

SOIL N₂O EMISSIONS

Basic Research and Data Collection

Authors

- ▣ Jerry L. Hatfield
- ▣ Timothy B. Parkin

Background

- ▣ N_2O as part of the greenhouse gas complex
- ▣ Component of agricultural system most closely related to management decisions, i.e., fertilizer management
- ▣ Offers the potential for an area in which agricultural systems could have the greatest response using alternative forms of N materials

Basic research studies

- ▣ Monitor N₂O with different methods
 - Static chambers
 - Dynamic chambers
 - Micromet techniques

Static Chambers



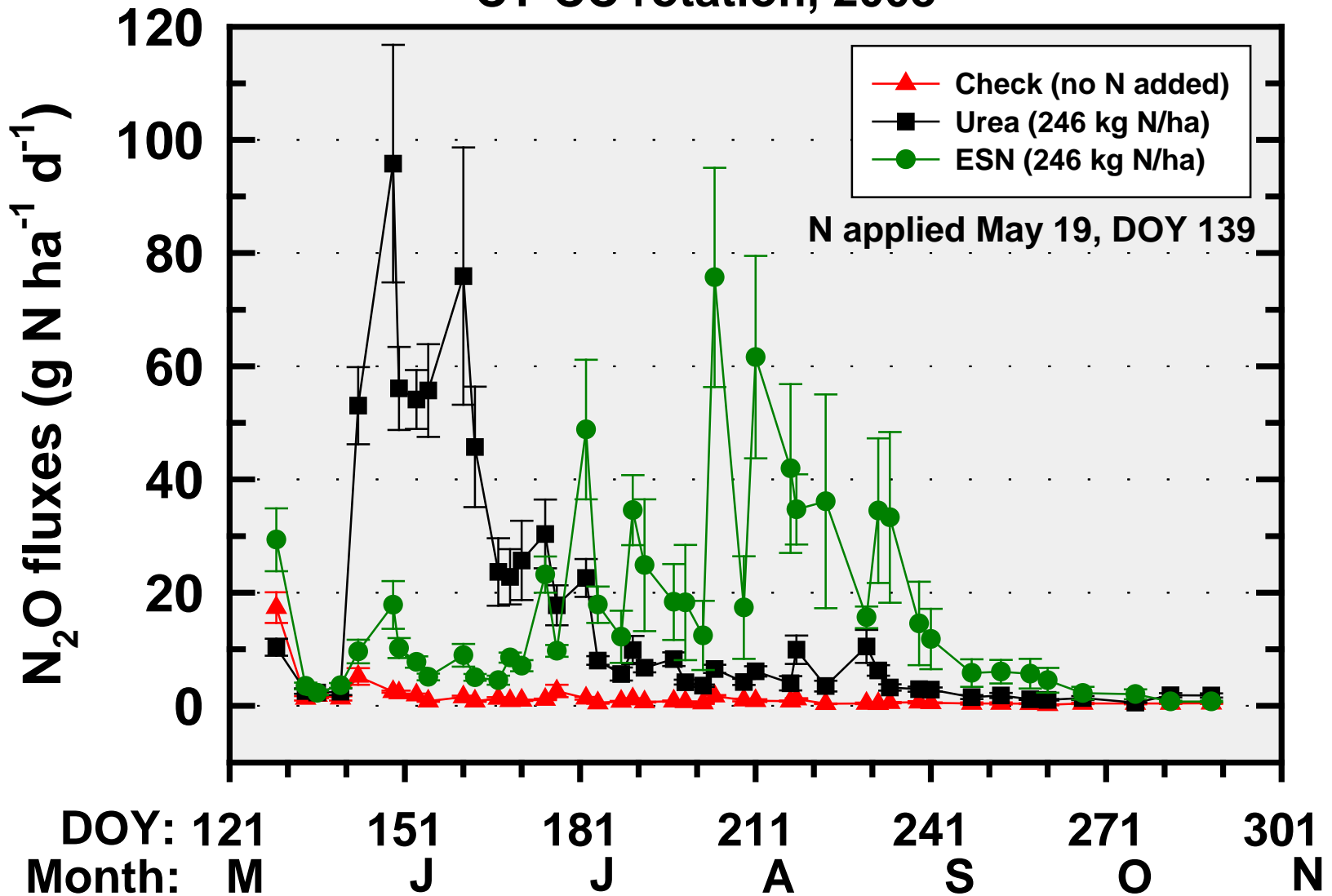
ARS Technicians collecting GHG samples, soil temp, and water data in ST-CC rotation



Injecting field gas samples into vials for analysis on Varian 3800 GC.

