Study of Denitrification Efficiency in Sugar Beets of the Northern Red River Valley

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Objectives of Study

1. Determine if Nitrogen loss through denitrification, as measured by N_2O flux is affected by the source of N or the timing of application and/or method.
2. Determine if other greenhouse gases (CO_2, CH_4) losses are affected by the source N or the timing of application.

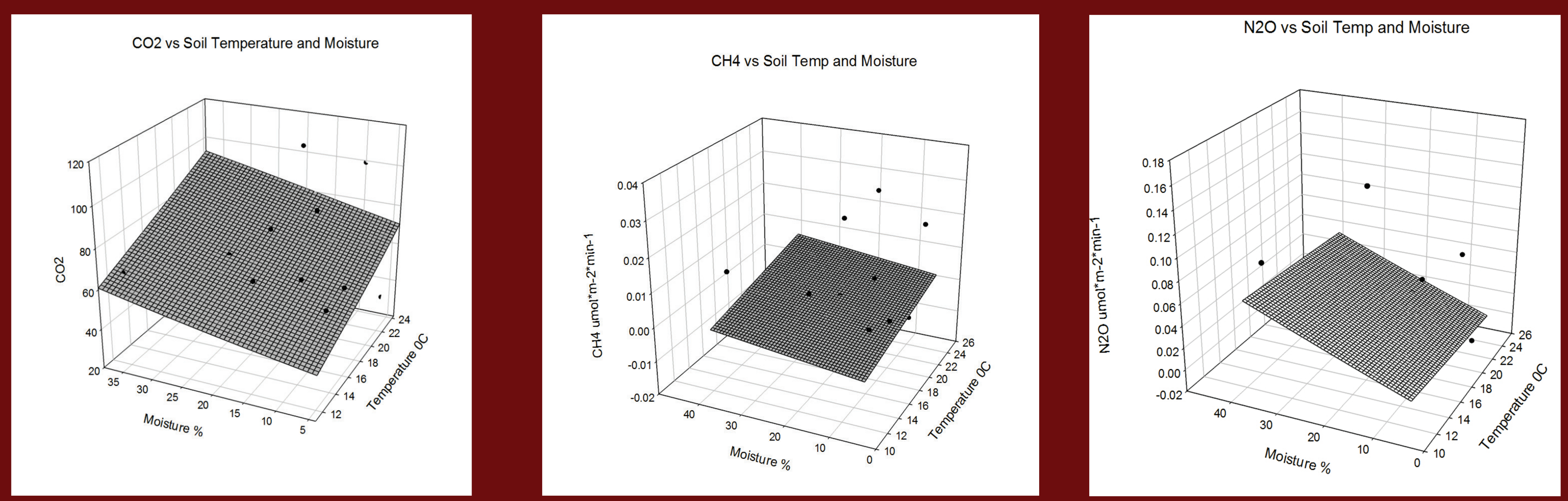

Figure 1

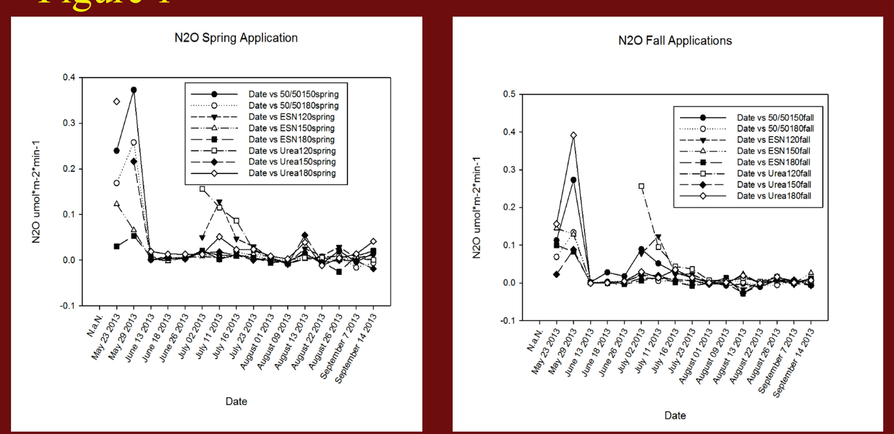

Figure 2

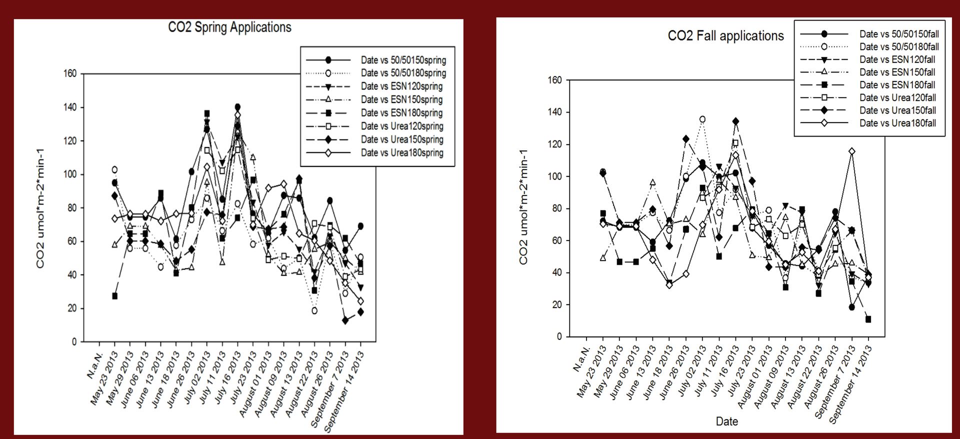

Figure 3

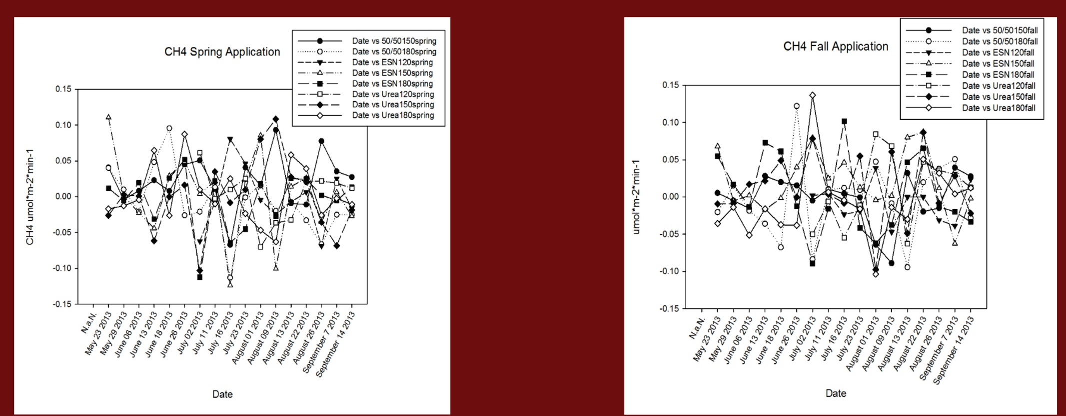

Figure 4

Acknowledgements

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- National Soil Dynamics Laboratory
- David Haugen
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Abstract

