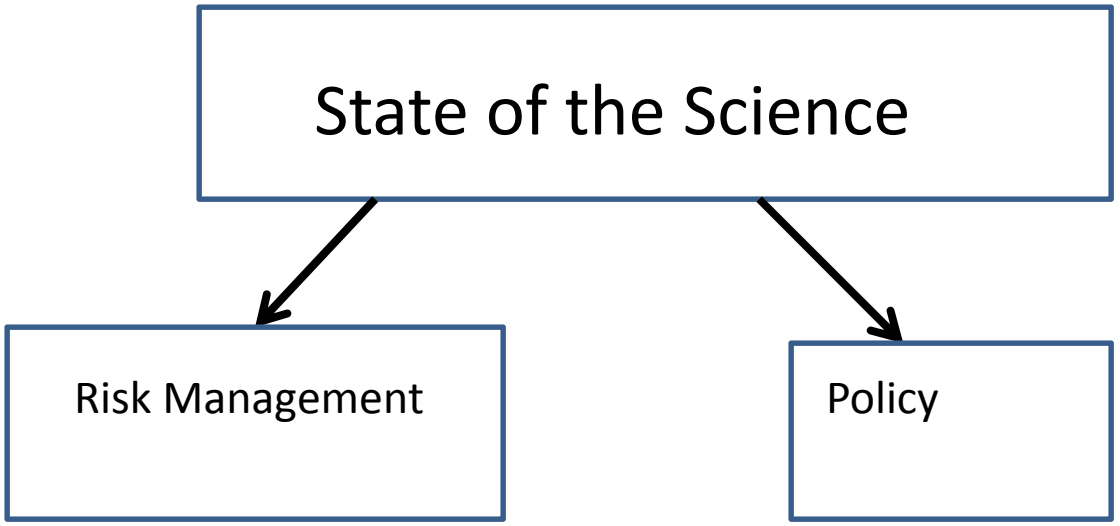


An Agriculture Perspective

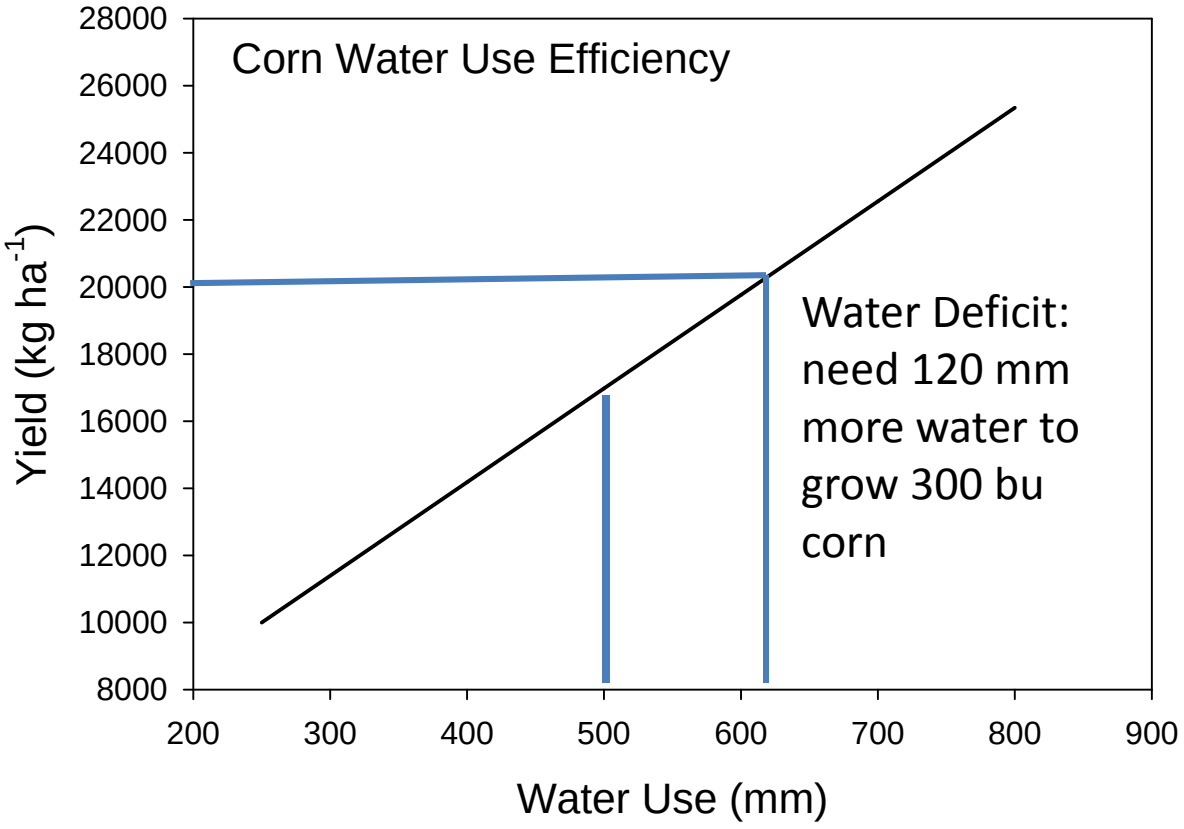
Forecasting into the Future

- Distribution of agricultural crops is not expected to change significantly. Changes in rainfall amounts have caused a shift in South Dakota and North Dakota.
- Emissions of GHG will be affected more by management and the interaction with climate.
- Extreme events in temperature and precipitation, impacts on agriculture

Climate – Crop Models

- Extreme events in temperature and precipitation, seasonality
- Seasonal shifts in precipitation (upper Midwest increase in spring precipitation, decrease in summer precipitation)
- Role of the soil is overlooked from a water availability and nutrient source
- Continued degradation of soil resource on a worldwide basis, potential for erosion in the spring

Water Requirements



Information Needed

- Spatial scale
  - Crop reporting district or county level
- Temporal scale
  - Daily timesteps with emphasis on extremes
- Examine agriculture from the perspective of a crop calendar
  - Planting decisions
  - Growth impacts
  - Harvest decisions

