



Fine Tuning Cereal Rye Management ahead of Soybean Production

Guacho, C., C.A. Mitchell, J.M. Green, A. Vasquez, E. Miller, D. Schaefer, and L.E. Gentry

Department of Natural Resources and Environmental Sciences, University of Illinois, Urbana, IL



Cereal Rye Cover Crop

- Cover crops are being evaluated as nitrogen (N) catch crops in tile drained regions of the Upper Midwest. In central Illinois, producers can be very successful using cereal rye as an overwintering cover crop, especially ahead of soybean production; however, the relationship between cereal rye biomass production and tile nitrate loss reduction is not known.
- This study evaluates the relationship among cereal rye biomass, biomass N, and tile nitrate reduction. Drawing from two NREC-funded studies, a range of cereal rye biomass was produced (<0.5 ton/A to 2.75 tons/A) ahead of soybean production.

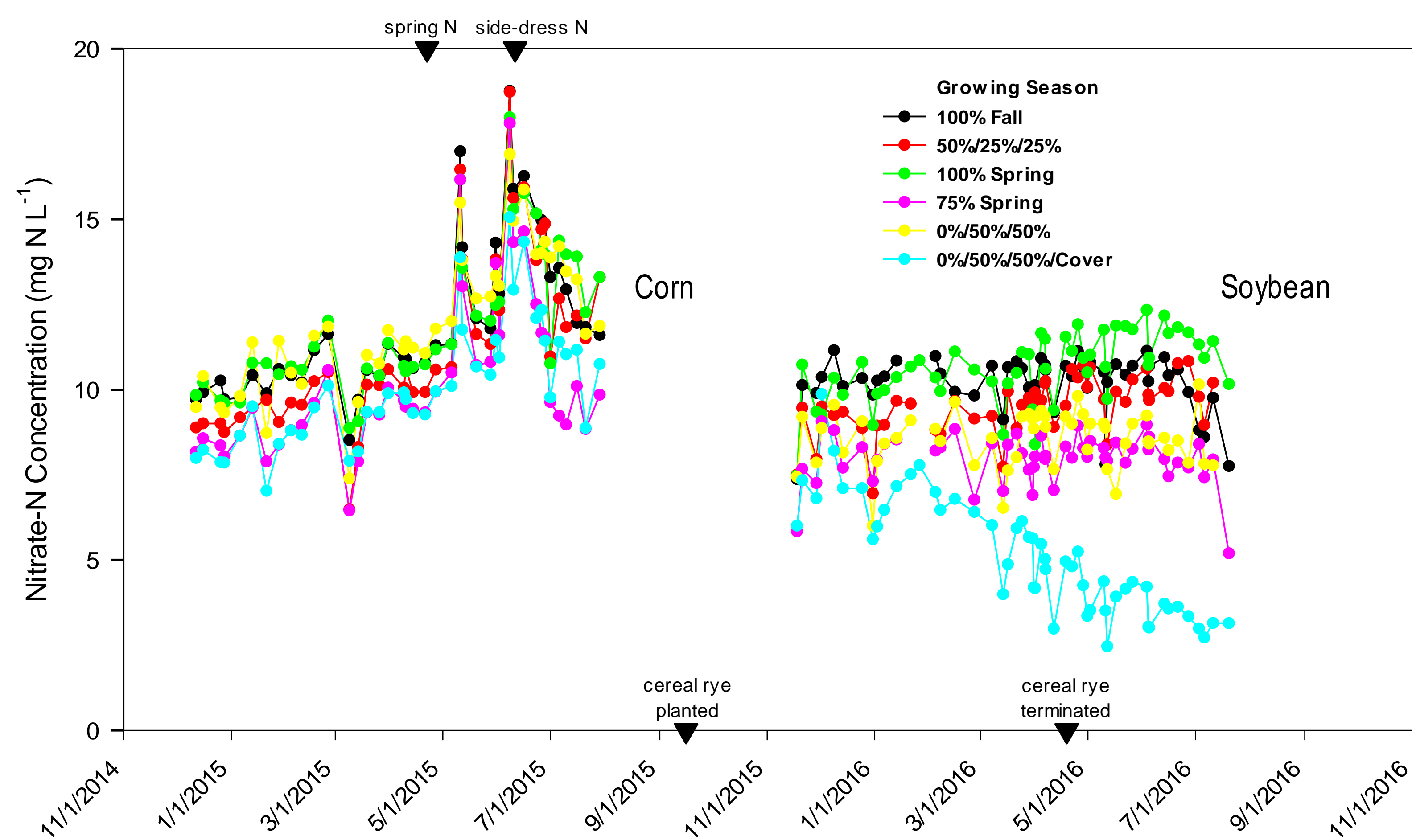
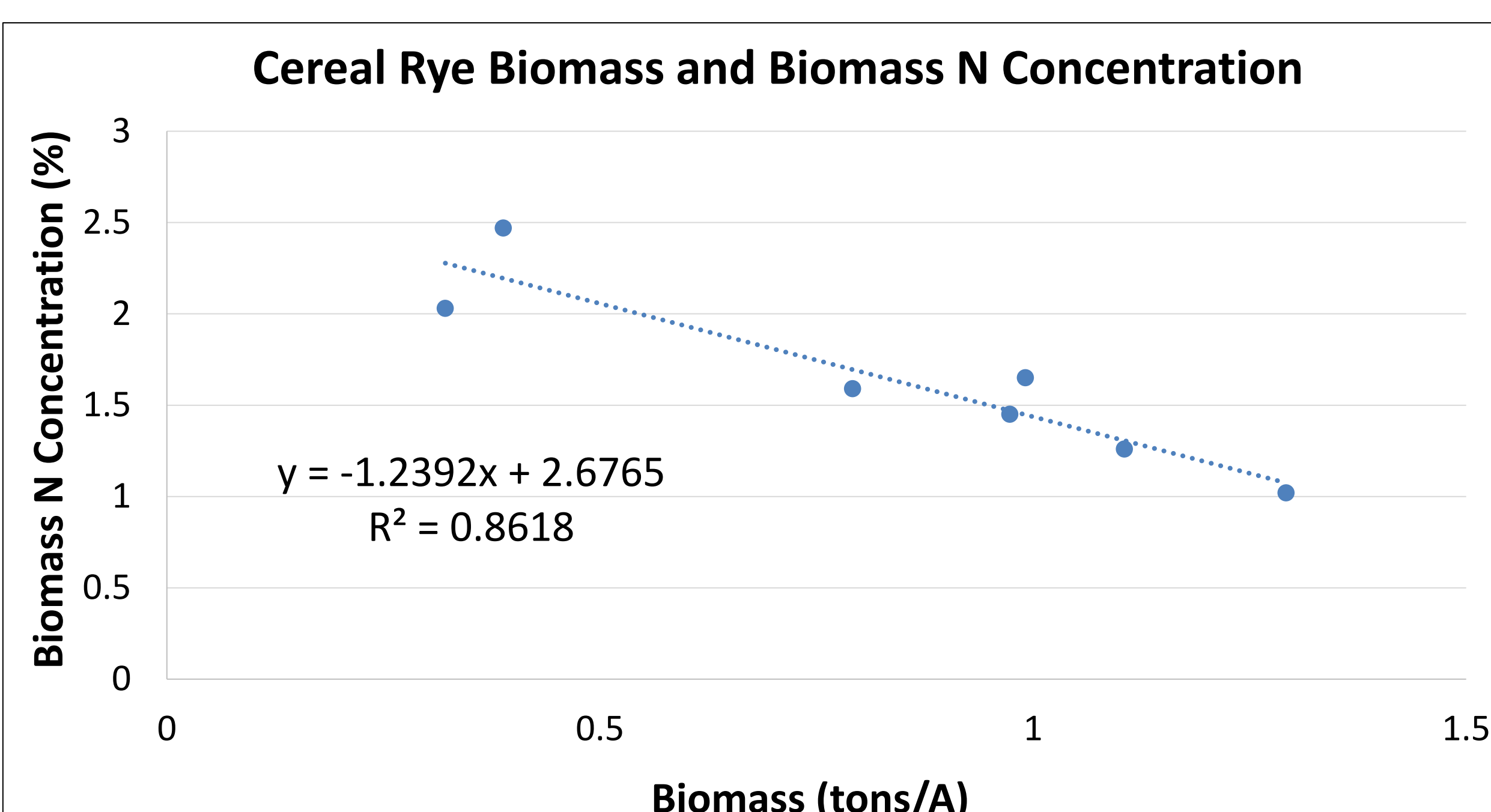


Figure of tile nitrate concentrations from 6 N treatments at the Douglas County replicated tile drainage study. The cover crop treatment (blue dots) was cereal rye after corn in a corn-soybean rotation.