Half of all sugar beets grown in the U.S. are grown in Minnesota and North Dakota. Which amounts to approximately 450,000 acres. Nitrogen management is critical in the production of sugar beets, as too little can result in poor root development. Low drainage soils in the Red River Valley can require substantially higher nitrogen rates, which has left farmers asking if there are alternative strategies which can lead to greater efficiency in Nitrogen use.

Materials and Methods

Treatment

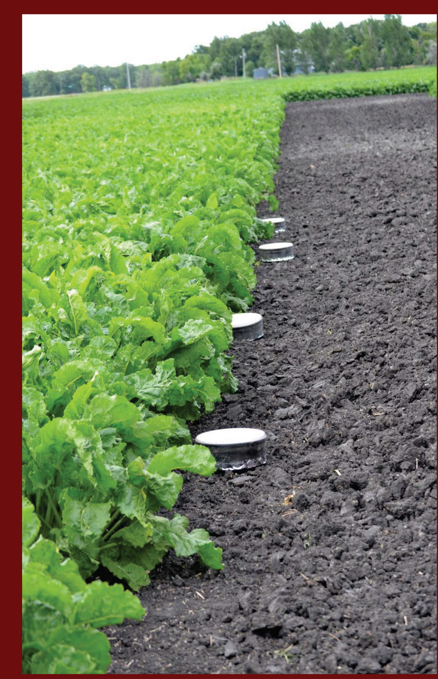
- 2 Nitrogen rates are used; optimal and sub optimal.
- 2 Sources of nitrogen fertilizer
  - Urea, polycoated urea (ESN), 50/50 mixture
- Fall broadcast and Spring broadcast
- Lower nitrogen rates with Urea or ESN
  - Sidedress Nitrogen during the growing season
  - Sideress Nitrogen rate: 30 or 60 lbs
- Site location: Alvarado Soils (Northern Red River Valley)