Urea vs ESN in Conventional Till Corn, Fort Collins, CO

CT-CC rotation, 2008



Clay loam soil; GS precip. =241mm; irrigation = 360mm; N band applied

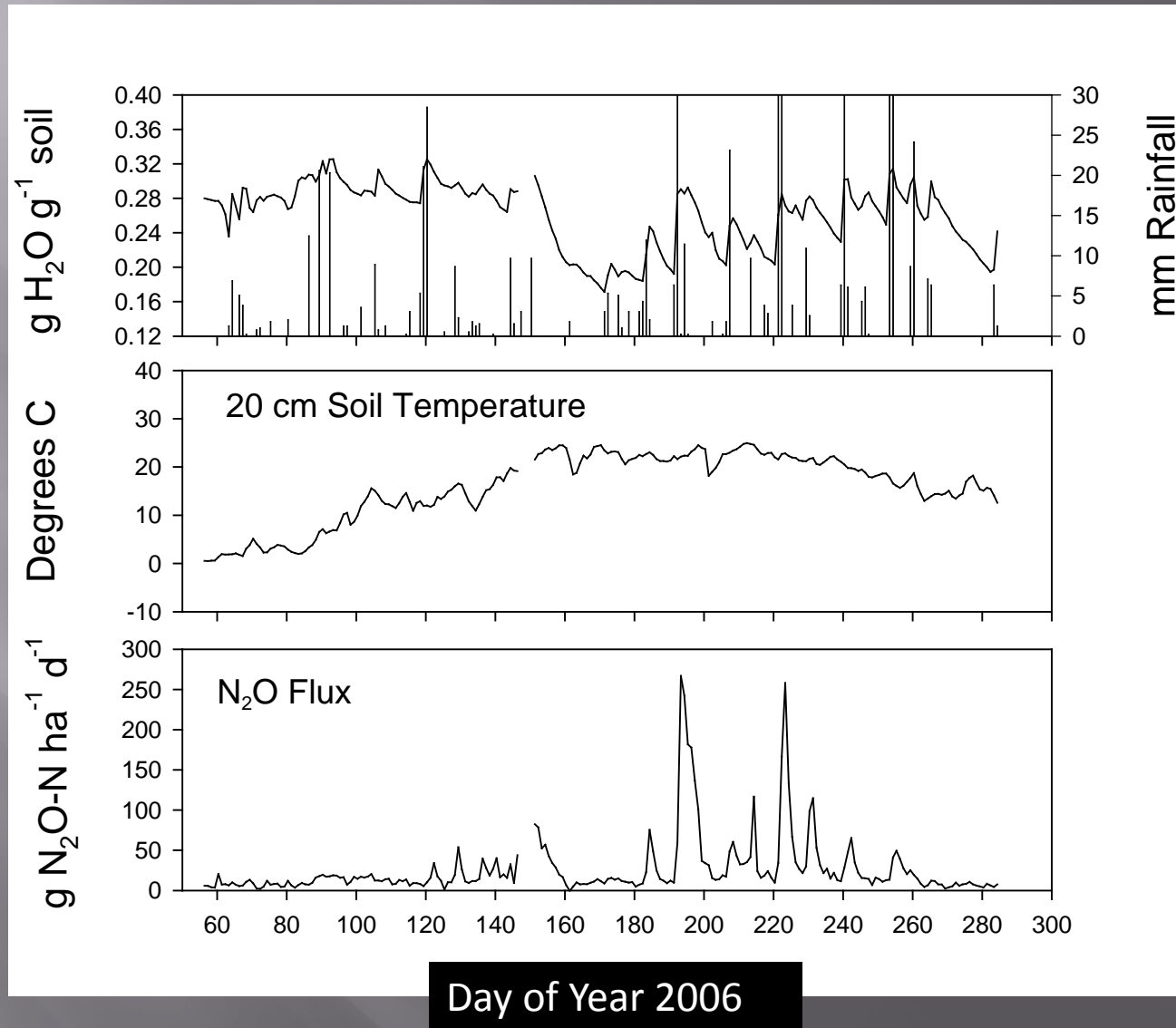
Source: Halvorson et al., 2010 SSSAJ 74(2):_-. Doi:102136/sssaj2009.0072.

