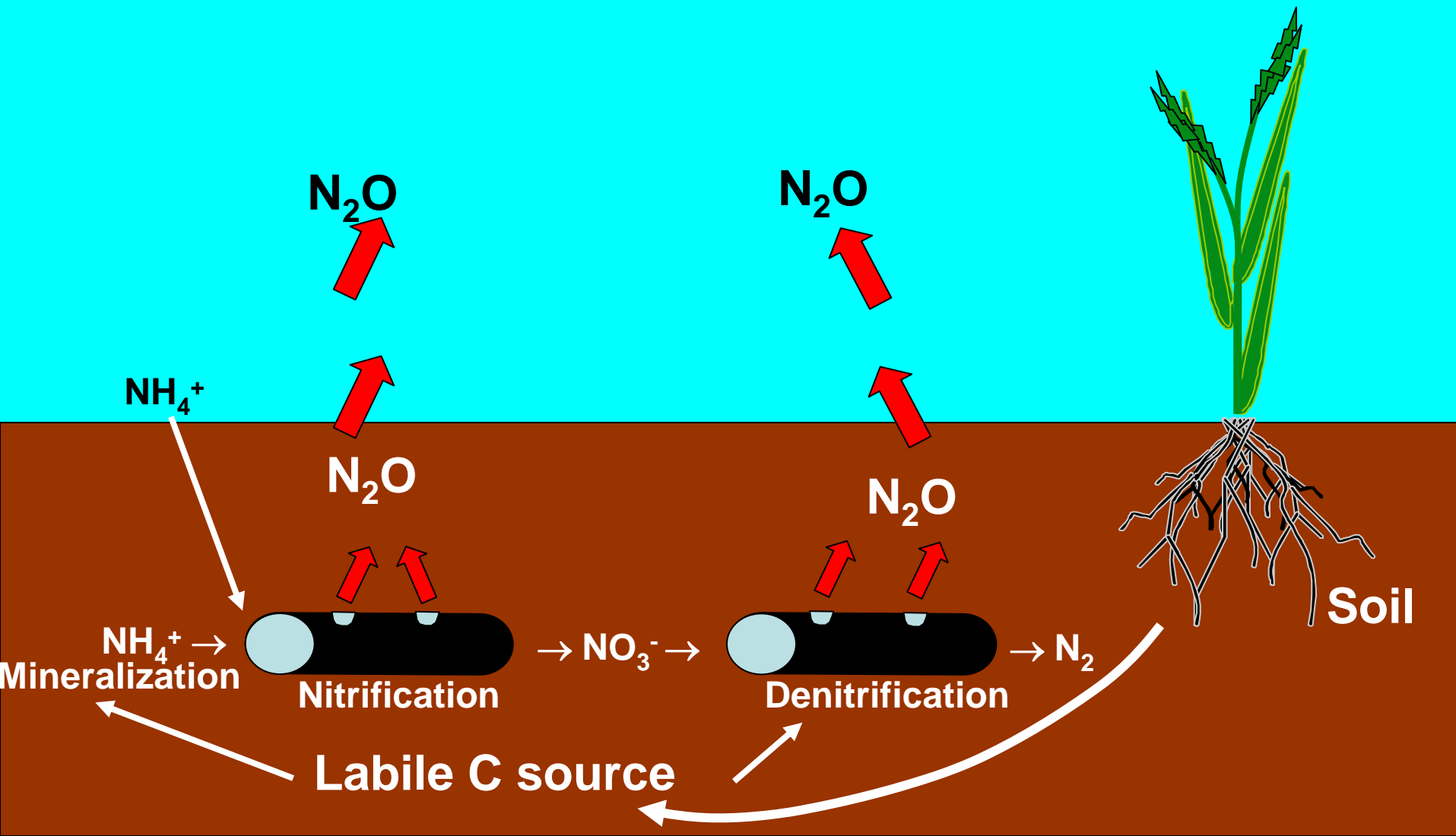


Controls and Driving Factors of Nitrous Oxide Flux from Agricultural Soil

Martin Burger
University of California Davis

Soil Factors affecting N₂O production and emission

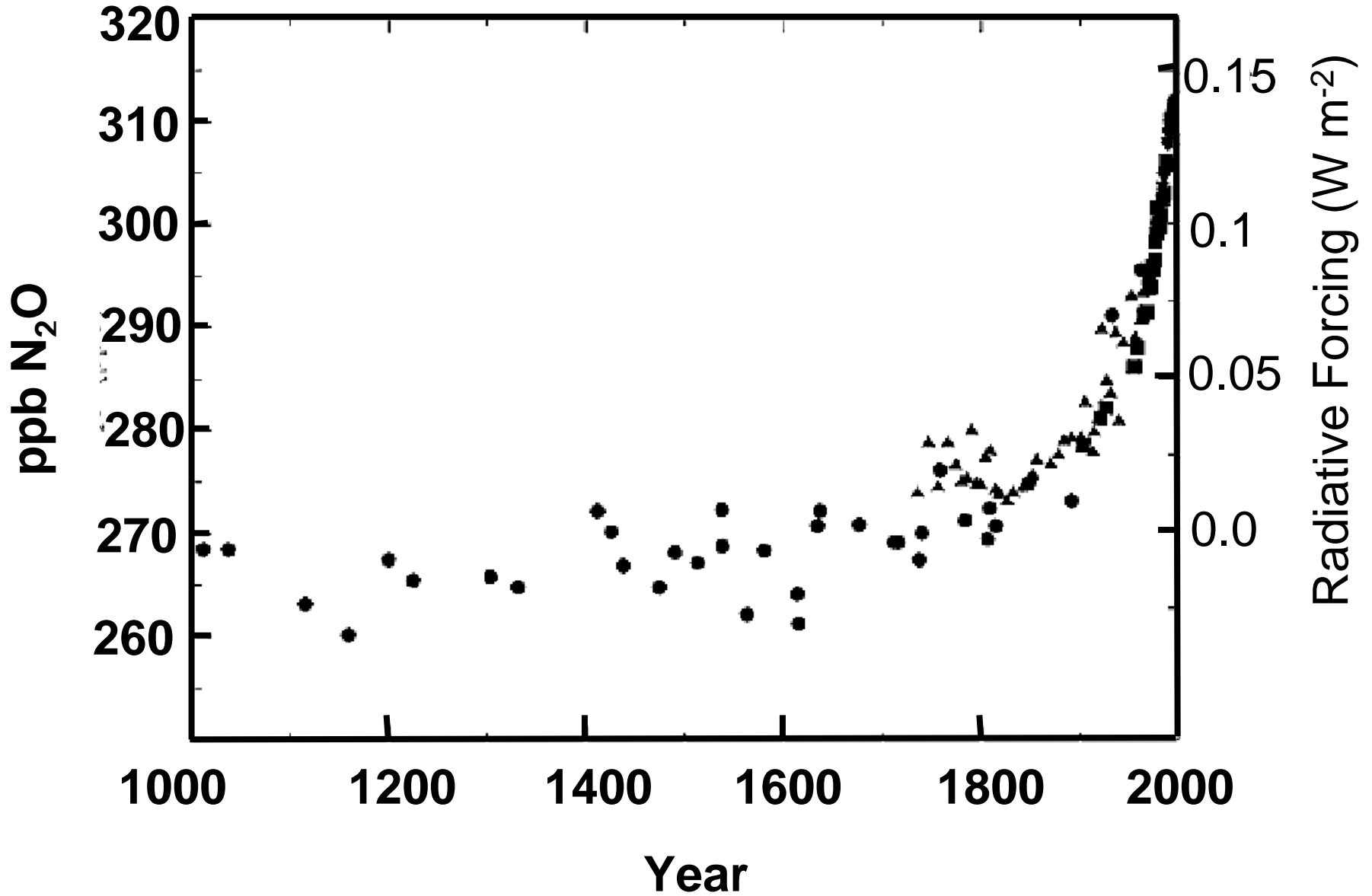
The “Leaky Pipe Theory”



Controls on N₂O Emissions

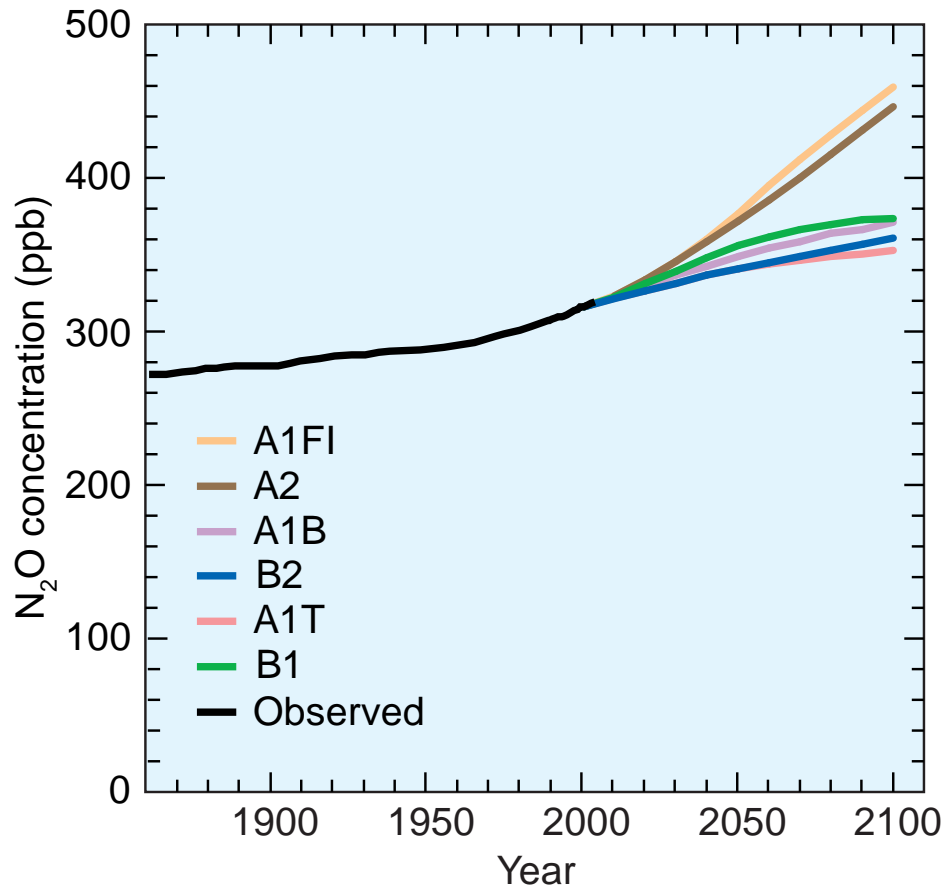
- **Soil water content (water-filled pore space)**
 - Regulates diffusion of gases into and out of soil