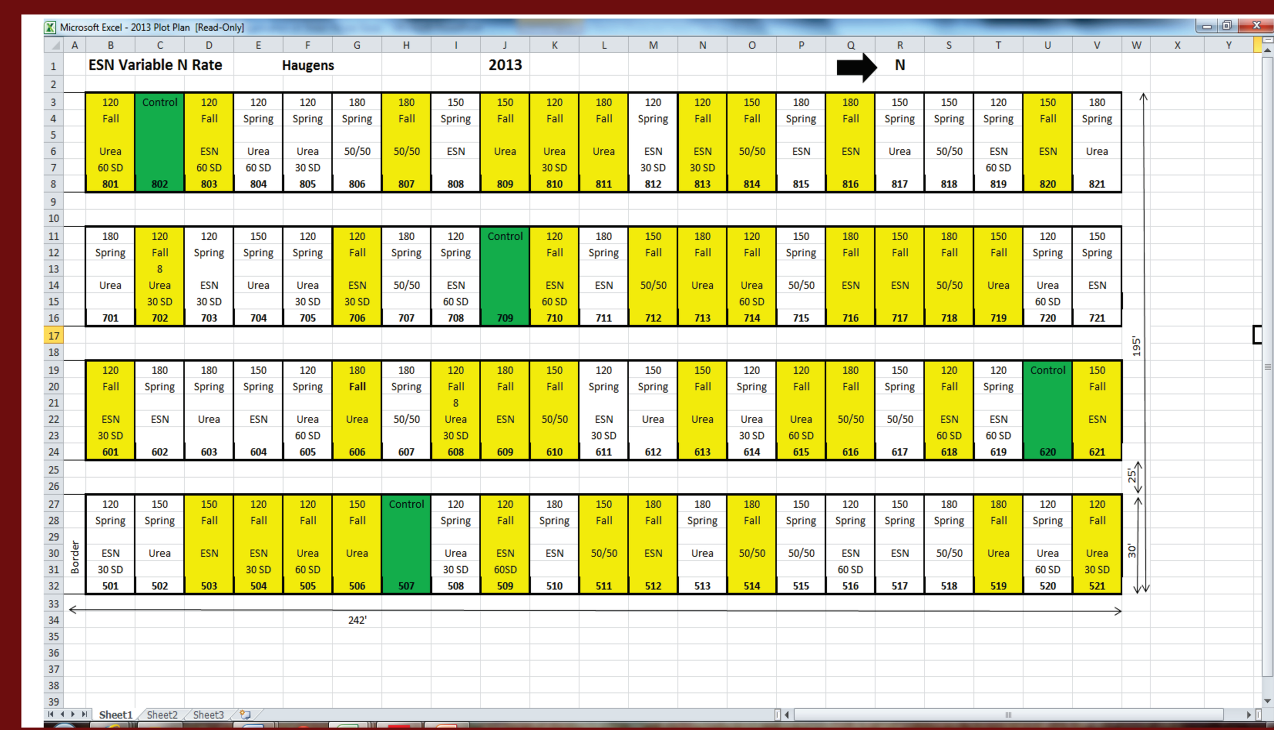
Materials

- 10 ml syringes
- 10 ml air-tight glass vials
- Gas capture chambers with anchors
- TH_2 portable soil moisture probe
- HM digital TM-1 industrial grade digital thermometer (soil temperature)
- Varian 450-GC
  - Three columns measuring gases of interest
    - Electron Capture Detector (ECD) measured N_2O
    - Thermal Conductivity detector (TCD) measured CO_2
    - Flame Ionization Detector (FID) measured CH_4
    - Concentrations determined by comparison to standards analyzed at the same time on the GC. Standard Curves were only accepted with r^2 of 0.99 or greater

Sample Collection

- Samples were taken weekly
- Samples were collected at times of 0, 20, and 40 minutes





Results

- Completed using the general linear model (GLM) of SAS
- Statistical significance is assumed at the $p<0.05$ as determined a priori.
- Data was transformed to meet the assumptions of the model; all graphs represent back transformed means.

Preliminary conclusions

CO2 (figure 3)
- 50/50 180 shows high spring in flux, although similar to 50/50 150 and Urea 180
- ESN 180 very low flux in early spring
- In the fall 50/50 150 has the highest flux
- ESN 150 spring & fall both show a low early flux
- Urea 180 fall has high flux near end of season

CH4 (figure 4)
- ESN 150 highest spring fluxes
- Has tendency to show negative fluxes, most likely due to sinks
- Urea 150 showing higher midseason trend
- 50/50 180 fall and Urea 180 fall show strong midseason flux

N2O (figure 2)
- Urea 180 fall shows high fluxes with both spring and fall
- 50/50 150 also shows both moderately high flux in both spring and fall
- Generally small peaks mid season but flux hangs close to zero for most of season although Urea 180 showing higher fluxes

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