Automated Chamber Trace Gas Flux

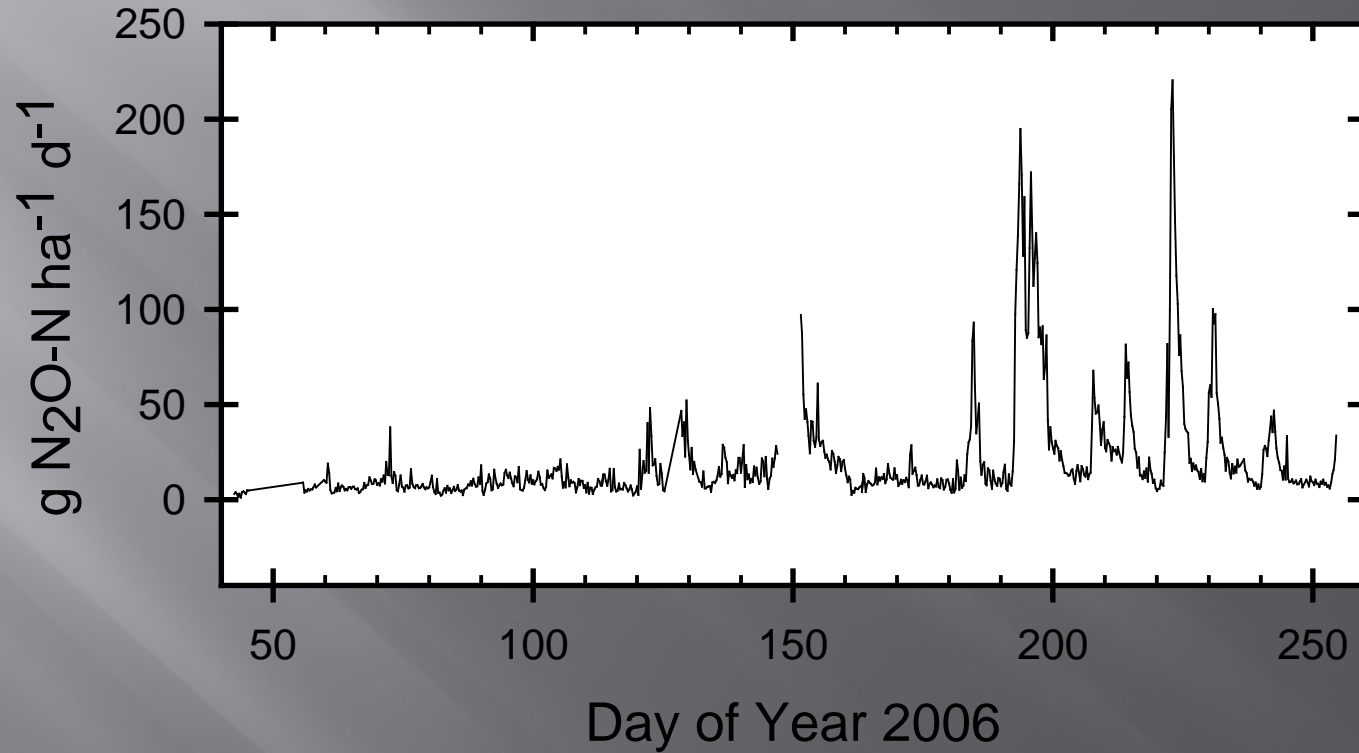
- Deployed Feb, 2006
- Chisel/Corn/Anhydrous NH_3
- N_2O and CH_4 flux
- Fluxes every 6 h



