COVER CROPS, MANURE AND NITROGEN

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INTRODUCTION

Fall manure application following corn silage harvest in late August through late September is a common practice in Wisconsin. Grass cover crops planted after manure application has both soil and water conservation benefits as cover crops provide soil coverage after complete removal of corn biomass and trap nitrogen (N) applied via liquid dairy manure. So, the question remains if the cover crops are just trapping nitrogen that would be leached out of the root zone or if it taps into the nitrogen that would be available to the subsequent corn crop. To simplify, does the presence of a fall cover crop affect the fertilizer N equivalent of fall applied manure. The objective of this study was to assess how the species and biomass of fall seeded cover crops affect the optimum N rate of corn when fall manure is also applied.

MATERIALS AND METHODS

Field trials were conducted at the Arlington, Lancaster, and Marshfield Agricultural Research Stations between 2014-2017. At each location cover crops were planted in 2014, 2015, and 2016 and the N response to corn was evaluated in 2015, 2016, and 2017. New field sites were utilized in each site year at each location. The experimental design was a randomized complete block, split plot design with four replications. The whole plot factor was cover crop and the split plot factor was N rate. The whole plot treatments were: (i) no cover crop, (ii) spring barley (seeded at a rate 70 to 90 lb/ac), (iii) annual ryegrass (seeded at a rate of 15 lb/ac), and (iv) winter rye (seeded at a rate of 70 to 90 lb/ac). Cover crops were drill seeded following corn silage harvest and liquid dairy manure application. The total N applied varied per site; at Arlington and Lancaster the available N was 80 to 90 lb-N/ac and at Marshfield the available N was between 25-30 lb-N/ac (low solid content manure). Spring barley winter killed, annual ryegrass typically winterkilled, and winter rye was terminated with glyphosate. Cover crop biomass as collected in the fall prior to winter kill (spring barley and annual ryegrass) or in the spring prior to termination (winter rye). Corn harvested as grain was planted two weeks after termination of the winter rye and received 20-30 lb-N/ac as starter fertilizer. The split plot treatments were N rates between 0 to 360 lb-N/ac in 60 lb-N/ac intervals). Nitrogen was broadcast applied at V4-6 as urea coated with Agrotain®.

For each whole plot treatment, the response to N was determined as either non-responsive or with quadratic plateau. A bootstrapping technique was conducted on each cover crop-site-year to identify if the AONR and the yield plateau each cover crop was statistically different than the no cover crop treatment. If it was, the EONR was calculated for each treatment. The change in EONR (Δ EONR) and the change in yield plateau (Δ max yield) between each cover crop treatment and no cover crop treatment was calculated and regressed against total biomass.