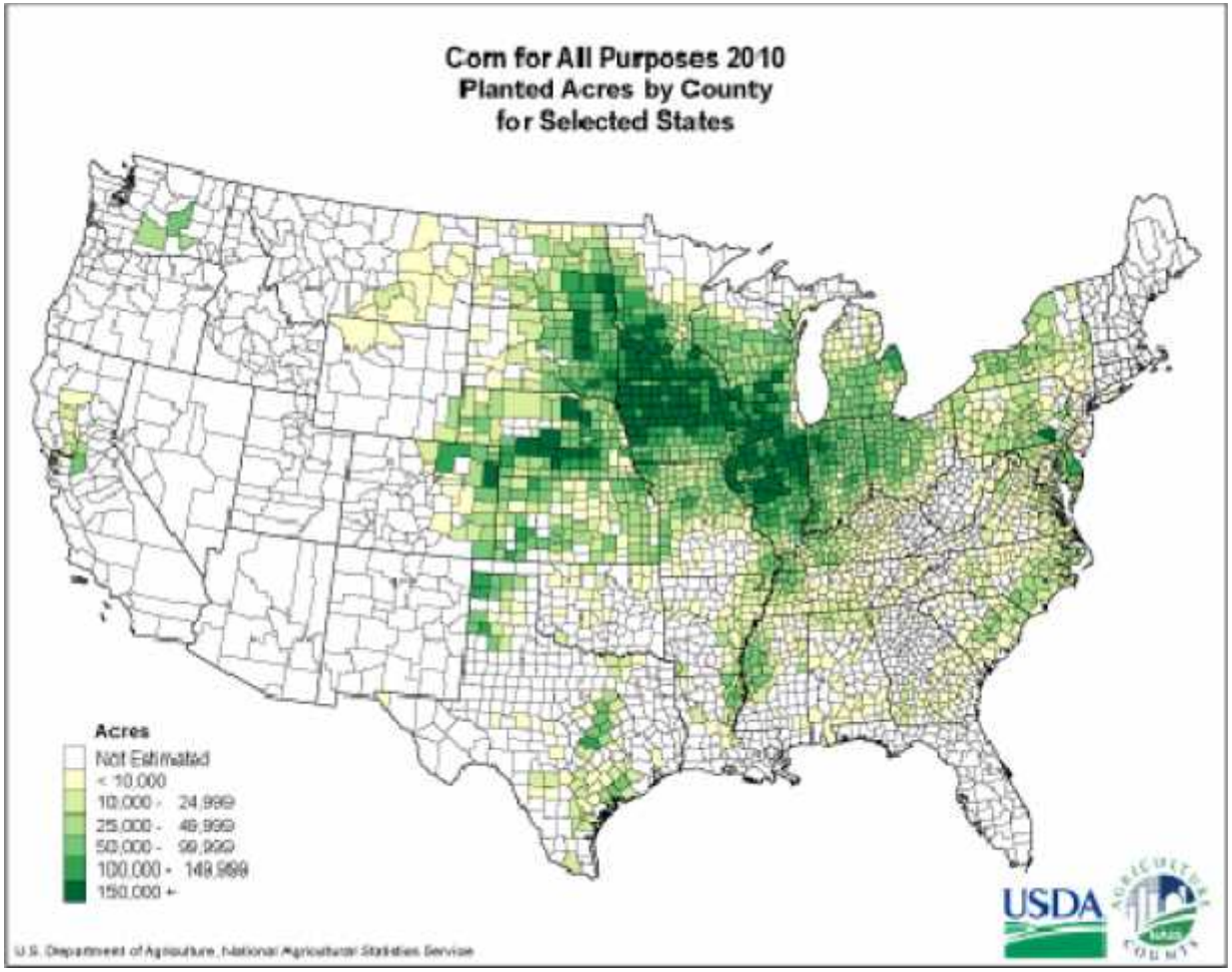
Biophysical Modeling

- Interaction among parameters driving plant growth
- Effect of plant stress on grain, fruit, or forage quality
- Effect of climate stress on plants and the interactions with weeds, insects, and diseases
- Water availability to plants (role of soil is overlooked)