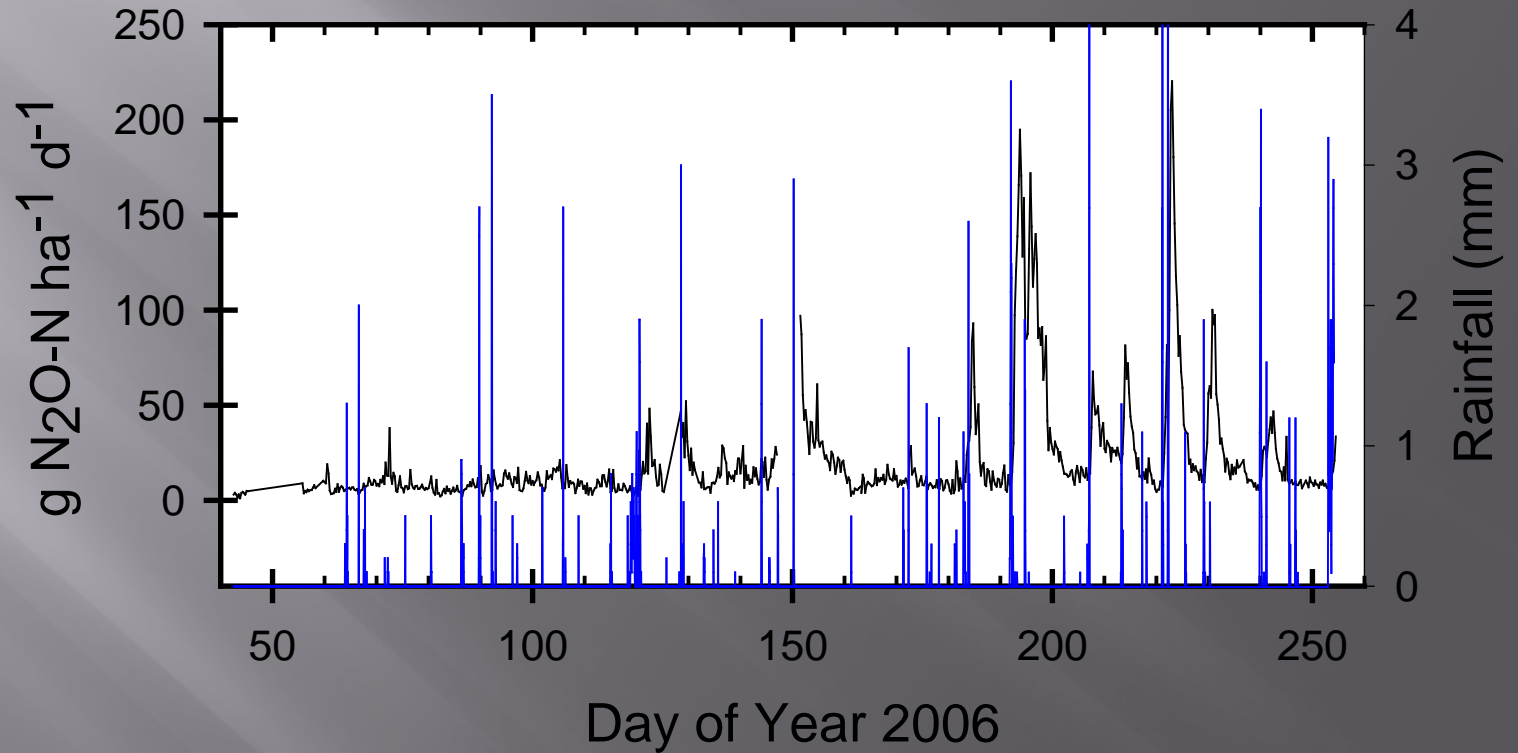
Rainfall, Soil Water Content, Soil Temperature and N₂O Flux