 - Microbial activity
- **Carbon availability**
 - Residue or manure incorporation
- **Temperature**
- **Nitrogen availability**
 - N-fertilizer, organic matter mineralization
 - Residual nitrate
 - Reactive N is main driver of N₂O increase in the atmosphere

N₂O in the Atmosphere



Source: IPCC, 2001

N₂O in the Atmosphere



**Observed and projected
N₂O concentrations**

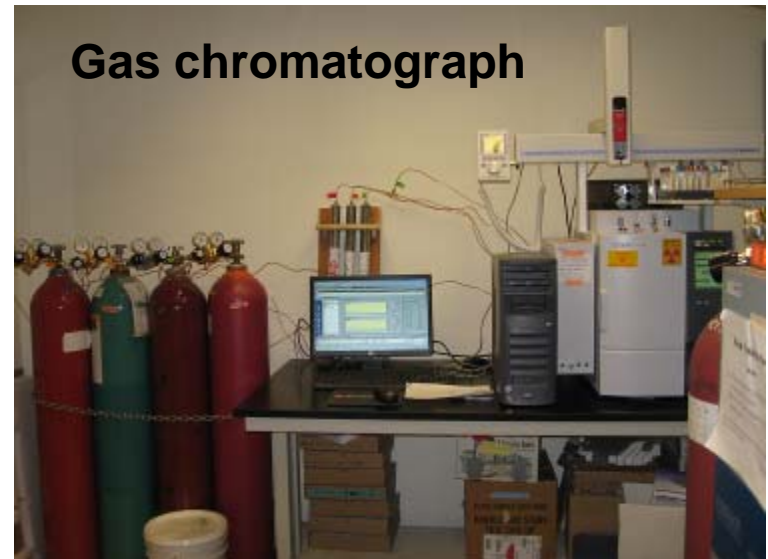
Greenhouse Gas Emissions (GGE)