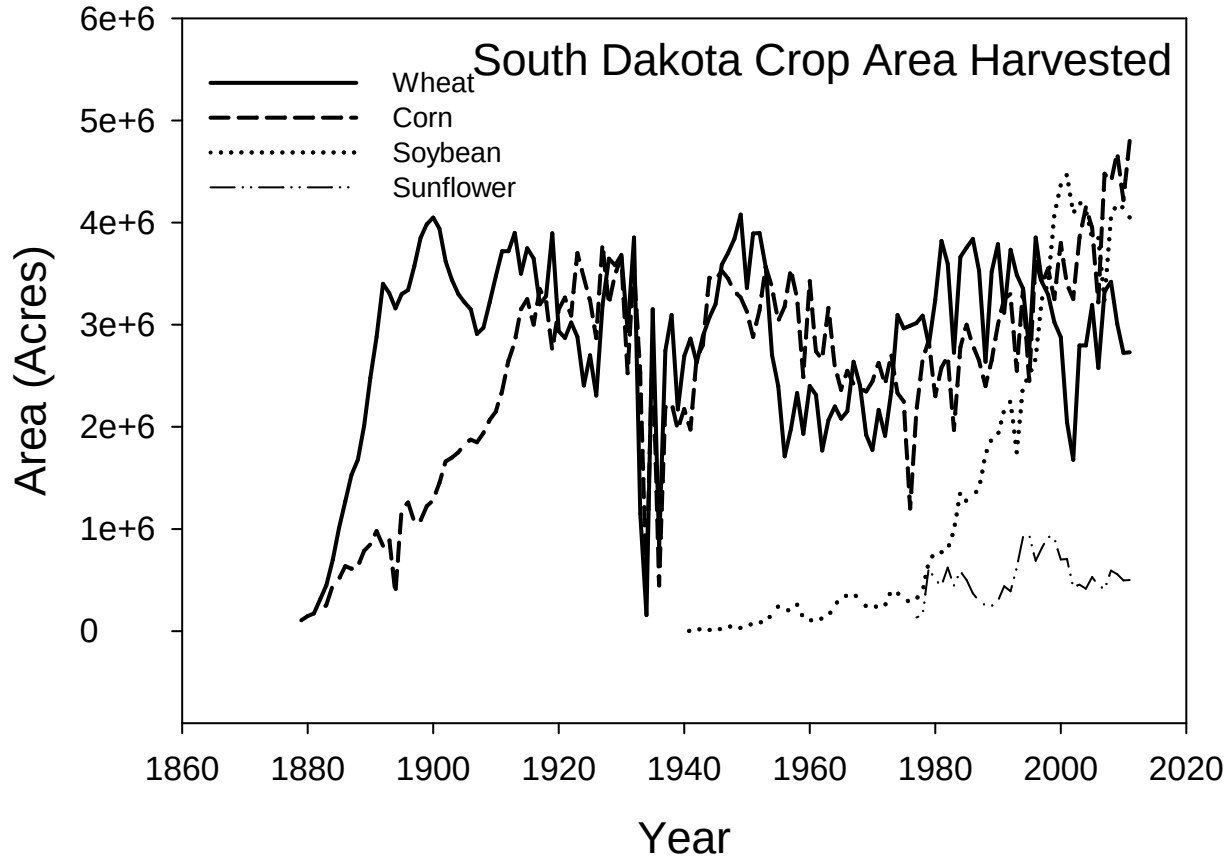
Priorities

- Understand how risk intersects with the dynamics of agricultural systems
- Understand the interactions among driving variables and crop or animal responses
- Understand how uncertainty interacts with the spatial and temporal dynamics of agricultural systems