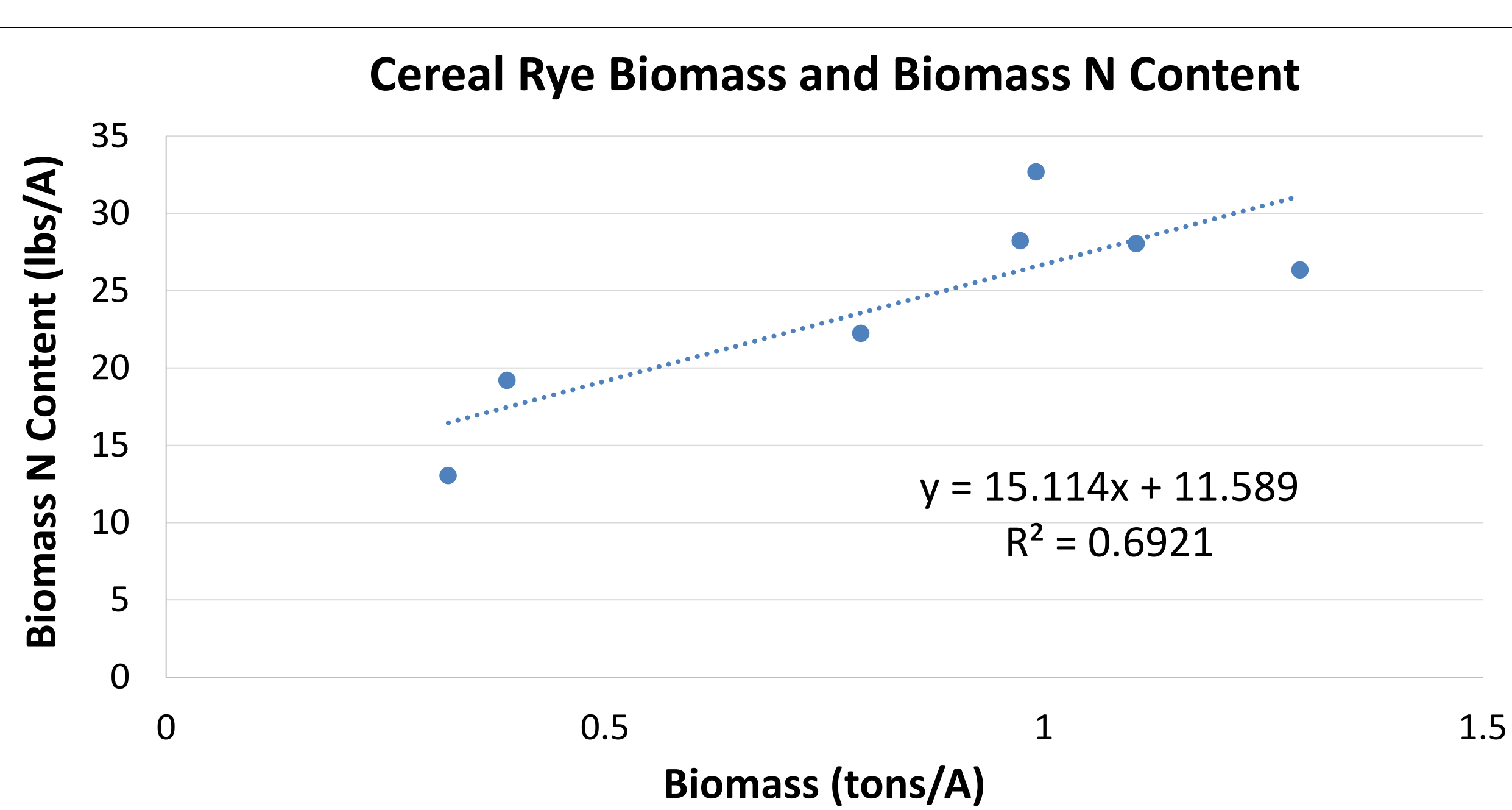
In the spring of 2016, tile nitrate loss was reduced by 43% (9 lbs of nitrate-N/A) following the production of 1.26 tons/A of cereal rye containing 28 lbs of N/A. This research demonstrated proof of concept that cereal rye can be used to greatly reduce tile nitrate in a corn-soybean rotation.

In addition, this study documented the quick response time of tile nitrate to management.

Management Considerations



- There is a strong inverse relationship between cereal rye above ground biomass and its percent nitrogen concentration.
- Therefore, as cereal rye develops the carbon to nitrogen ratio of the biomass greatly increases, slowing the microbial degradation of the cover crop residue.



- It's interesting to note that biomass N content increased only 30% as above ground biomass tripled.
- We have found a minimum threshold of 0.5 tons/A of cereal rye biomass is required to consistently reduce tile nitrate loss.

Planting "Green" into Soybean

Planting "green" means to plant the row crop into living cover crop. The cover crop is terminated at this time either by crimping or spraying herbicide. Cereal rye grows quickly in the spring and the extra month of growth allowed by planting green can have a major impact on tile nitrate loss (75% reduction in tile nitrate with 2.75 tons/A of cereal rye). The high C:N ratio of a large cereal rye cover crop does not appear to be problematic for soybean as it relies on N fixation for the majority of its N requirement. We have found that soybean can be safely planted into biomass amounts as high as 2 tons/A; however, 2.75 tons/A of cereal rye slowed soybean emergence and decreased yield by 13%.



