Fertilizing Cover Crops: Do You Have to Put Some in to Get More Out?

Progress report for activity between August 2022 and February 2023

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In late August and early September 2022, cover crops were established by aerial interseeding on two sandy corn fields on the Eastern Shore and by interseeding with ground-based high clearance equipment on two sandy corn fields at the University of Maryland Research and Education Center near Beltsville. The Easter Shore fields both had single-species radish stands seeded at 12.5 lb per acre. The research farm fields had two types of cover crops: cereal rye at 100 lbs per acre, and a mixture of cereal rye, radish, and crimson clover at 75 lbs, 4 lbs, and 15 lbs per acre respectively. In early September when the cover crops had emerged and had produced true leaves, pairs of plots were delineated, and a nitrogen fertilizer solution was applied. The CANOPEO phone app was used to determine the percent ground cover so that plots could be delineated with very similar initial cover crop stands before nitrogen and no nitrogen treatments were randomly applied to one of each pair of plots. At all sites, corn was yet to be harvested when the nitrogen solution was applied. There were eight replicate pairs of plots at each field, except that field 39A at Beltsville had a total of 24 pairs of plots with half in single-species rye and half in radish-rye-clover mixture cover crops as well as three different levels (0, 72, 144 kg/ha) of nitrogen side-dressing in June 2022. One plot in each pair received 500 ml of pure water sprinkled evenly on the cover crop foliage while the other plot received 500 ml of with 5.71 g ammonium nitrate dissolved in it to deliver 40 kg N / ha.

In early December when maximal fall cover crop growth was achieved and winter dormancy was sitting in, the plots were revisited and the above-ground cover crop biomass was cut 1 cm above the soil and harvested from each 0.5 m plot. 50% green cover for each plot once again measured. The collected biomass was dried at 65° C until it reached a constant dry weight which was then recorded and the biomass per unit area of land was calculated. Currently, these samples are being ground and prepared for total carbon and nitrogen analysis.

The dry weight data for the above-ground cover crop tissue have been analyzed in the response to applied nitrogen in all four fields is shown in Figure 1. The response to nitrogen in the sandy field on the research farm with subplots for three levels of nitrogen fertilization applied to the corn in June 2022 is shown in Figure 2. The overall response to N application averaged across all sites and plots is shown in Figure 3.

Figure 1 suggests that there was a small response in dry matter production to the applied nitrogen at all four fields but only in Field 39d was the response statistically significant. The difference in that field amounted to an increase of 426 kilograms dry matter per hectare. This difference was close to the overall average response of 347 kg/ha of dry matter (Figure 3). Although the nitrogen content of the dry matter is not yet known, if we assume an average N content of 3% we can estimate that the increased nitrogen uptake would be approximately 0.03 * 347 = 10. That suggests that the application of 40 kg of nitrogen resulted in an additional 10 kg of uptake on average, meaning that the fertilization of the cover

crop left an extra 30 kg of nitrogen in the soil susceptible to leaching. It is still possible that a somewhat greater impact on N uptake may have been realized if the N application also increased the N concentration in the cover crop tissue.

Figure 2 shows the response of the cover crops to the level of nitrogen applied to the corn in June as well as to the nitrogen applied to the cover-up directly in September. The trend is for a greater response to the September nitrogen in the plots that received the highest nitrogen rate at corn side-dressing (144 kg/ha), suggesting that only in the plots with higher residual nitrogen did the increased growth stimulated by the September nitrogen application to cover crops allow cover crop roots to reach this extra nitrogen from deeper layers. However even this trend was not statistically significant at a 95% confidence level.

Future work will include analyzing the total carbon and nitrogen for all of the cover crop biomass tissue samples as well as analyzing the nitrate in the soil at all of the paired plots for fields. We will then be able to write a final report evaluating the efficacy of applying small amounts of nitrogen to cover crops on low-nitrogen Sandy soils shortly after planting in the fall.

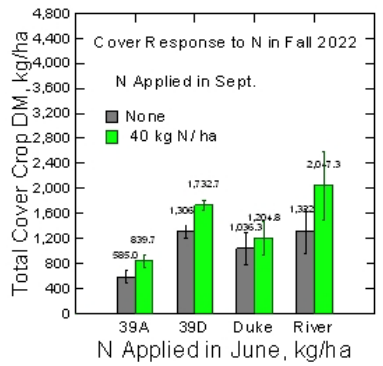

Figure 2. Cover crop dry matter response in December 2022 to N application soon after emergence in September for four sandy, low-nitrogen fields.

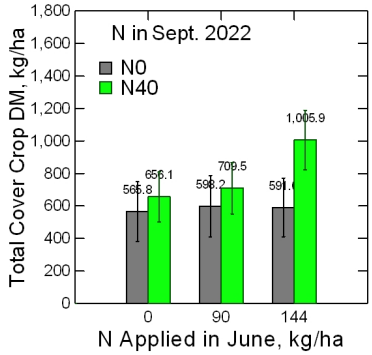

Figure 1. Cover crop dry matter response to the interaction of three levels of N applied to corn in June and two levels of N applied to the cover crop in September. CMREC Beltsville.

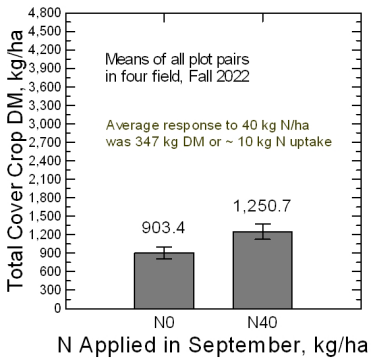

Figure 3. Overall average December 2022 dry matter for cover crops with and without N application in September 2022. Means of all fields.