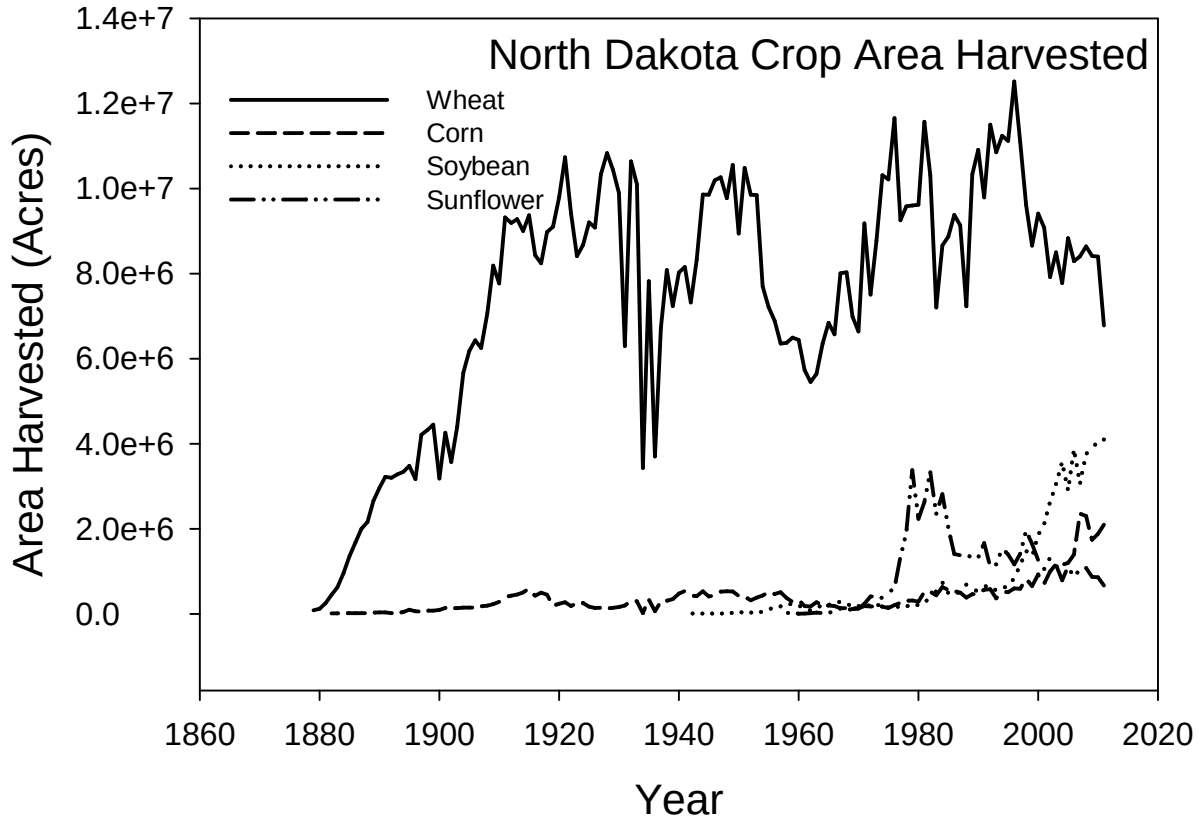
US Corn Production



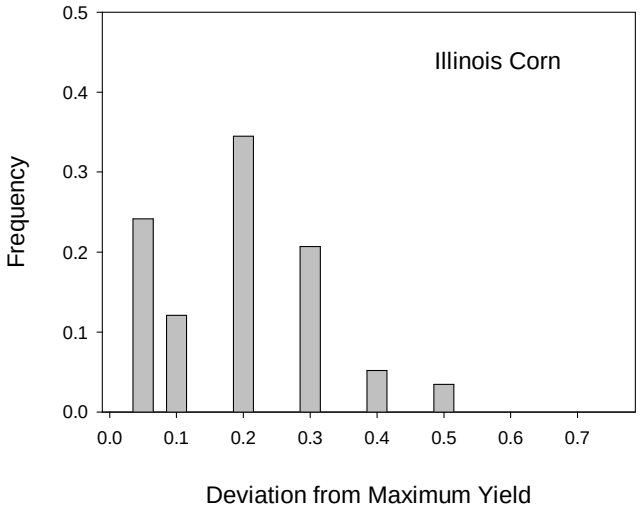
South Dakota Crop Distribution

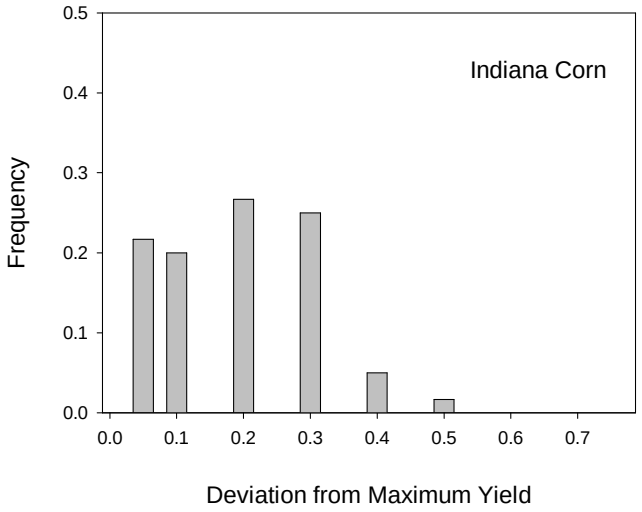


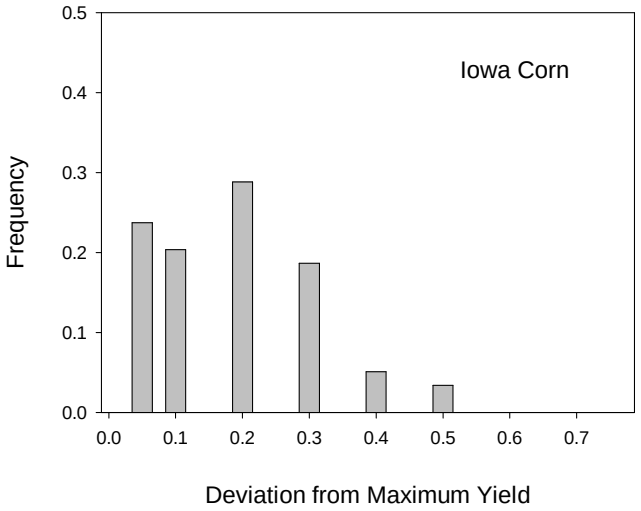
North Dakota Crop Distribution