- Photo of Eric Miller planting "green".
- Cereal rye heads will be present to accumulate more than 2 tons/A of biomass.
- We have seen annual flow weighted mean nitrate concentrations as low as 1.5 ppm with >2.5 tons/A of cover crop biomass produced.
- We observed weed control benefits with this amount of cereal rye biomass.

How much cereal rye biomass is needed to achieve a 45% reduction in tile nitrate loss?

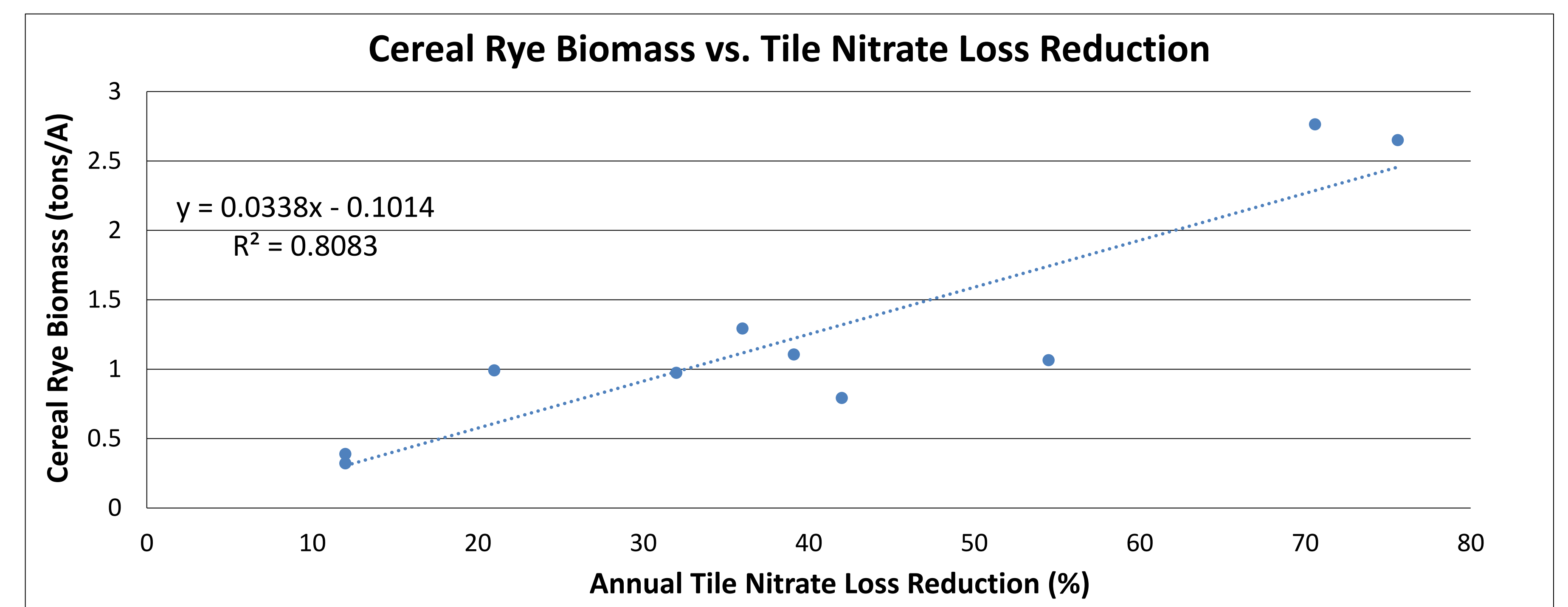


Figure of the relationship between cereal rye biomass accumulation and tile nitrate loss reduction.

With 7 years of data (10 site-years in total) from the Douglas and Piatt County studies, we see a strong relationship between cereal rye biomass and tile nitrate loss reduction $R^2 = 0.81$. Our equation predicts that a 45% tile nitrate loss reduction (overall goal of the IL NLRs) requires approximately 1.5 tons/A of cereal rye biomass with a 30% reduction requiring 1 ton/A of biomass.



Until this analysis, we didn't know how much cereal rye biomass was required to achieve a nitrate loss reduction of 45% on tile drained fields in central Illinois, and as luck would have it, we do not seem to have the perfect photograph depicting a 1.5 tons/A of cereal rye biomass under strip-tillage ahead of corn. The photo to the left shows 1.4 tons/A of cereal rye biomass under strip-tillage ahead of corn. Now we know exactly what we are looking for in a photo!

Conclusions

- Cover crop biomass amounts between 1 and 2 tons/A may represent the best compromise between tile nitrate loss reduction potential and risk to soybean production.
- We have evidence that carbon added to the soil from a large cereal rye cover crop (>2 tons/A) can also help reduce nitrate loss to tiles following soybean production.

Acknowledgements

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