Quantifying Soil Carbon Dioxide Emissions for Conservation Tillage Practices in Agricultural Soils

Marissa Goodwin[1], Tyler Goeschel[2], E.C. Adair[2], H. Darby[3]

[1]College of Agriculture and Life Sciences, [2]Rubenstein School of Natural Resources, [3]Extension
University of Vermont

INTRODUCTION:

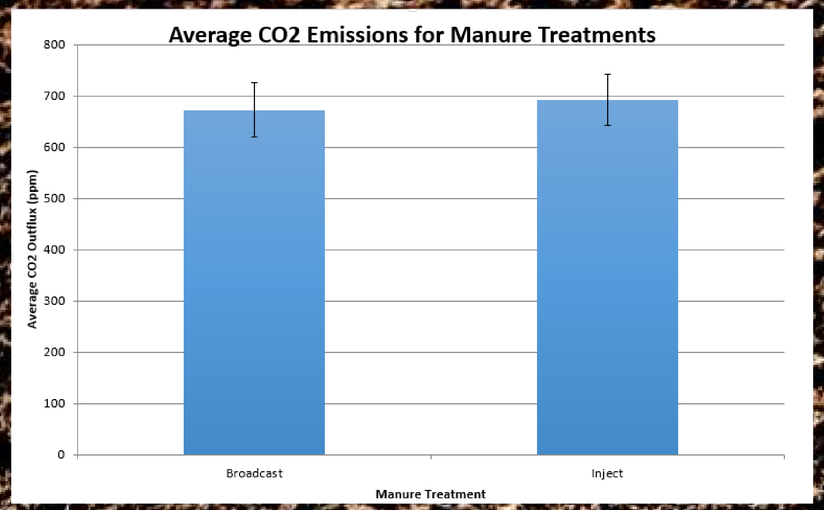
- **Agricultural activities account for 10% of all greenhouse gas emissions in the United States.**
- **Large agricultural CO_2 emissions result from soil organic carbon that is oxidized following soil disturbance. Best management practices can be implemented to reduce these emissions.**
- **CO_2 emissions were found to be higher on conventionally tilled soils than soils under conservation tillage (Jin et al, 2014).**
- **Conservation tillage can mitigate CO_2 emissions while building soil organic carbon (Jin et al, 2014).**
- **Question: How will CO_2 emissions differ in a corn field undergoing three conservation tillage practices: vertical tillage, strip tillage and no tillage?**

Hypothesis: CO_2 emissions will decrease with less invasive tillage practices. CO_2 emissions will be highest under vertical tillage and lowest under no tillage.

METHODS:

- **Sampling Site: Borderview Farm in Alburgh, VT**
- **Soil GHG emissions were captured using gas chambers that were constructed and inserted into the soil following the GRACEnet protocol**
- **To sample, 15 mL of gas sample was taken from each chamber at the start time (0 minutes) and then again at 10, 20 and 30 minutes.**
- **Gas samples were injected into 10 mL evacuated and sealed vials**
- **The gas samples were analyzed using a gas chromatograph within 4 days of the sampling date**
- **Samples were taken at sites undergoing two different manure treatments: manure injection and broadcast manure**

Results:



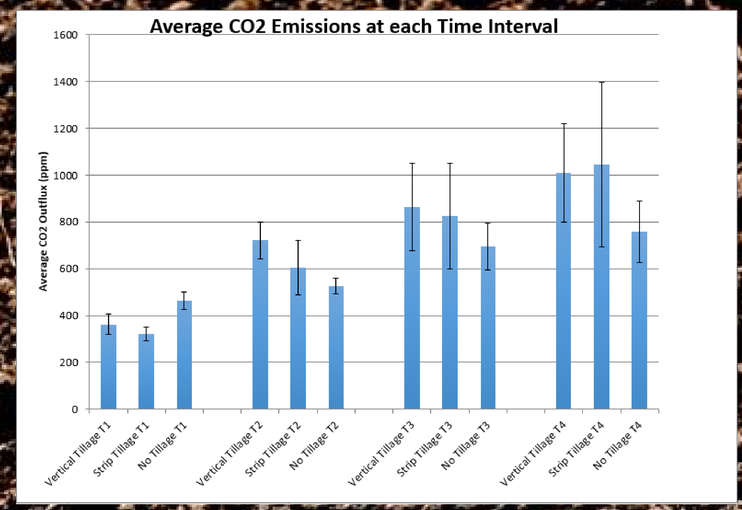


Figure 1 (left). Average CO_2 emissions for each manure treatment. Figure 2 (right). Average CO_2 emissions for each tillage practice at each time interval. Both manure treatments are included in Figure 2 averages. Data were collected from June to August 2014.

Conclusions:

Our data suggests that the different manure treatments did not have a significant effect on CO_2 emissions (Figure 1), which coincides with research done on the effect of manure management on greenhouse gas emissions (Chadwick et al, 2011).

The data shown above (Figure 2) also suggests a trend that CO_2 emissions are lowest under the no tillage management practice than the other two tillage practices. There is also an increase in CO_2 emissions at each time interval which was expected (Figure 2).

Although the trend of each of the graph appears to suggest that CO_2 emissions are highest under vertical tillage and lowest under no tillage, the data must be regarded as inconclusive. There were technical difficulties regarding the storage of the gas samples and the Gas Chromatograph analysis which resulted in numbers of high variability. Although the average CO_2 emissions appear to follow a trend, there is a need for more data to be collected before drawing a concrete conclusion.

Acknowledgements:

I would like to thank my mentors Tyler Goeschel and Carol Adair, as well as Roger Rainville for allowing us to do research on his farm. Funding for this research was provided by NFS Grant EPS-1101317

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