	<u>Tg CO₂ equivalents</u>	%
• Net GGE in U.S.	6432	100
• N ₂ O all sources	469	7
– N ₂ O Agricultural soil	365	6
• N ₂ O emissions in California	?	

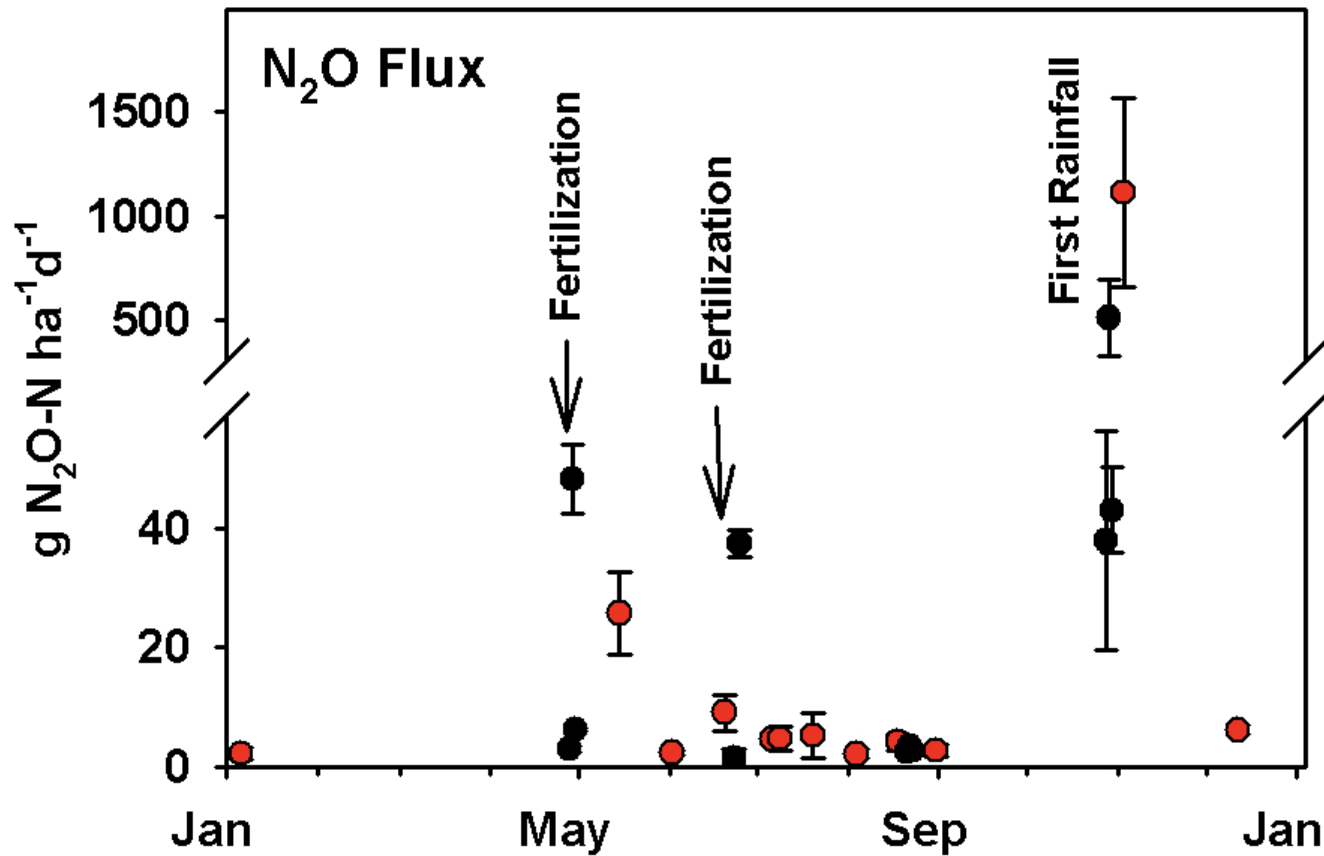
Chambers used for static N_2O flux measurements in the field