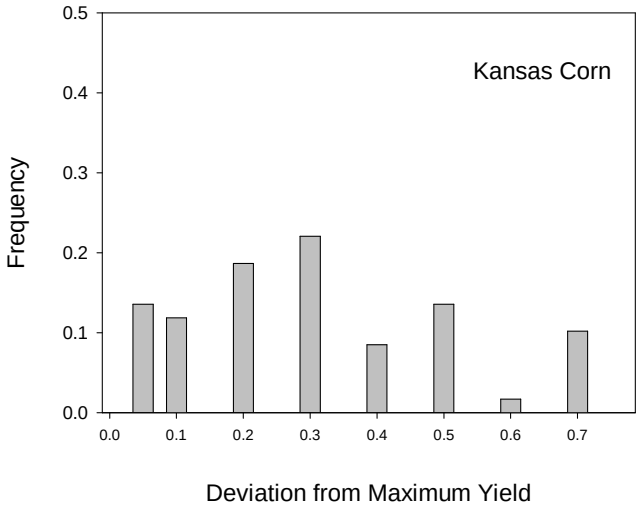


Midwest Corn

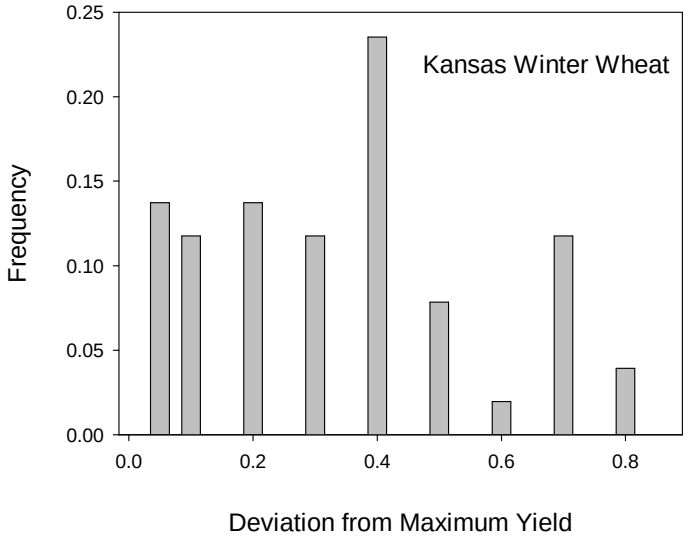


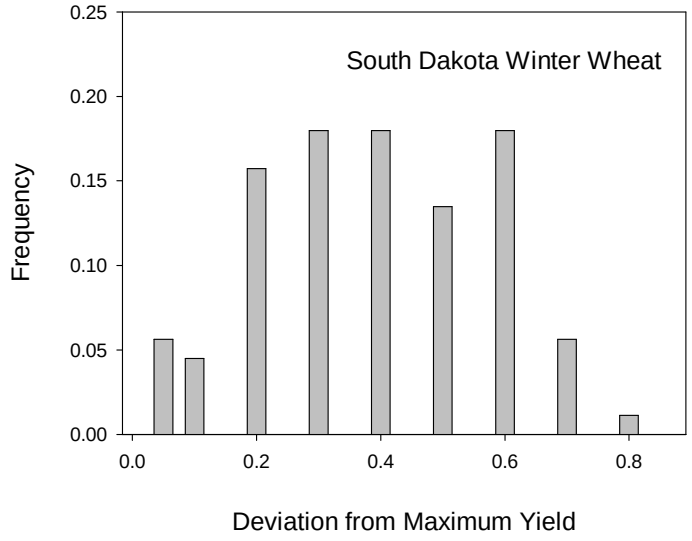




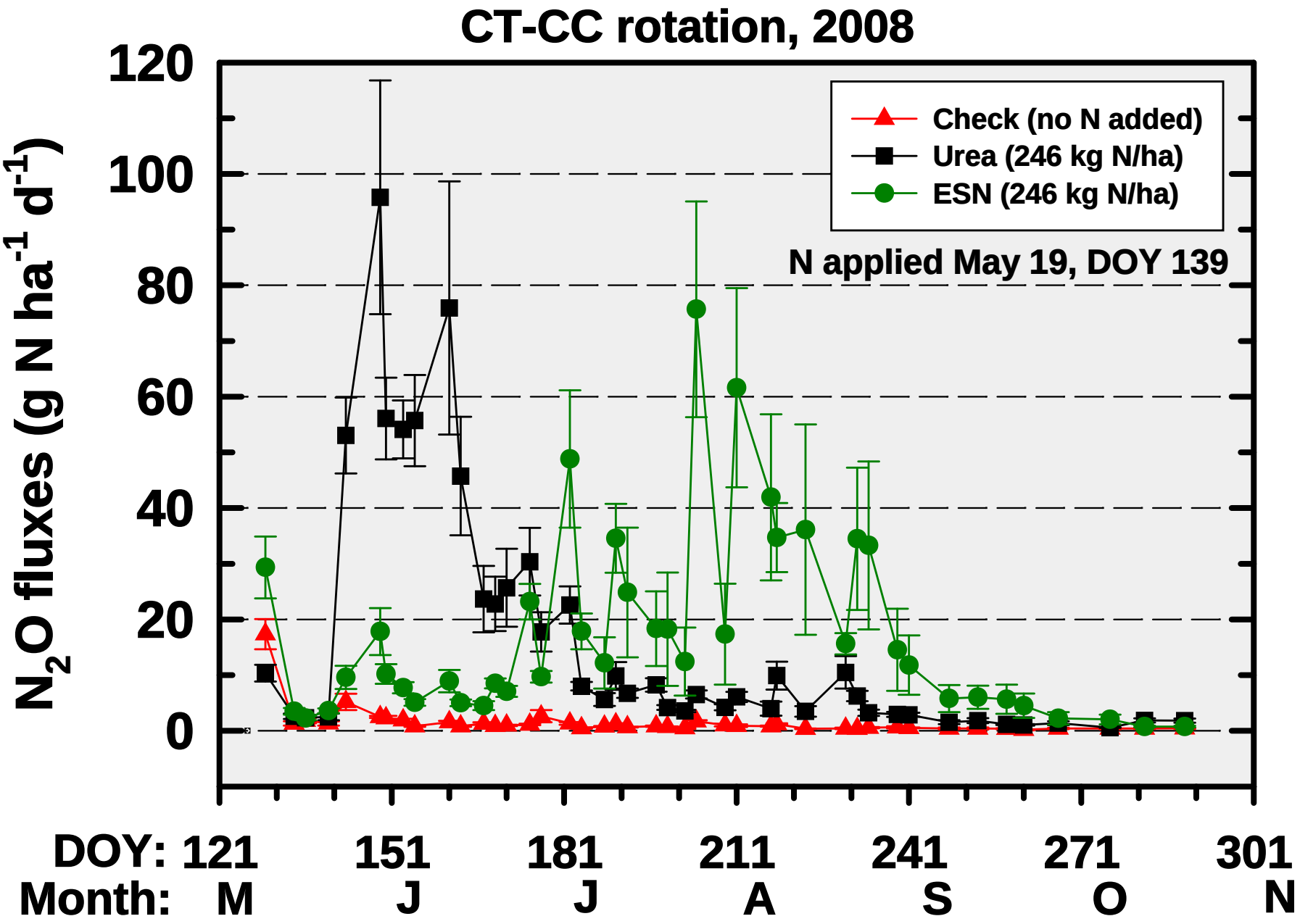


Winter Wheat

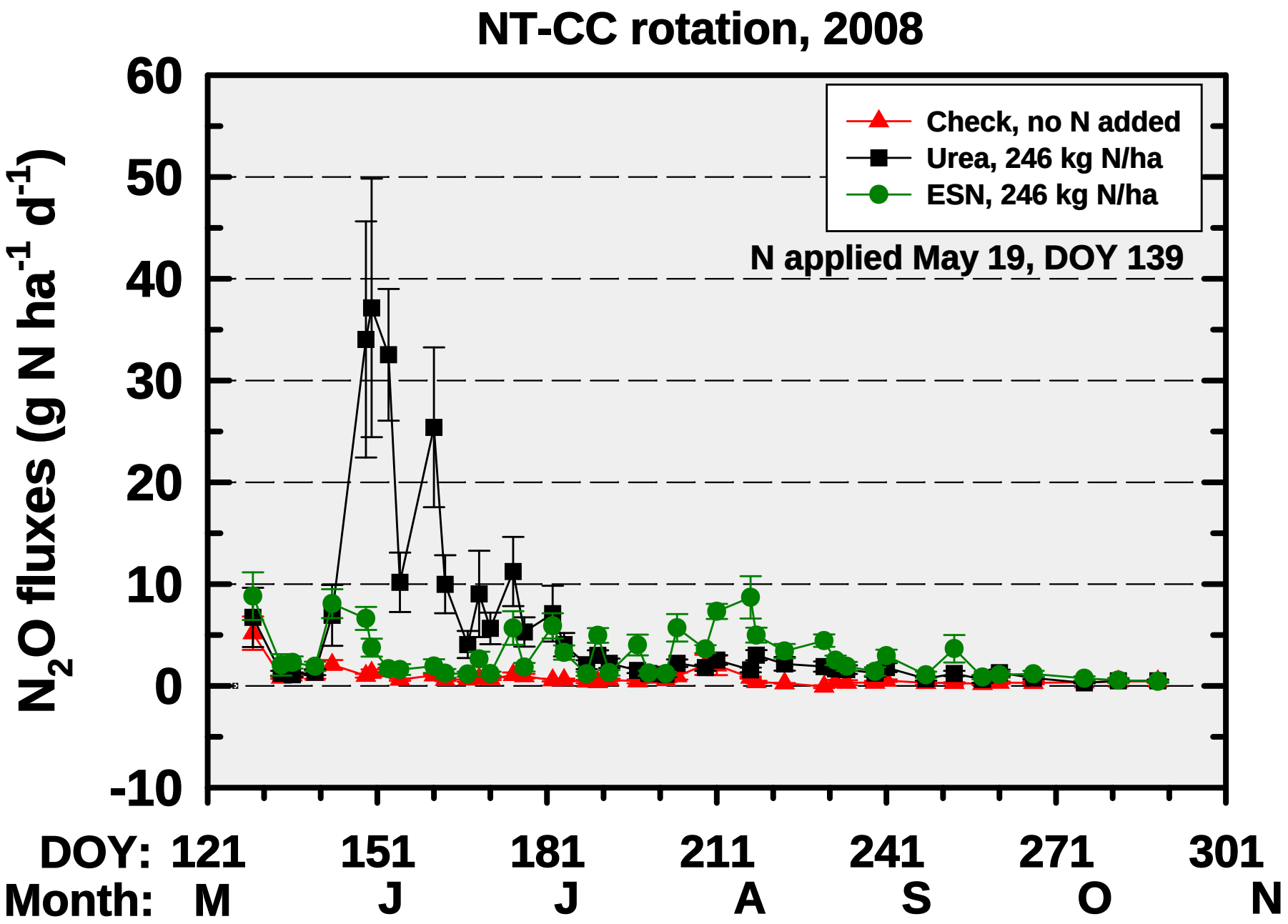


