GHG Emissions from Corn-Soybean Rotations on a Mollisol

Diane E. Stott, Douglas R. Smith & Dennis L. Bucholtz

USDA-ARS, National Soil Erosion Research Laboratory, West Lafayette, IN

Changes in management can convert agricultural fields from a net source to a net sink of greenhouse gases (GHG).

In 2003, as part of the USDA-ARS GRACEnet Project, a field study was established. The objectives were to determine the impact of conventional and conservation practices typical in the Eastern Corn Belt on C sequestration and GHG emissions.

TREATMENTS

There were five treatments for a corn-soybean rotation implemented:

1. Fall chisel/Spring disk tillage with N fertilizer applied as urea ammonium nitrate (UAN) before planting corn – "Conventional" treatment (CD)
2. No-till with UAN applied before corn (NTP)
3. No-till with UAN applied to corn in a split application (NTS)
4. No-till with winter rye as a cover crop with pre-plant UAN before corn (NTC)
5. Nu-tillage (modified no-till using a nu-till planter) with pre-plant UAN before corn (NU)

Nu-till Planter:
Leaves the area above the seed-row bare, to allow warming of the soil in the spring.

SITE LOCATION

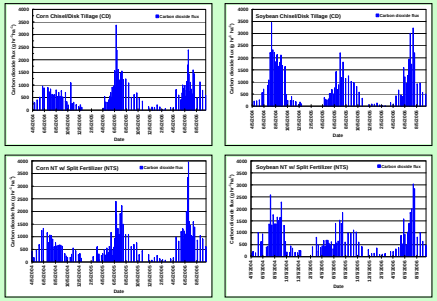
Sites are located in Tippecanoe County, Indiana on a Typic Haplaquoll.

MATERIALS & METHODS

- Each treatment replicated four times.
- Corn & soybean phases of the rotation were planted each year.
- GHG emissions were regularly monitored beginning with the 2004 growing season (March-October).
- Beginning in 2005, winter emissions were monitored (Nov-Feb).
- Gas samples taken in the field using static chambers.

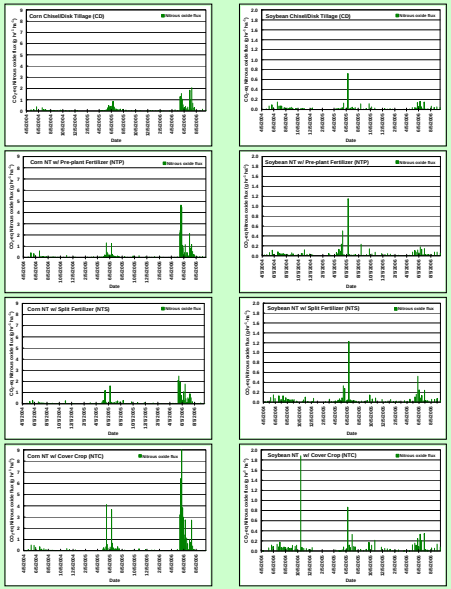
RESULTS & DISCUSSION

CO_2 Emissions



- CO_2 emissions in corn peaked in late June.
  - CD & NTP systems were similar.
  - NTS, NTC & NU were slightly lower.
- For soybean, CO_2 emissions peaked in late July and were higher than corn.
  - CD had slightly higher emissions.
  - NTS & NU were the lowest.

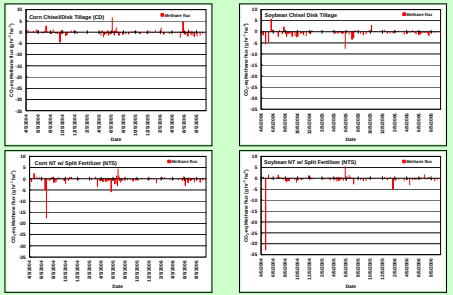
N_2O Emissions



- Sites were flooded in June 2004, reducing emissions.

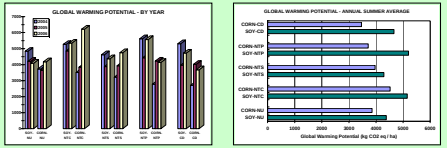
- For corn, N_2O emissions peaked 4-6 weeks after fertilizer application.
  - Emissions from smallest to largest – CD < NTS < NTP < NU < NTC.
  - NTC probably higher due to decaying plant material.
- Soybean, with no N-fertilizer applications, had lower emissions.
  - NTC system had the highest rates because of the decaying ryegrass residue.

CH_4 Emissions



- For both crops, the treatments served as both source and sink for CH_4 emissions.

Net Global Warming Potentials



- Annualized net warming potentials shown above do not included winter emissions or sinks.