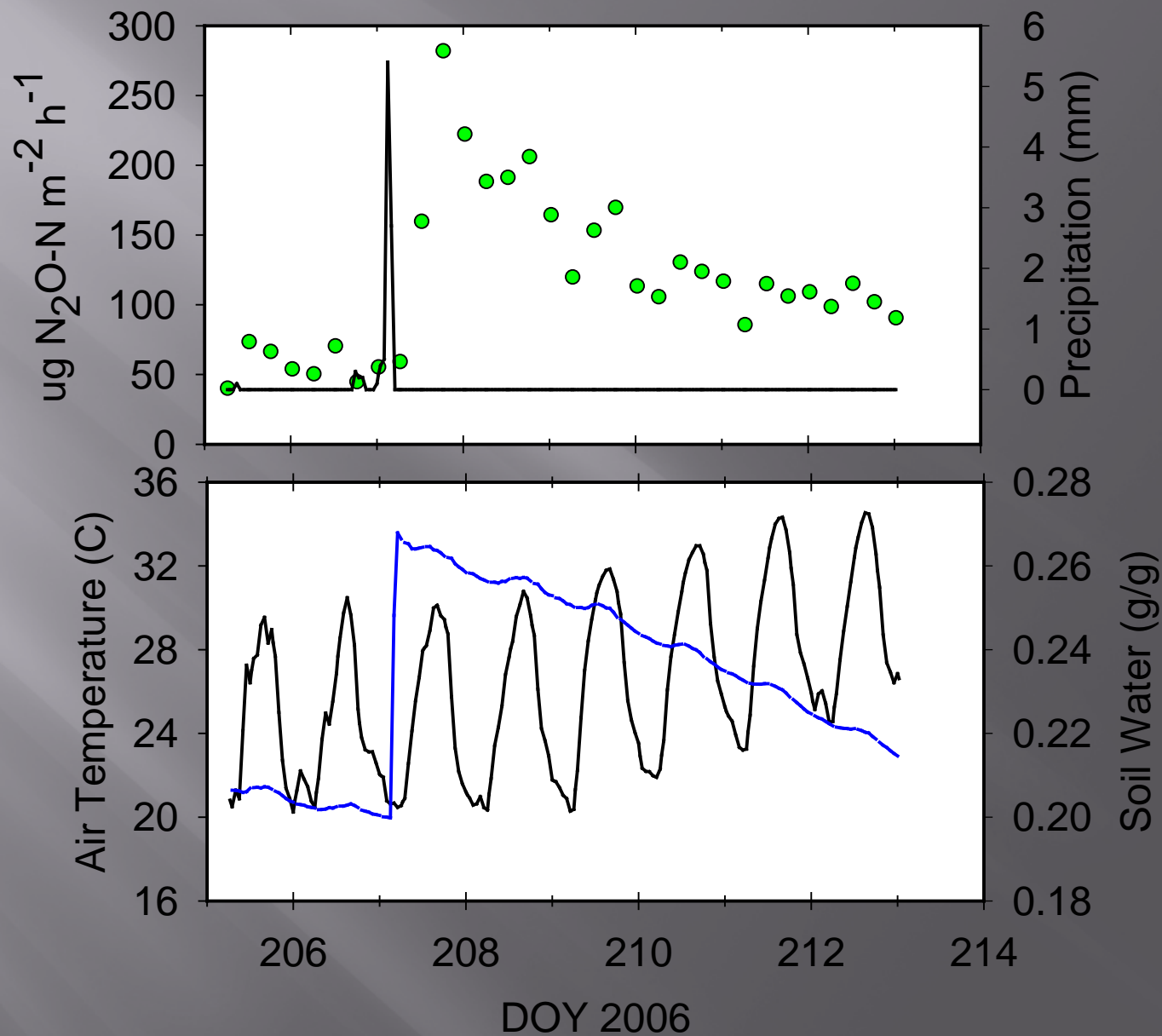
Average Nitrous Oxide Emissions Automated Chambers



Nitrous Oxide Emissions and Rainfall



July 24 – August 1



USDA-ARS GRACEnet

(Greenhouse Gas Reduction through
Agricultural Carbon Enhancement)

Goal