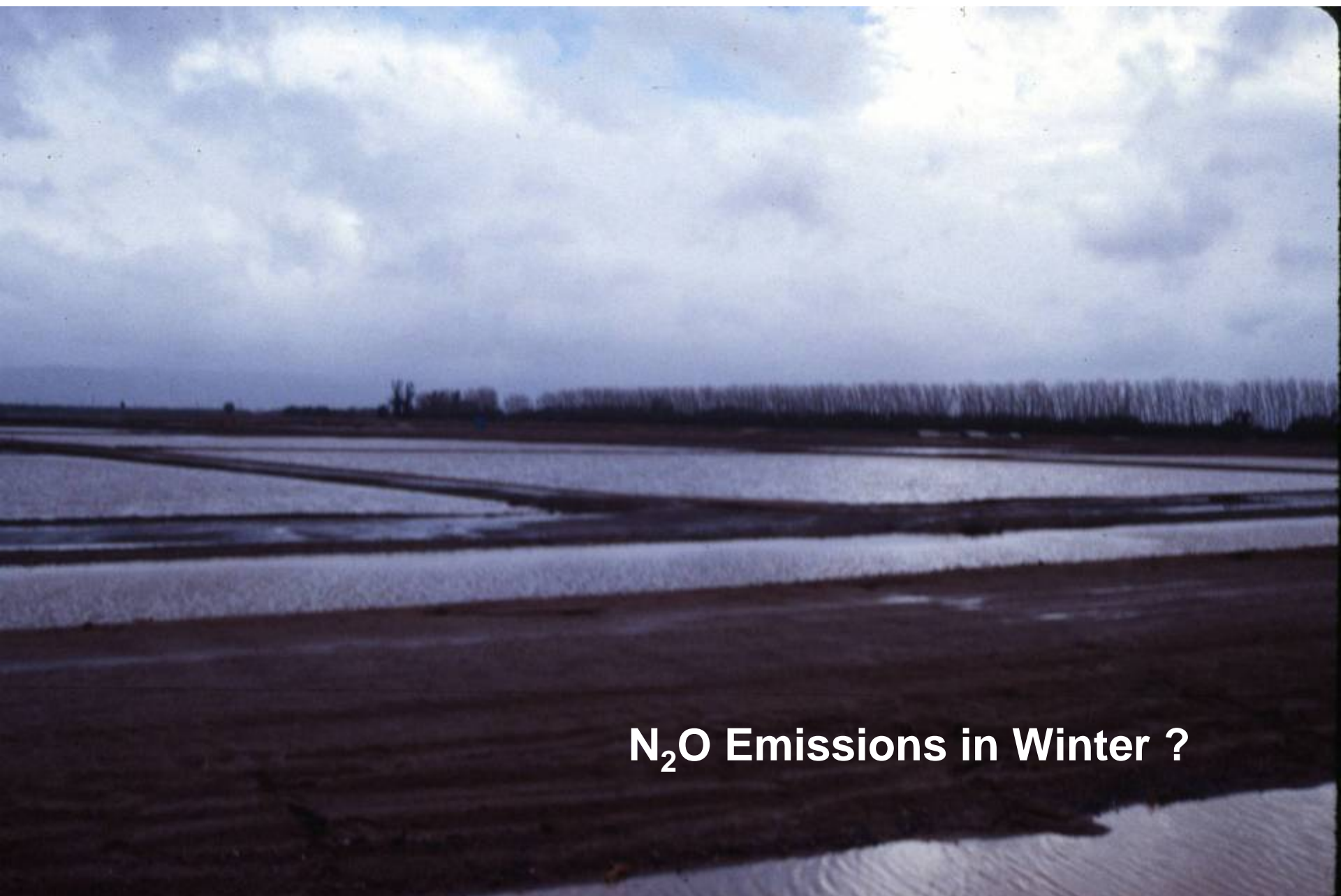


Gas chromatograph



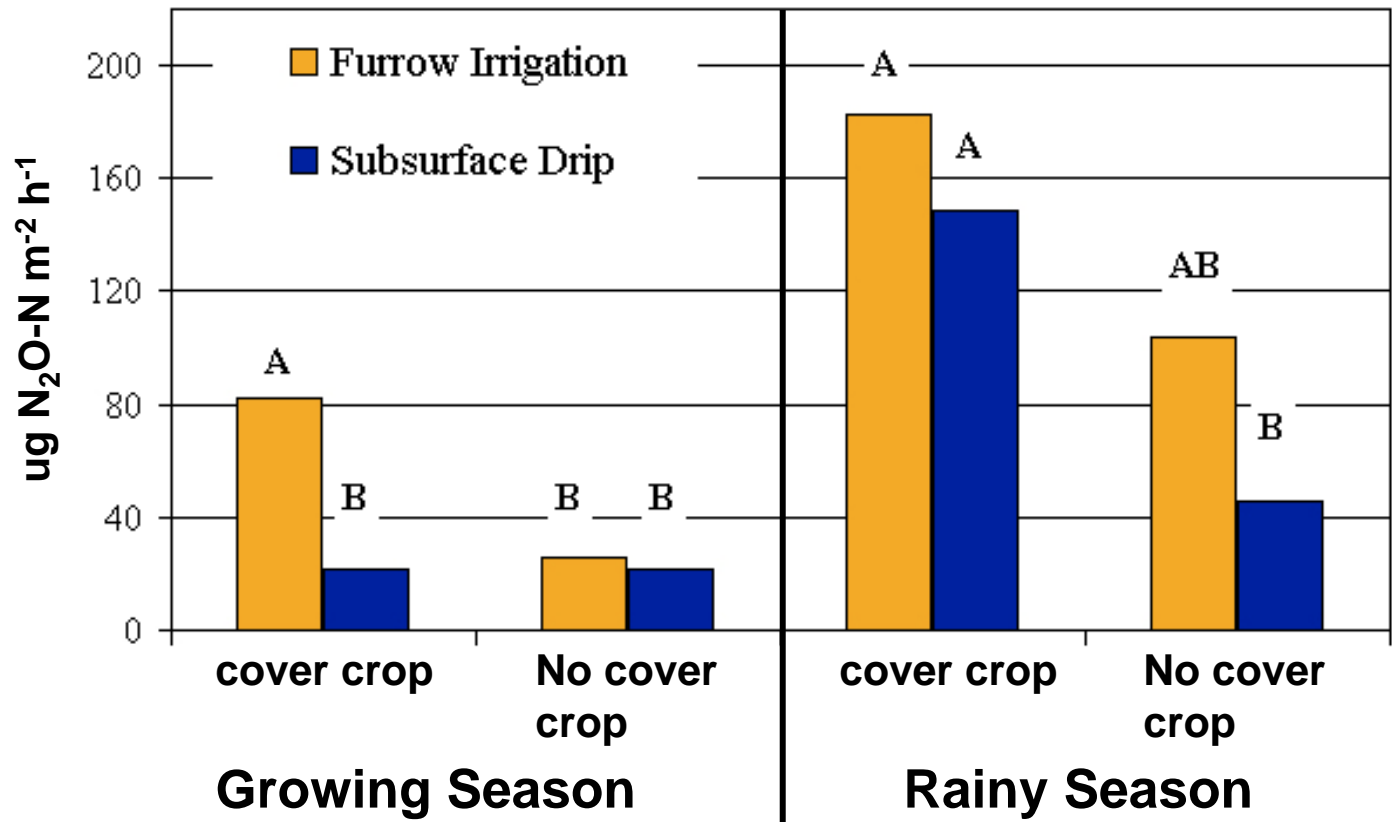
N₂O emissions tend to be event based





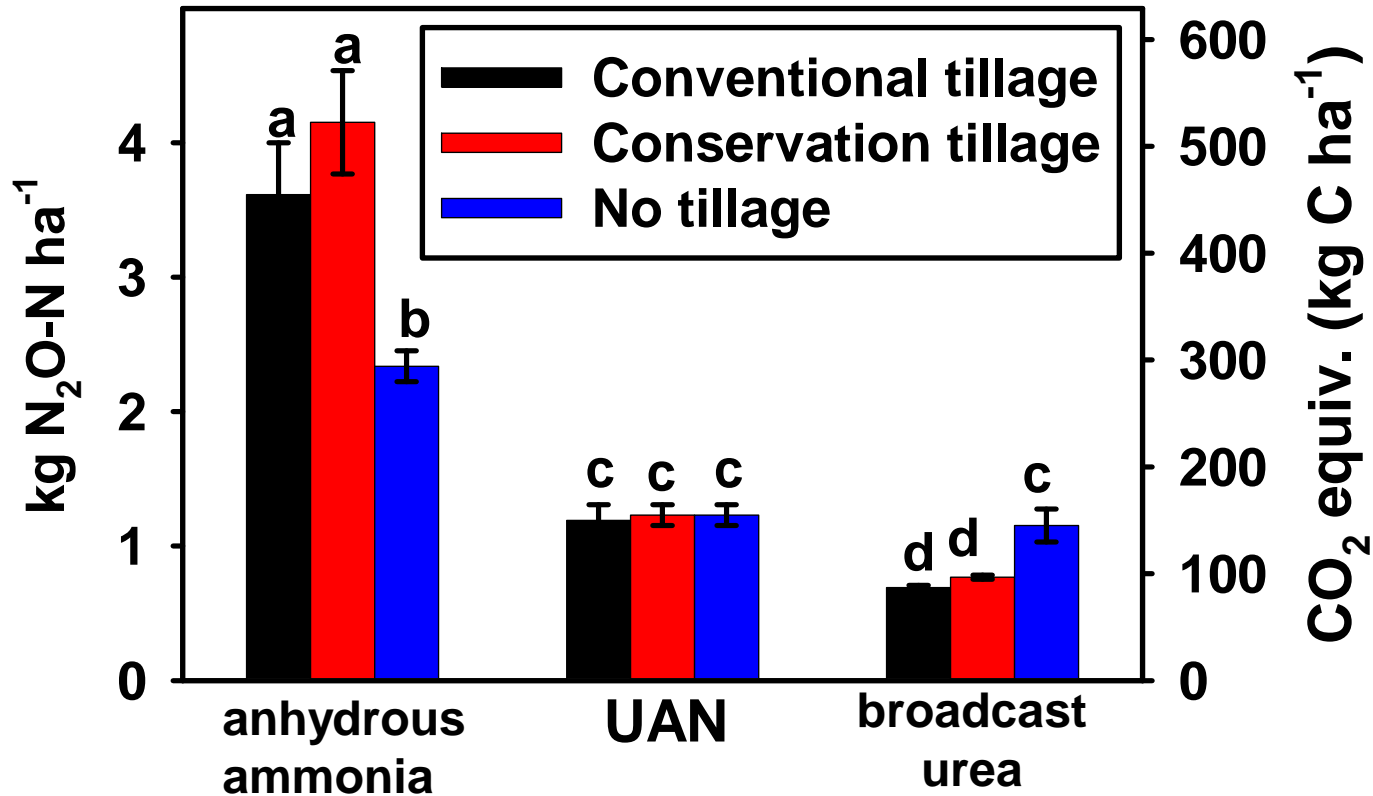