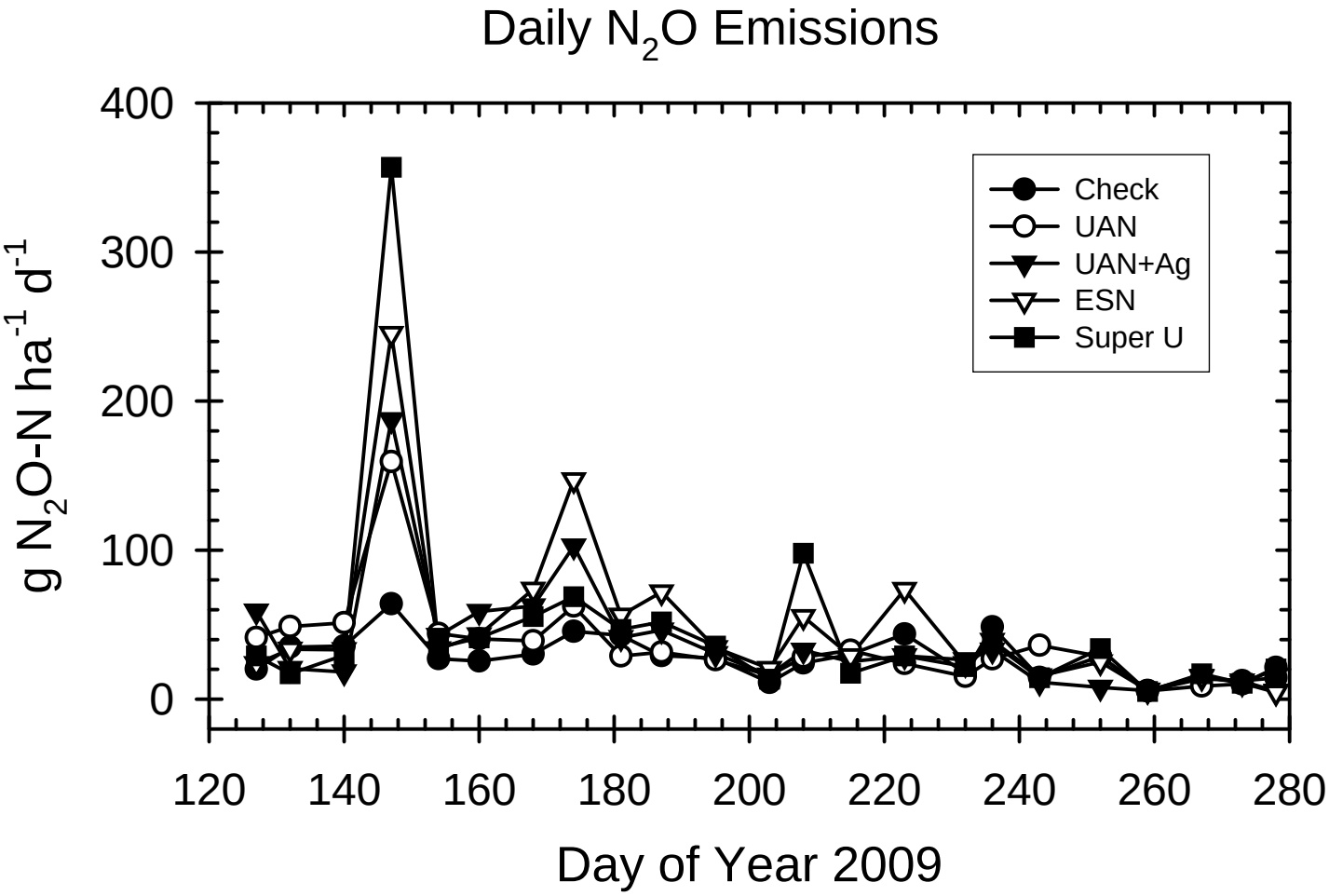


Urea vs ESN


CT-CC rotation, 2008
Check (no N added)
Urea (246 kg N/ha)
ESN (246 kg N/ha)
N applied May 19, DOY 139
N2O fluxes (g N ha-1 d-1)
120
100
80
60
40
20
0
DOY: 121 151 181 211 241 271 301
Month: M J J A S O N

