Flooding, Soil Quality, and Cover Crops: Two Case Studies

Lindsey Ruhl*, Josef Görres

*contact: lruhl@uvm.edu
Website: www.floodedsoils.wordpress.org

How does flooding effect soil quality?

- Reducing Pore Space: Loss of pore space can result in decreased infiltration rate, ultimately exacerbating runoff potential.
- Lowering Soil Fertility: Anaerobic respiration can cause alterations in elemental availability.
- Decreasing Mycorrhizal Colonization: Mycorrhizae facilitates increased plant uptake of nutrients.

What is Post Flood Syndrome?

Post flood syndrome is the result of mycorrhizae loss in the soil. Mycorrhizae help increase the soil volume a plant has access to, aiding the plant in the uptake of nutrients. A study by Viebrock (1988) showed that plant roots with mycorrhizal colonization had access to phosphorus as much as 20-40X further than roots without mycorrhizal colonization. Mycorrhizae is a symbiotic fungus that inhabits cortical root cells. Without a host plant, mycorrhizae cannot live.

Mycorrhizae Colonization in Root Wall

Case Study #1: Does Soil Fertility Change with Small-Scale Elevation Differences?

Correlation of Elements with Elevation by Sampling Date
*based on .05>p-value

	May 3, 2012	Oct. 18, 2012	April 9, 2013	June 21, 2013
Al	YES (-)	NO	NO	NO
Ca	NO	NO	NO	NO
Fe	YES (-)	NO	NO	NO
K	YES (-)	NO	YES (+)	NO
Mg	NO	NO	NO	NO
Mn	YES (-)	NO	NO	NO
P	YES (-)	NO	YES (+)	NO

On four dates, soils were collected in and 18” field depression with an average difference of 2” in elevation. Over the course of one year, we found:

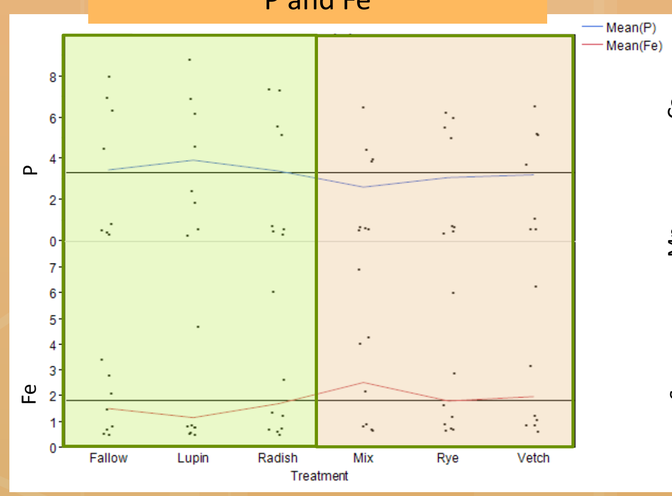
- Higher correlations of elements and elevation during spring when soil has been minimally disturbed.
- After the wettest two consecutive months recorded in Vermont, there was no correlation on such a small scale.

Case Study #2: Do Cover Crops Effect Soil Fertility?

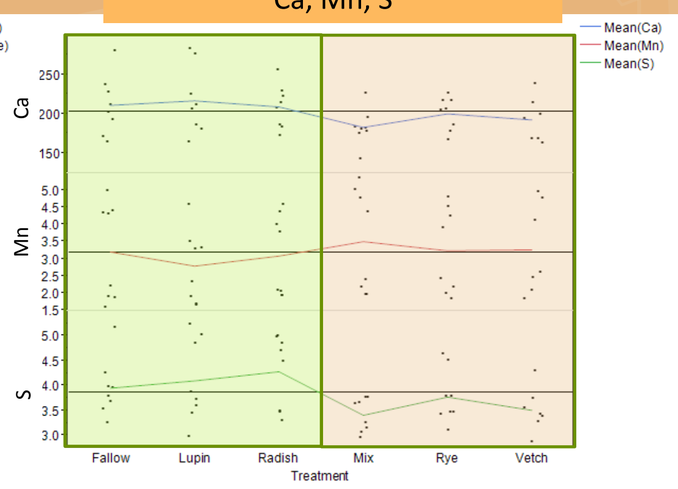
Six treatments were planted in October 2012. Soil samples from May 2013 were analyzed. Here’s what we found:

- Effect on Ca, Fe, Mn, P, and S can be grouped as positive or negative by success of cover crop.
- Treatments did not fall is such groupings for K, Mg, and Al.