N₂O Emissions in Winter ?

Irrigation and Cover Crop Effects on N₂O Emissions



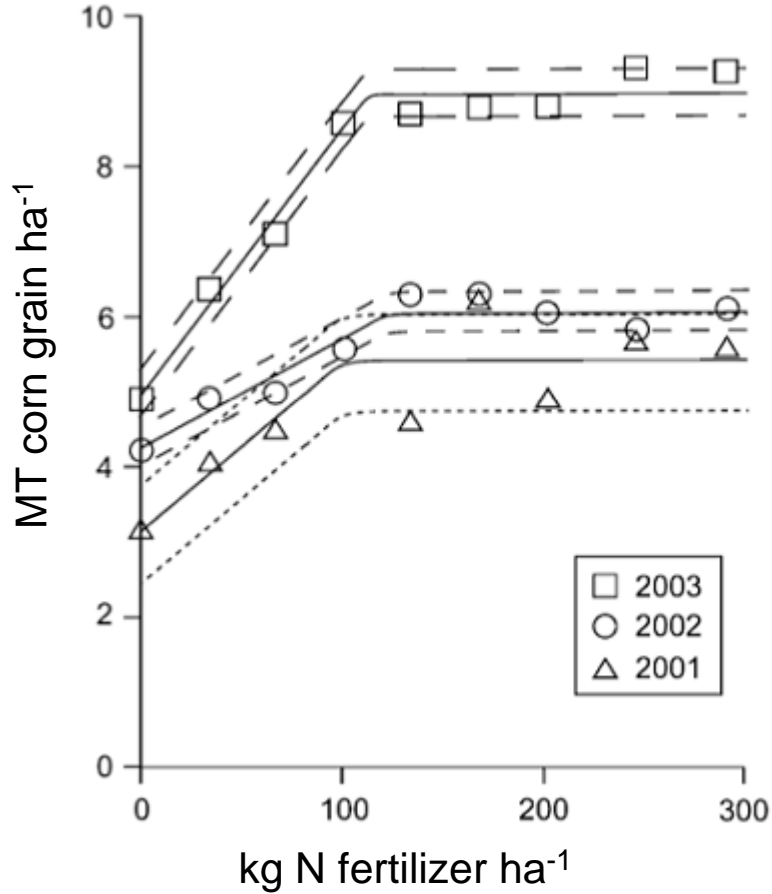
Interaction of Fertilizer Type & Tillage on N₂O Emissions