...develop and evaluate management practices that increase soil C and decrease net greenhouse gas emissions



Management Systems

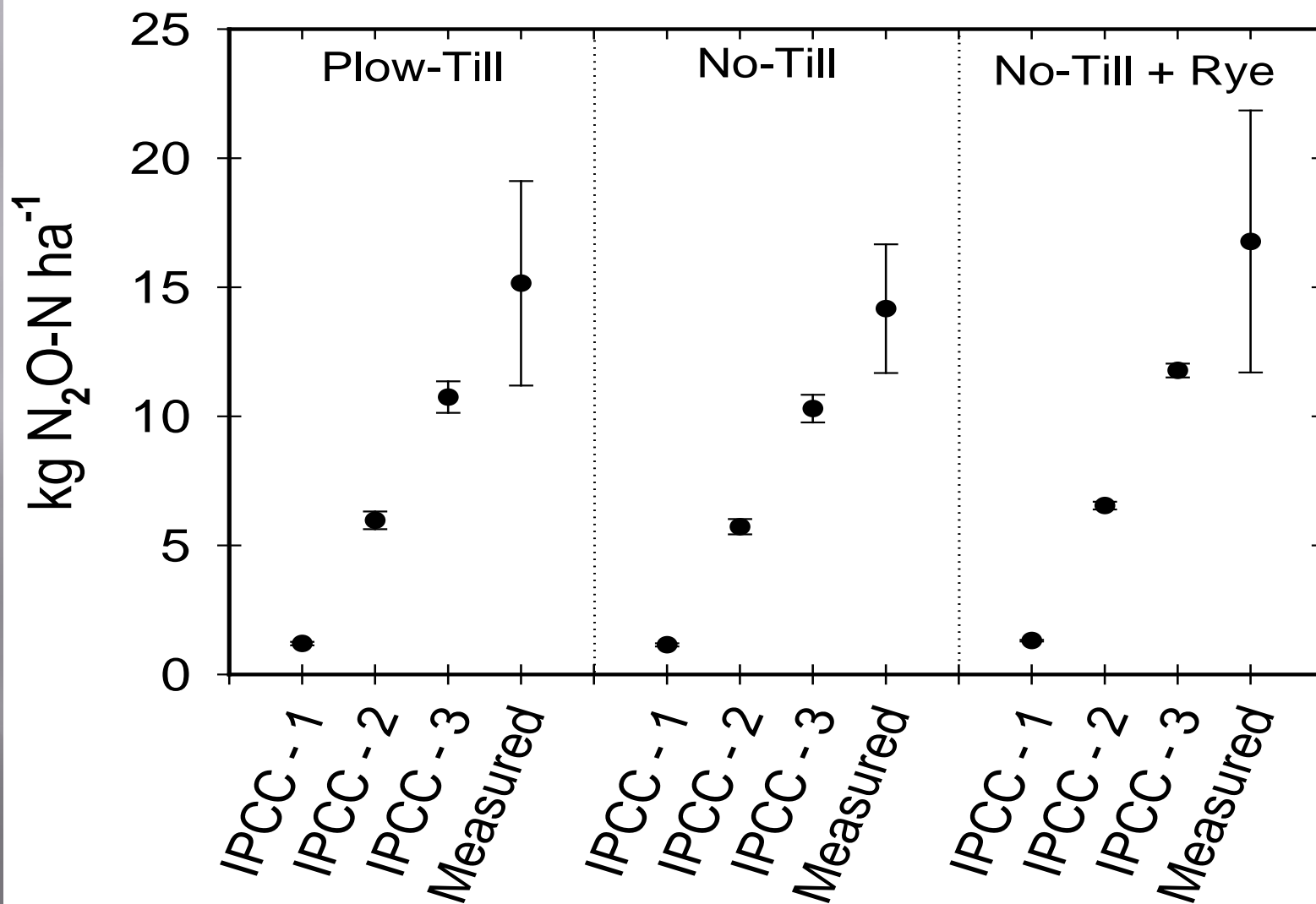
- Tillage (Chisel Plow / No Till)
- Fertility (Timing / Inhibitors / Manure)
- Rotations / Cover Crops