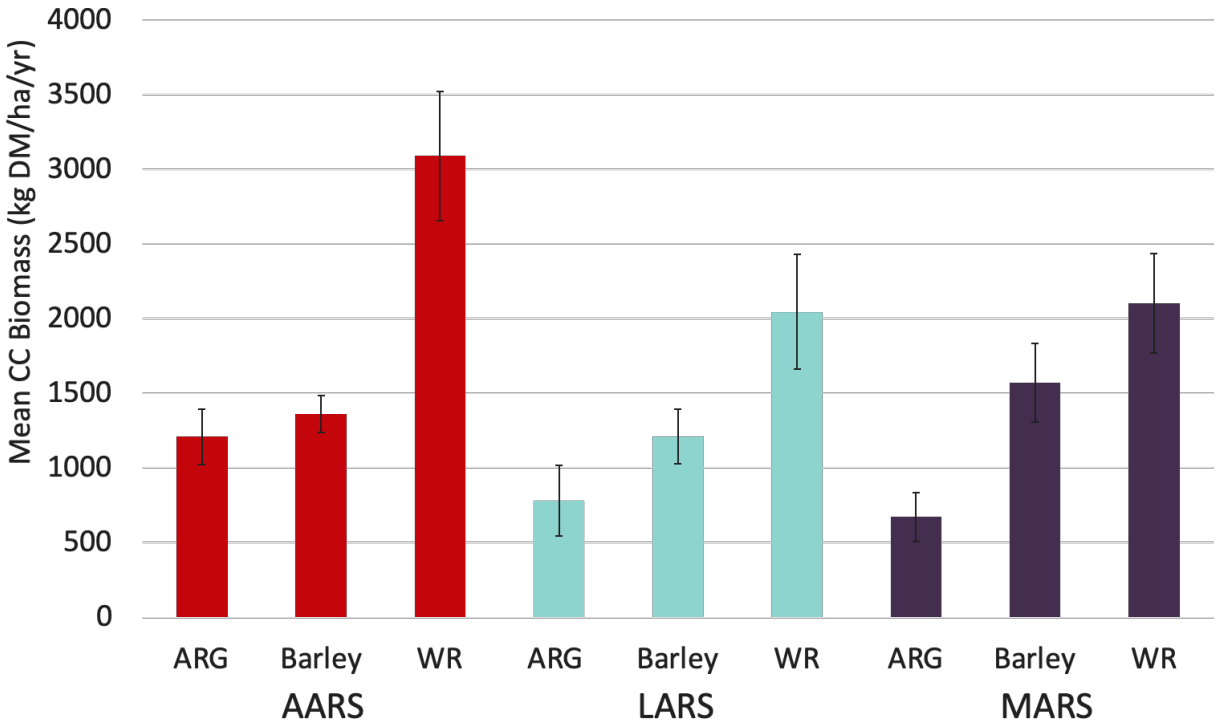

Figure 1. Cover crop dry matter biomass by site year. ARG=annual ryegrass, WR=winter rye

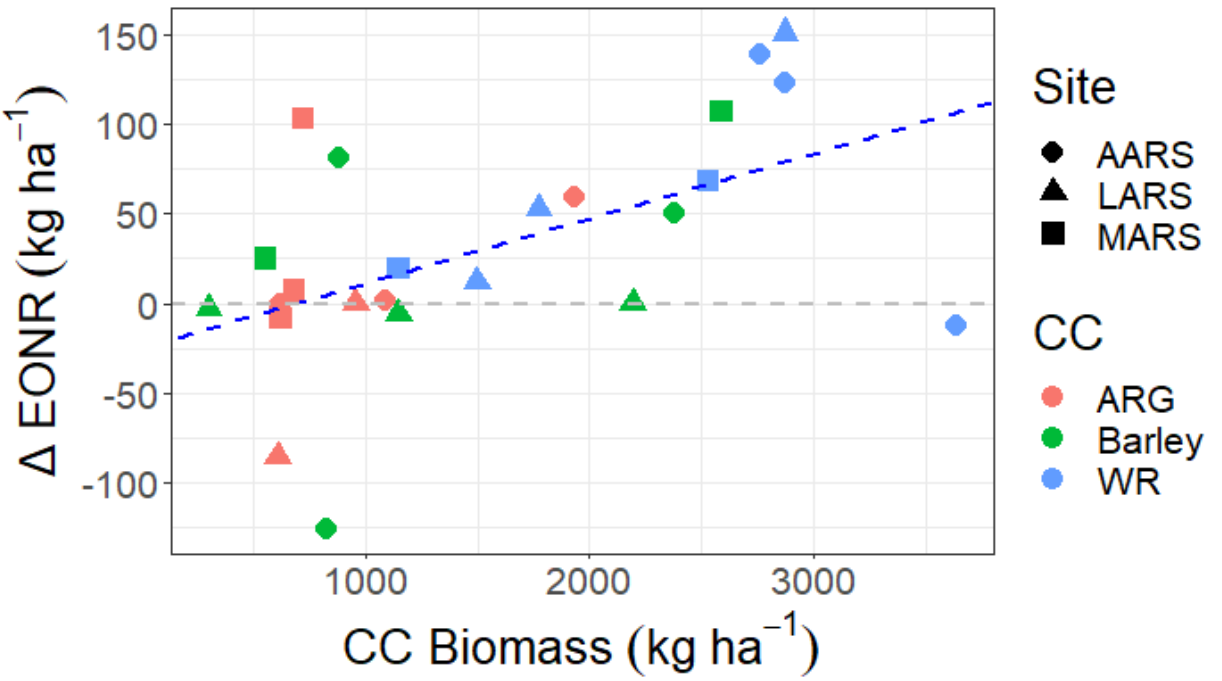

Figure 2. Linear regression between cover crop biomass and the change in EONR (compared to the no cover crop control). Regression equation y=0.036x-24.5; R^2=0.28.