Corn crop (May - Nov 2004)

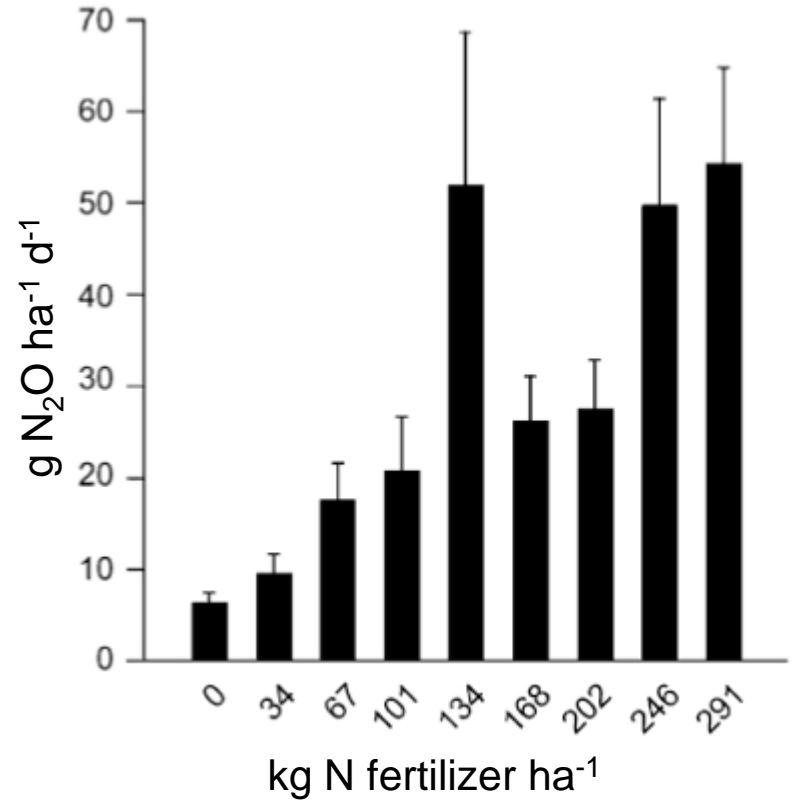


N₂O emissions, Yield and Fertilizer N

N Fertilizer Rate vs. Yield



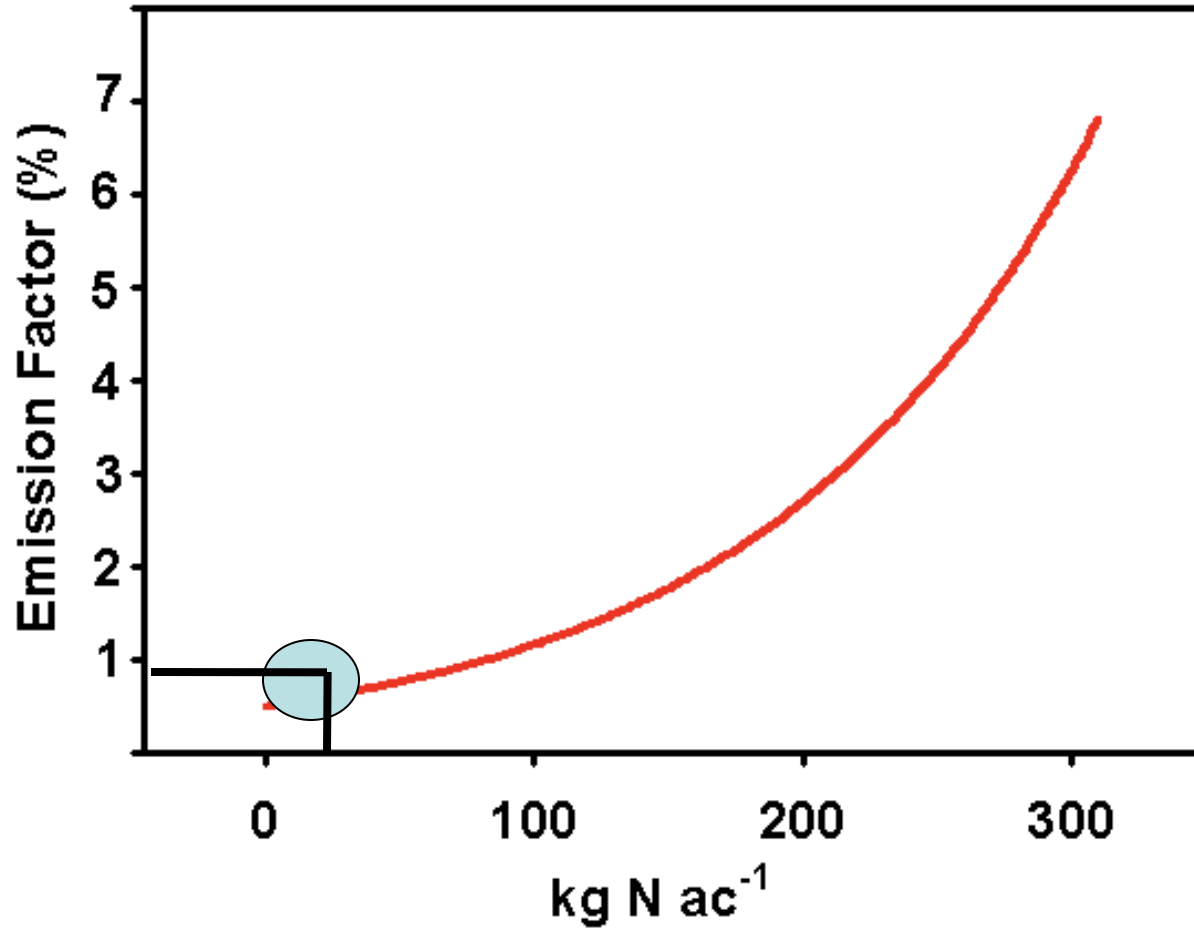
N Fertilizer Rate vs. N₂O Emission



“N₂O Emission Factor”