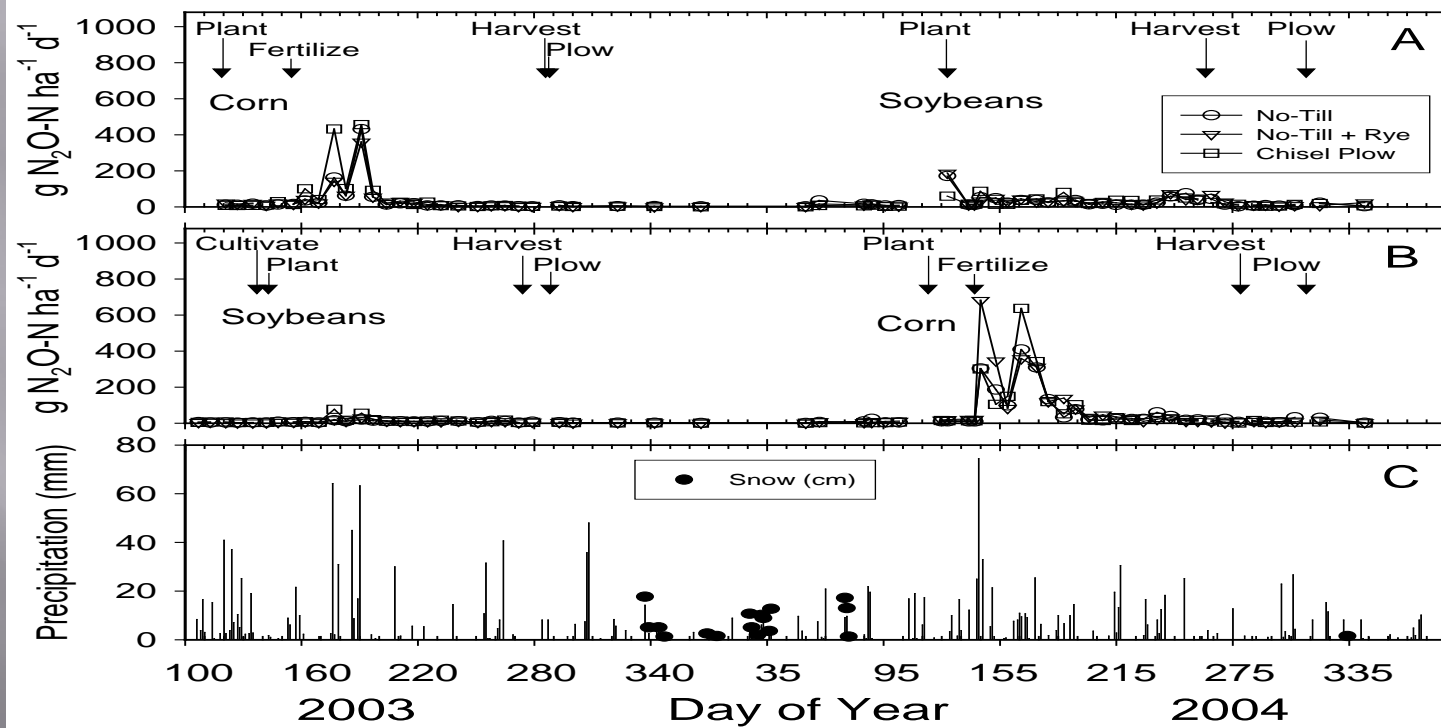
Measurements

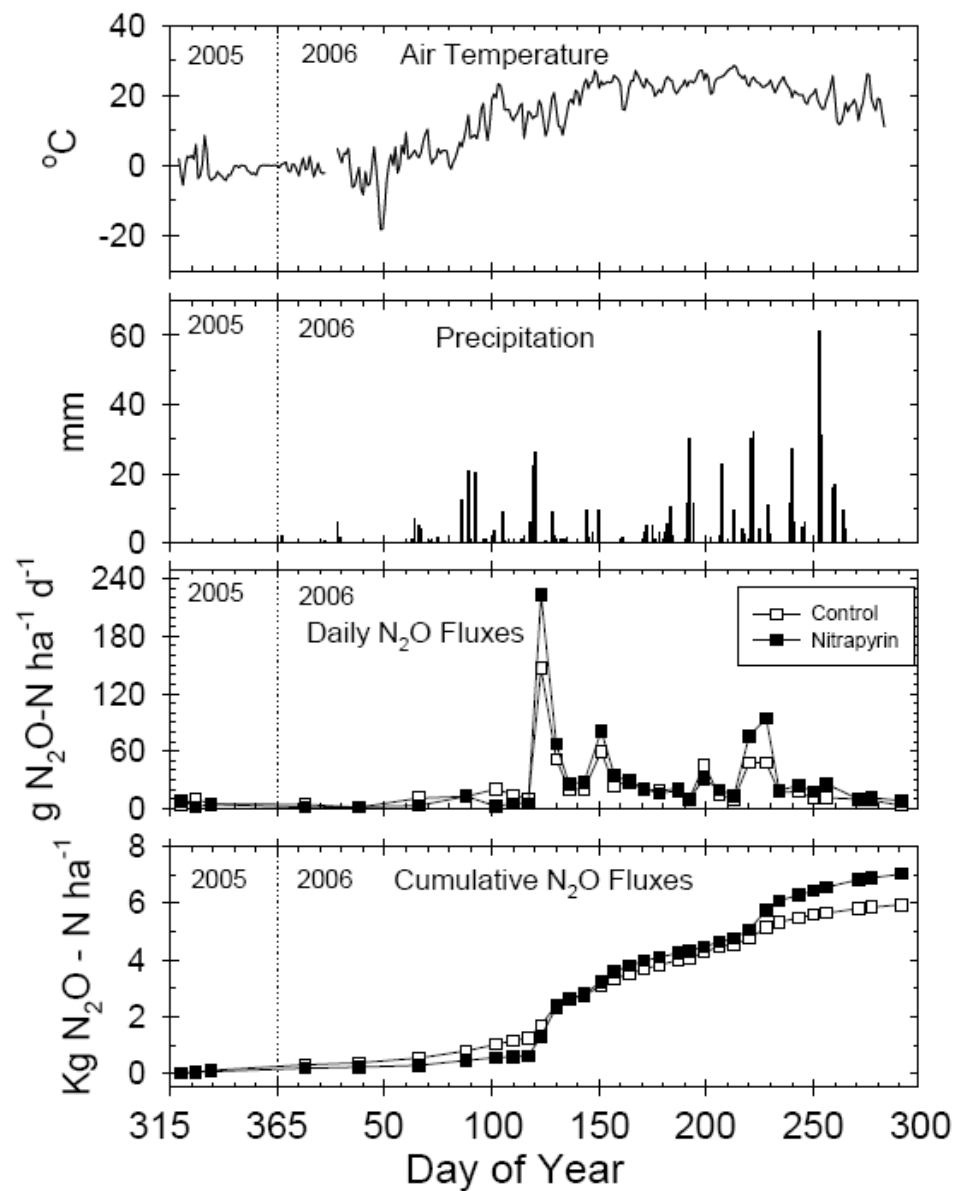
- Trace Gas Flux (CH_4 , N_2O) - soil chambers (Relaxed Eddy – June '06)
- Soil
- Plant
- Weather
- Climate