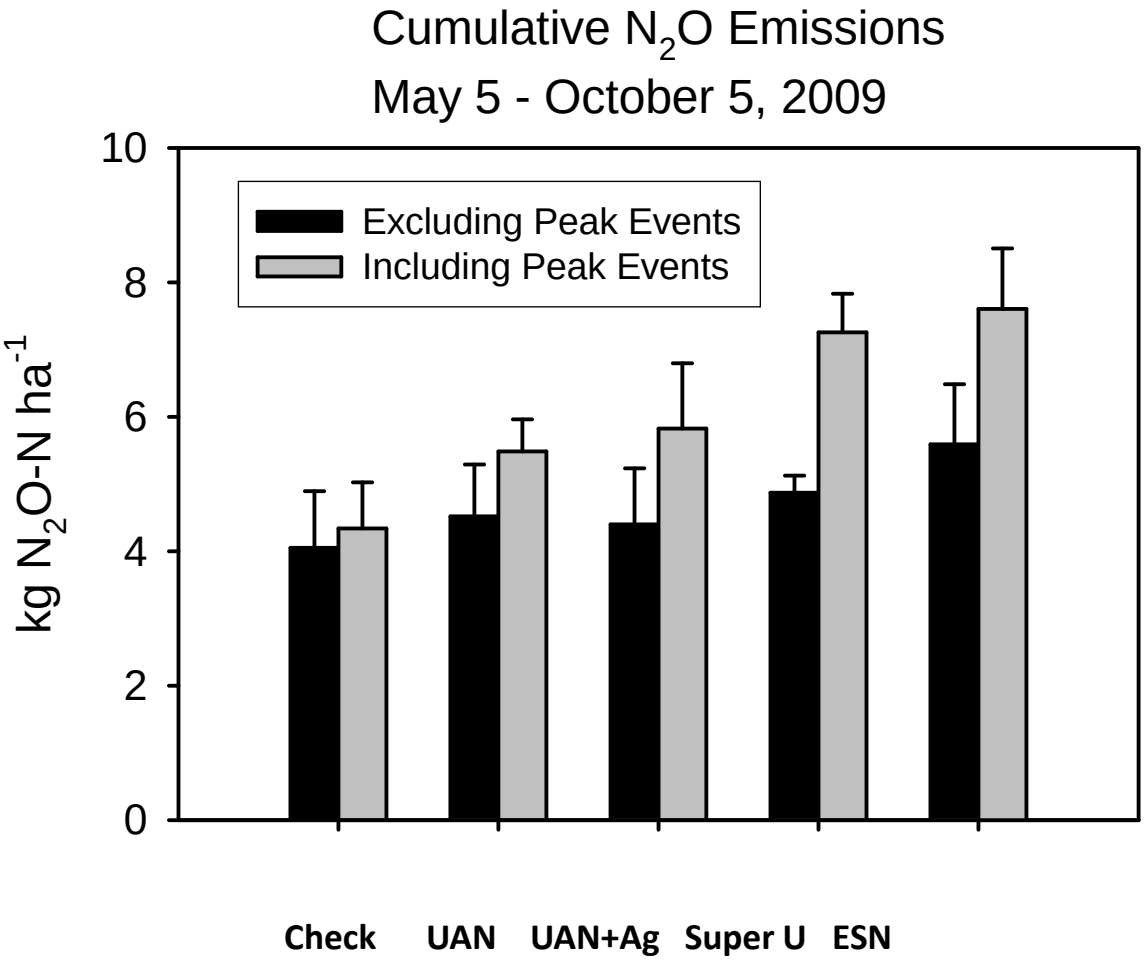
Urea vs ESN


NT-CC rotation, 2008
Check, no N added
Urea, 246 kg N/ha
ESN, 246 kg N/ha
N applied May 19, DOY 139
N2O fluxes (g N ha-1 d-1)
60
50
40
30
20
10
0
-10
DOY: 121 151 181 211 241 271 301
Month: M J J A S O N



-Fertilizer applied May 5 (DOY 125) at rate of 112 kg N / ha

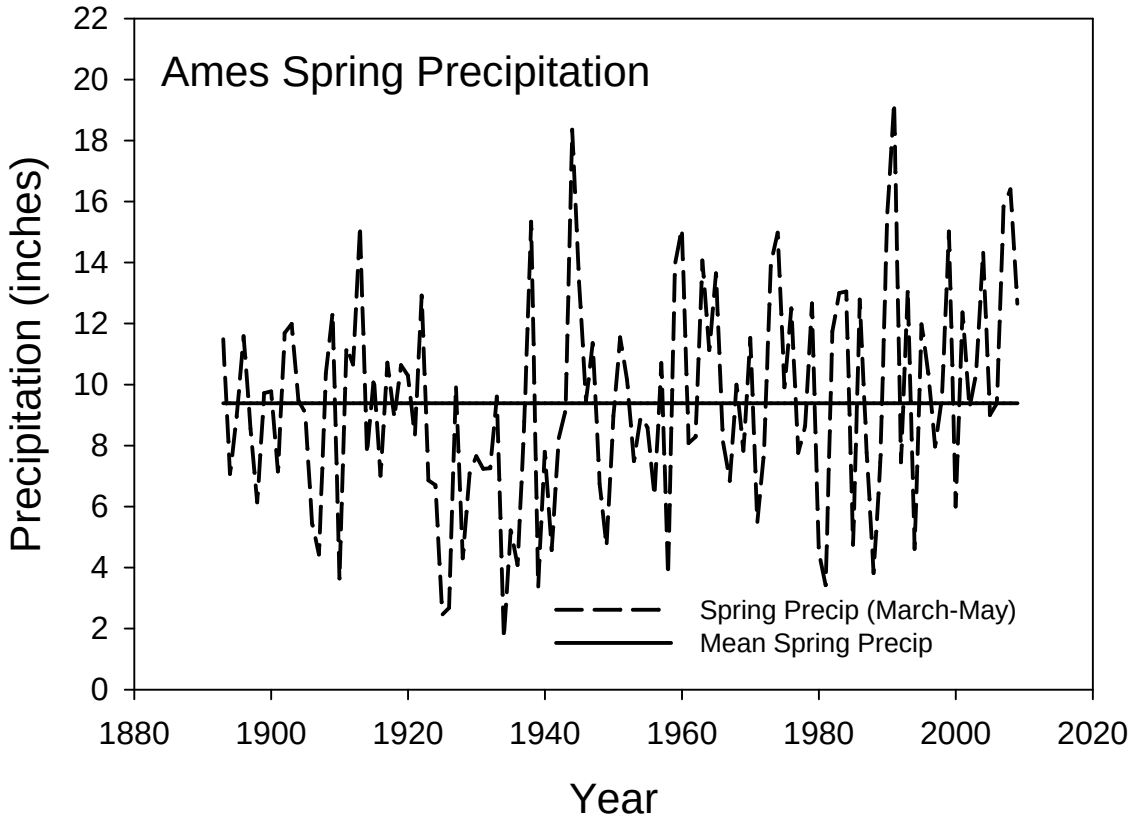
-Peak N_2O emissions observed on May 27 (DOY 147) and on June 23 (DOY 174).