Hypothetical Model

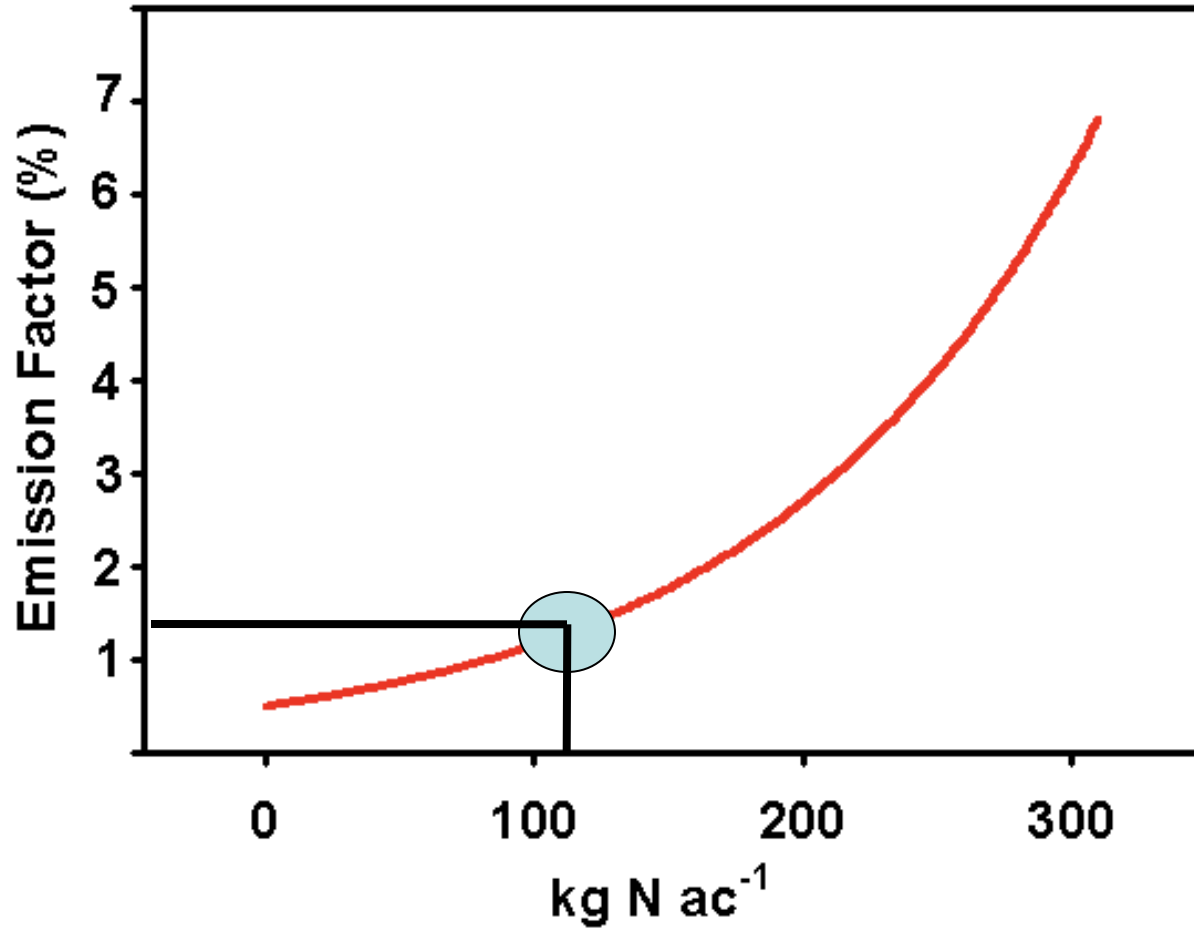
Applied Fertilizer N vs. N₂O Emission Factors



“N₂O Emission Factor”

Hypothetical Model

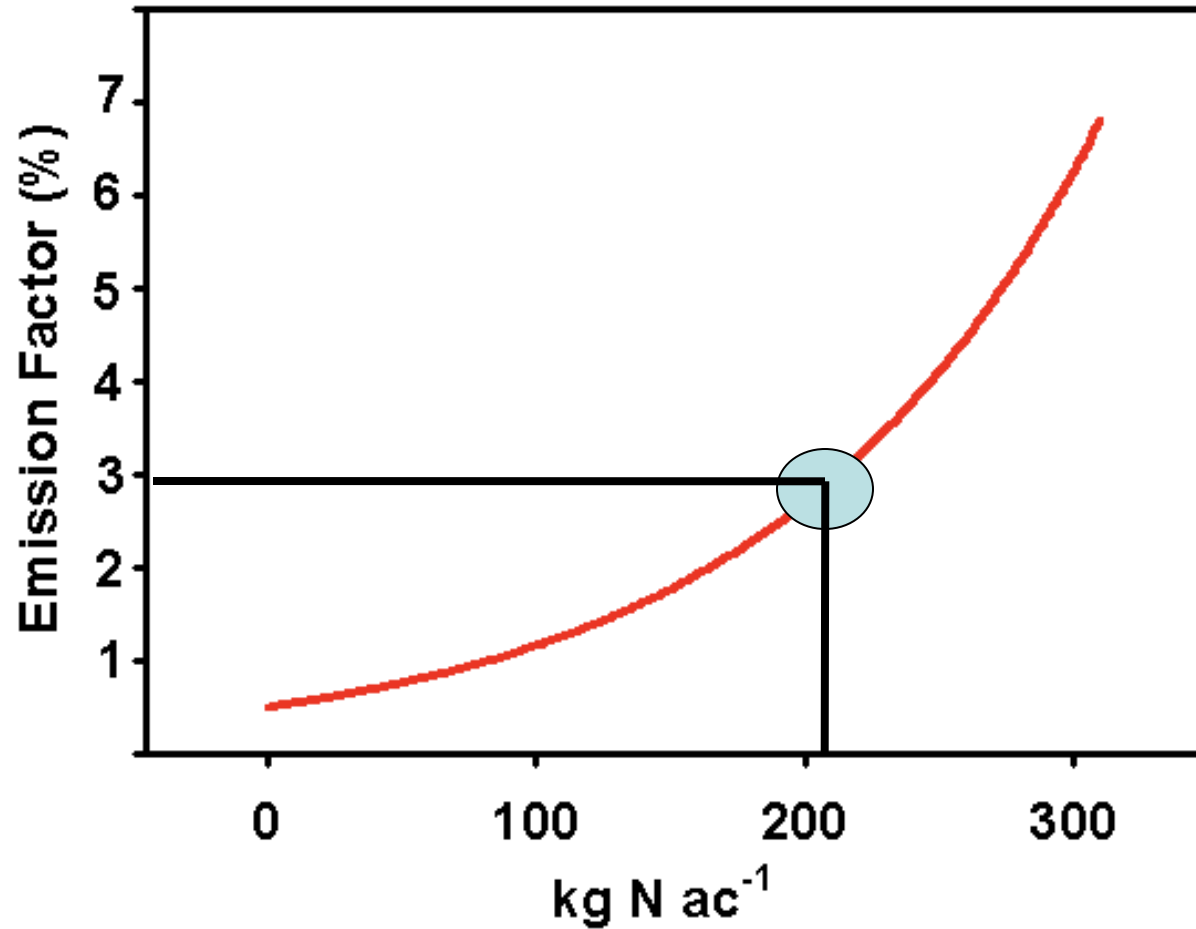
Applied Fertilizer N vs. N₂O Emission Factors