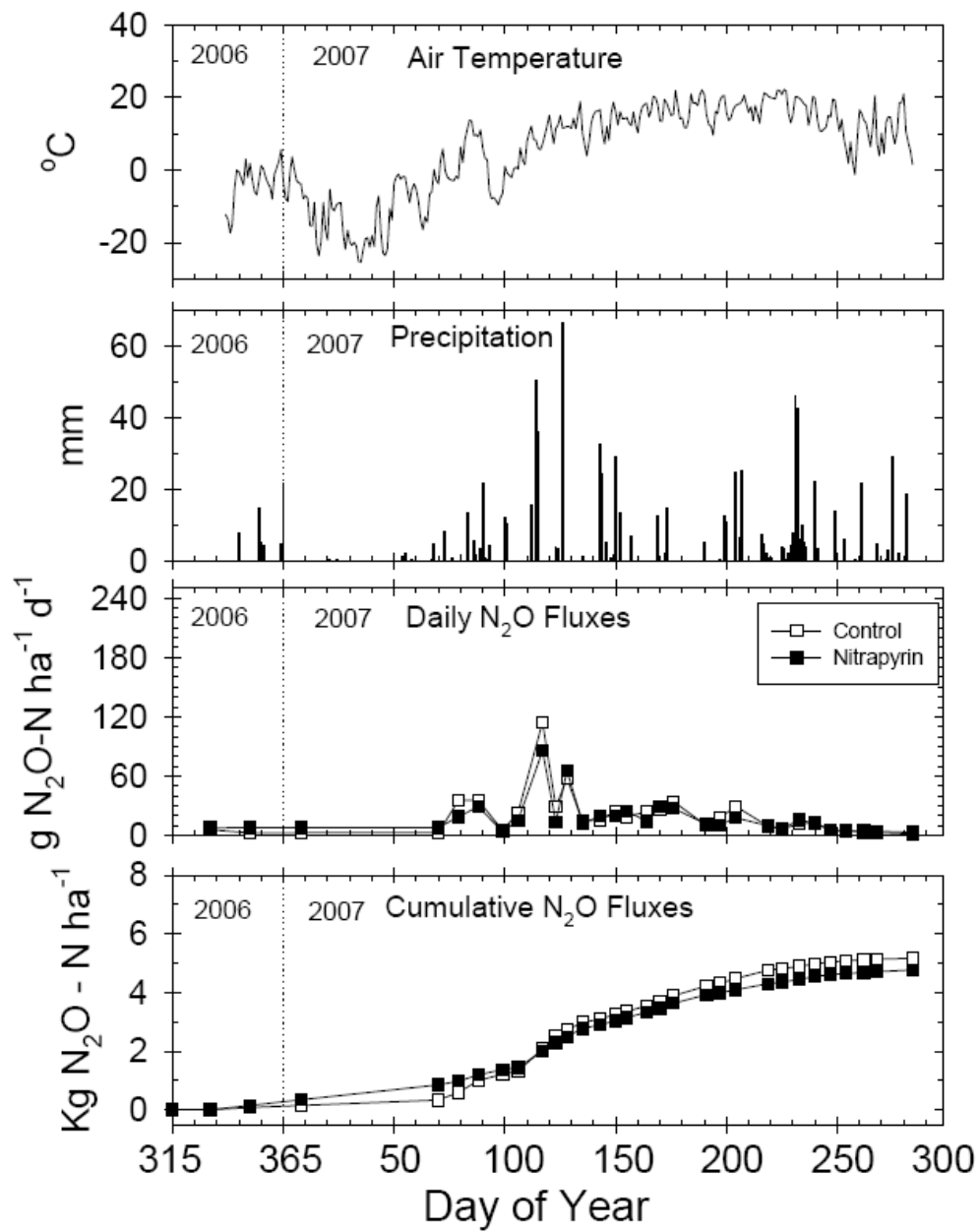
(Protocols: www.usda.gracenet.gov)

Measured vs. IPCC Estimated N₂O Emissions









Observations

- ▣ We need continuous monitoring to account for the variation in meteorological conditions
- ▣ Soil-based chambers are acceptable for comparing treatments but are limited in handling the spatial variation present in a field
- ▣ Micromet techniques can evaluate the effect of changes in soil water content and management practices but require larger plot areas