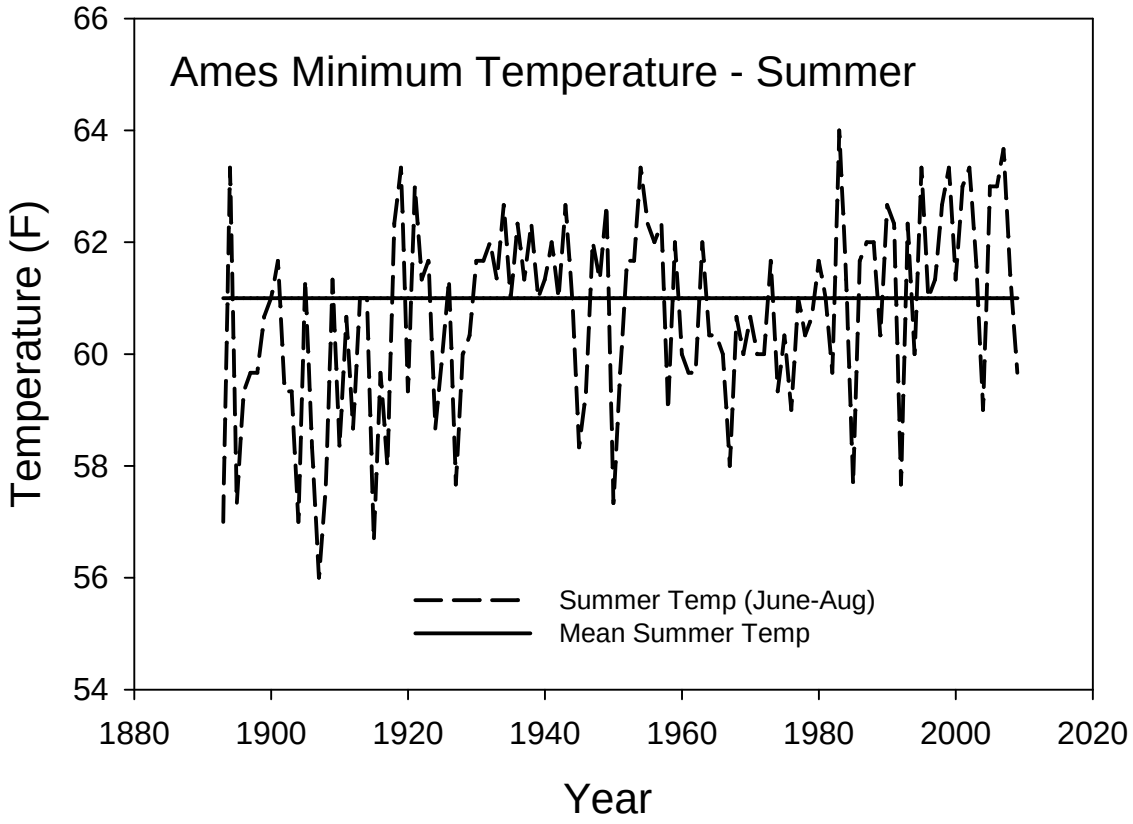
Peak N_2O emissions that occurred on May 27 and June 23 accounted for 6.7%, 17.6%, 24.5%, 32.9% and 26.5% of the cumulative seasonal N_2O emissions for the Check, UAN, UAN+Ag, Super U and ESN treatments, respectively.

No significant difference in cumulative fluxes when peak emissions are excluded.

Spring Precipitation (Ames)

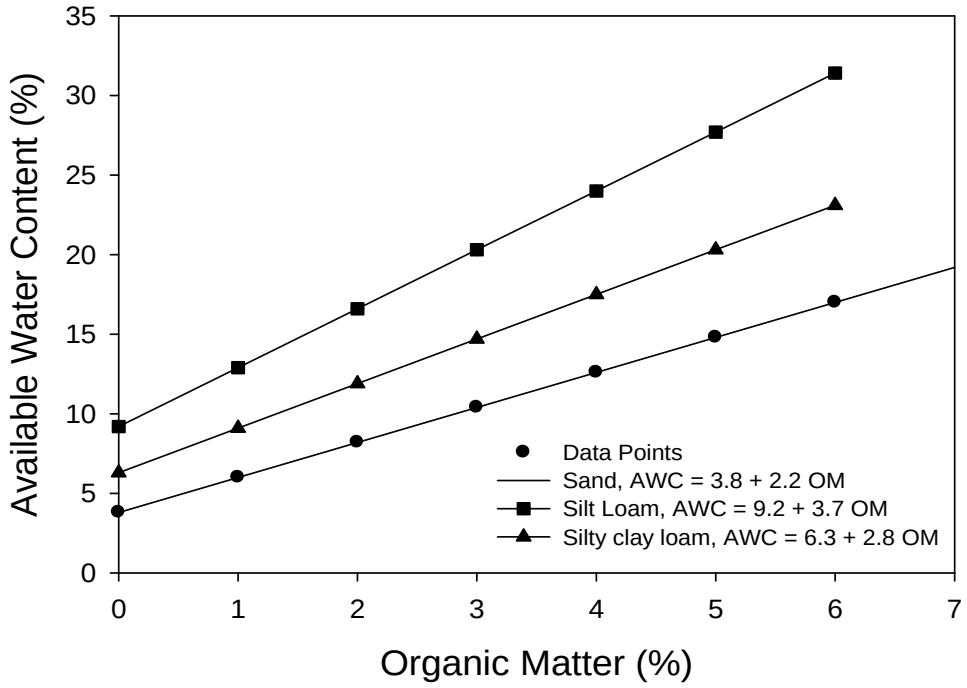


Nighttime Temperatures (Ames)



Soybean Production Field Late August 2005

Soil Water Availability



Hudson, 1994

Crop response to the environment is a complex set of interactions among light, temperature, CO_2, and water. Future development of biophysical models will have to account for these interactions.