“N₂O Emission Factor”

Hypothetical Model

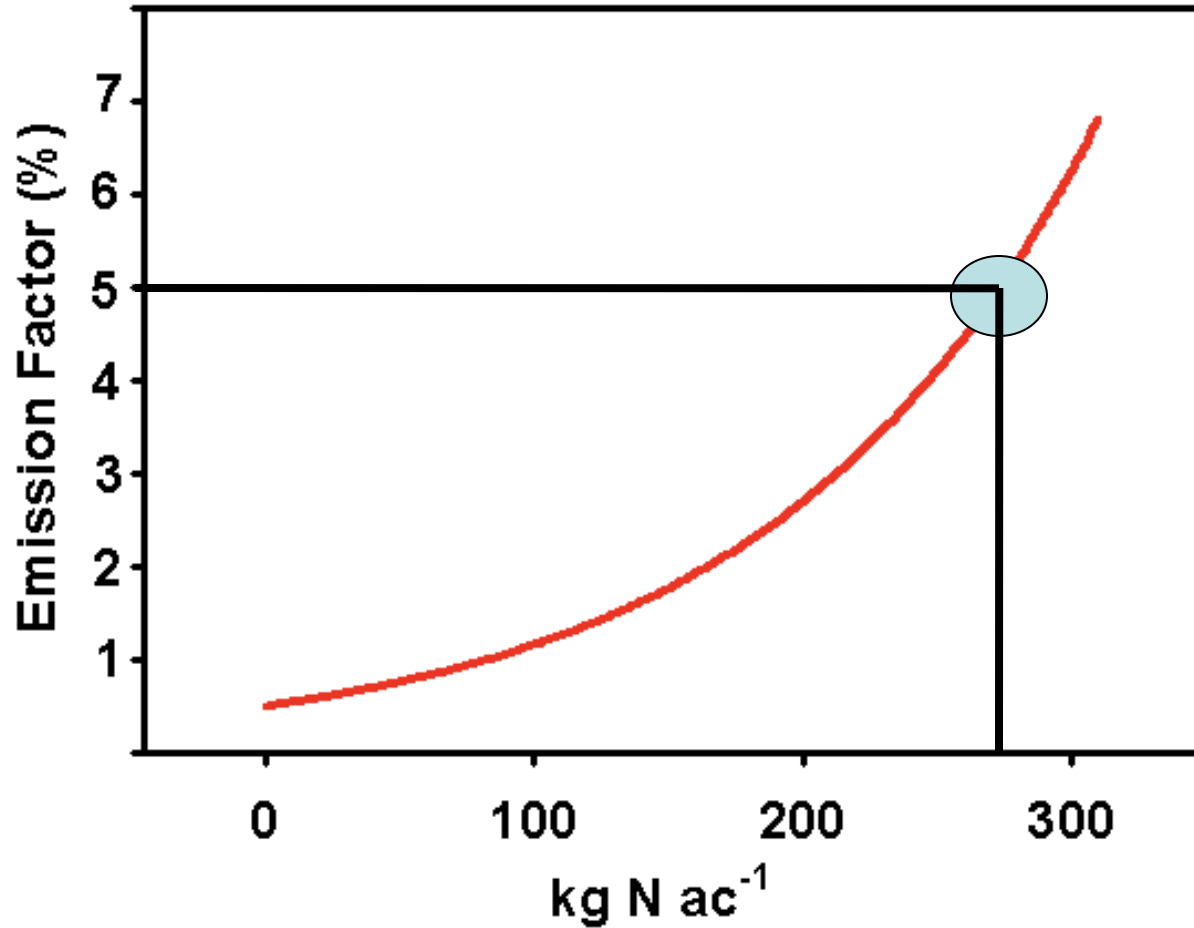
Applied Fertilizer N vs. N₂O Emission Factors



“N₂O Emission Factor”

Hypothetical Model

Applied Fertilizer N vs. N₂O Emission Factors



Conclusions

- **Controls and drivers of N₂O emissions are well known, but the magnitude of the emissions is difficult to predict**
- **Optimizing N fertilizer use efficiency is probably also the best strategy to minimize N₂O emissions**
- **Actual N₂O flux measurements in California cropping systems will provide improved emission estimates and information on mitigation potential**