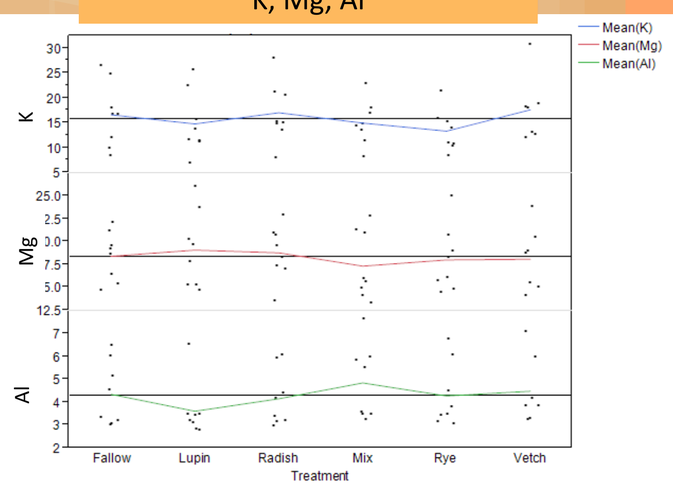
Effect of Establishment Success: P and Fe



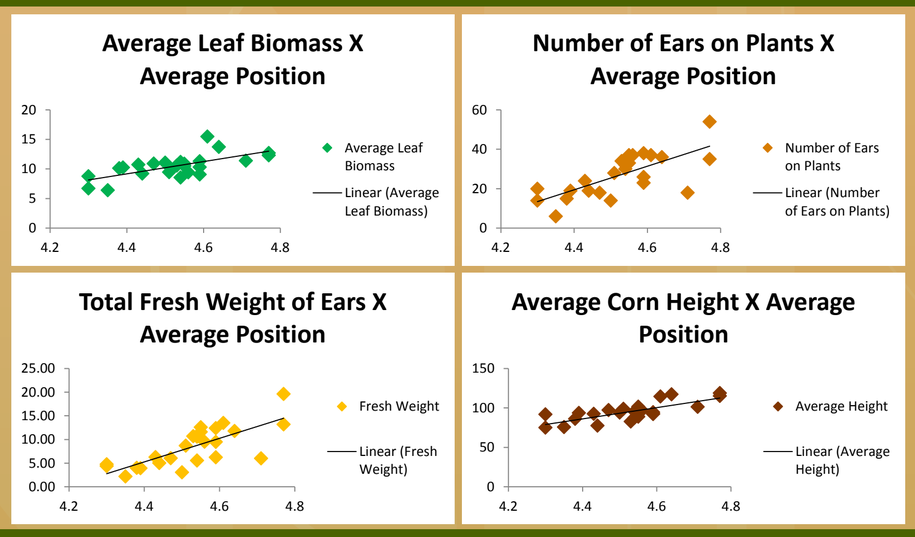
Effect of Establishment Success: Ca, Mn, S



Effect of Establishment Success: K, Mg, Al



Case Study #2: Does Elevation in Field Location Affect Soil Fertility?



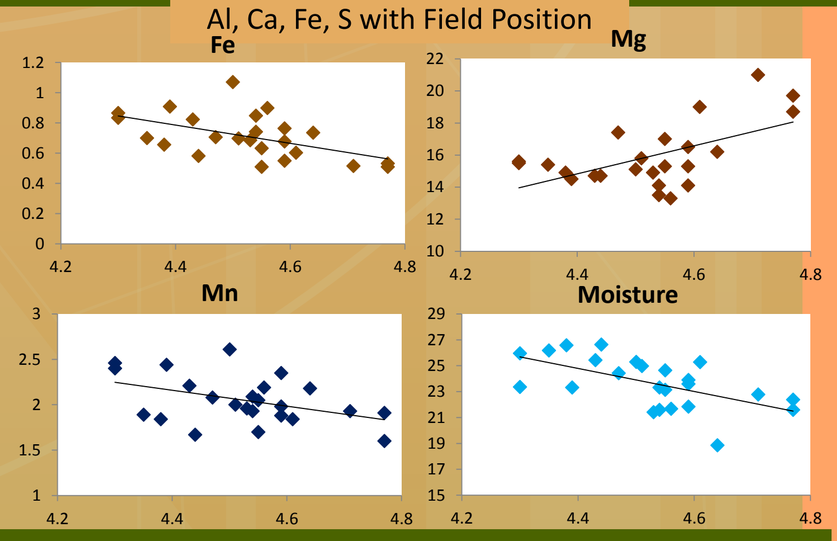
In May 2013, soil samples were taken from over wintered cover crop stands. We found:

- Fe, Mg, Mn, and moisture significantly correlated with elevation in field position.

In late summer 2013, corn biomass and height were measured. Data shows:

- Elevation in field position has a statistically significant impact on corn growth.
- Lower elevations in field positions have lower plant growth than higher positions.

Significant Correlations Between Al, Ca, Fe, S with Field Position



Conclusion

Individual treatments did not have a significant effect on soil fertility. However, when considering success of cover crop, outcomes differed between plots with established and unestablished cover crops. Preliminary results indicate that elevation in field position significantly affected fertility and corn growth, suggesting that cover crops need to be managed with respect to field position.

Acknowledgements

Special thanks to:
Alan Howard
Alison Brody
Jonathon Gonzalez
Purdue University Agronomy Department for right topmost picture of corn:
http://www.agry.purdue.edu/ext/corn/news/articles.98/p&c9825.html