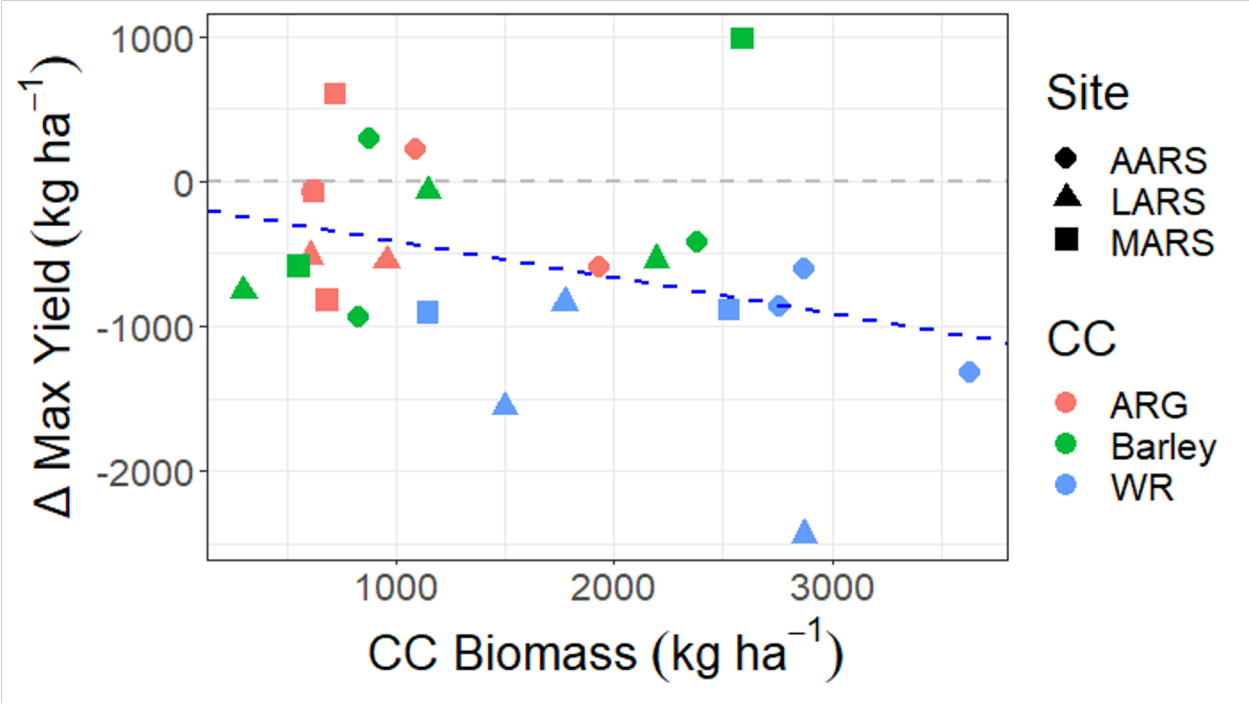

Figure 3. Linear regression between cover crop biomass and the change in maximum yield (compared to the no cover crop control). Regression equation y=-0.25x-168; R^2=0.11.

CONCLUSIONS

1. The greater the cover crop biomass, the greater amount of N needed to achieve economically optimum yield.
2. Corn yields were generally lower following cover crops, but biomass only explained 11% of the variation.

Nutrient management recommendations

This work, along with concurrent work support the following management recommendations:

1. Seed cover crops at a low of a rate as possible to minimize total biomass
2. Terminate cover crops as early in the spring as possible to minimize biomass
3. Based on regression analysis, additional N is needed (or more specifically, the manure N credit is less) once there is above 1,000 lb/ac of dry matter biomass.
4. If there is between 1,000 and 2,000 lb/ac of DM biomass, then 10 to 50 lb-N/ac more N is needed.
5. When greater than 2,200 lb/ac of dry matter biomass occurs, the entire manure-N credit was eliminated.