

LAIYERS: Land Management for Improved Yields, Environmental Resilience, and Sustainability

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Twenty-seven individually tile drained one-quarter-acre plots were established at Iowa State University's Agricultural and Biosystems Engineering Research Farm in spring 2021. Nine system treatments were assigned in triplicate to the research plots (Figure 1). The site was designed for comparison of litter and land management practices, with immediate and ongoing goals of evaluating crop yield response to poultry litter application timing and cover crops, and water quality impacts with reduced tillage practices.

All plots are managed using strip-till. Treatments include manure or chemical fertilizer (UAN) application before corn, with early winter or spring poultry manure at 150 lb. N/acre; spring UAN at 150 lb. N/acre; balance poultry manure with UAN with an early winter poultry manure at 150 lb. N/acre followed by UAN at 150 lb. N/acre; and split UAN with 75 lb. N/acre spring applied and 75 lb. N/acre as sidedress. The first poultry manure treatments were applied for the 2022 growing season, with early winter (EW) manure applied December 3, 2021, and spring manure applied April 26, 2022. All fertilizer treatments were applied at a target application rate of 150 lb. N/acre.

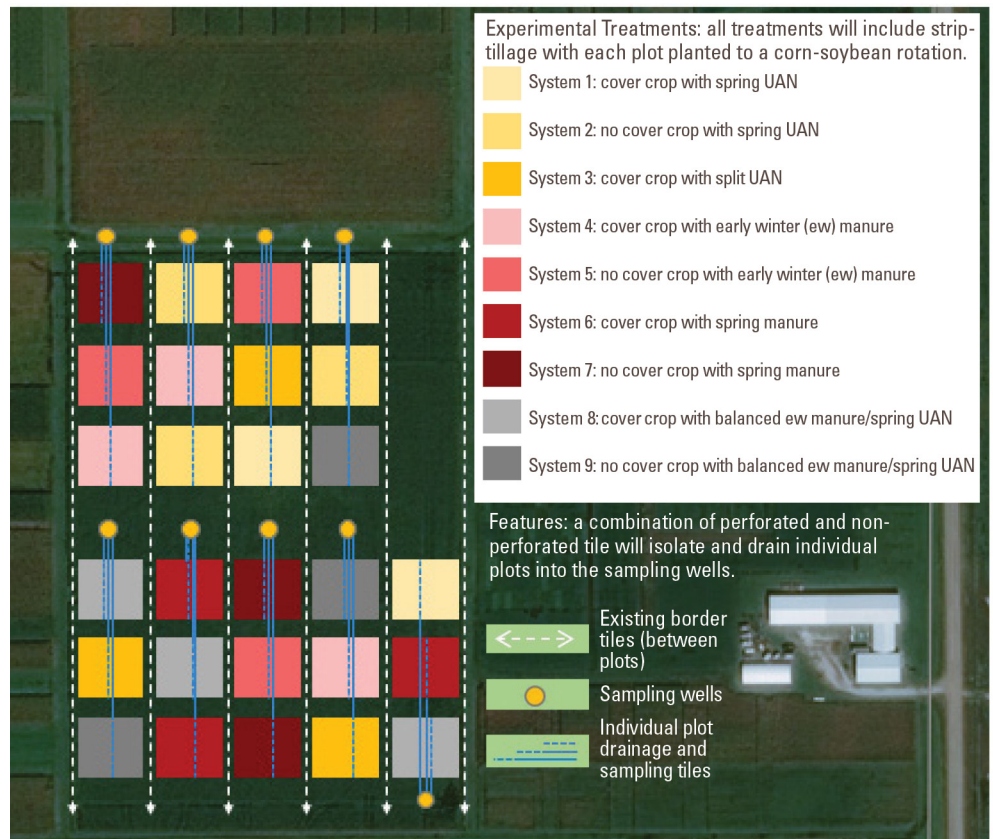


Figure 1. Illustration of the LAiYERS site plot layout and features.

Materials and Methods

Installation. Tile installation and plot establishment at Field 40 (LAIYERS) was completed in June 2021. Drainage tile was installed centrally along the length of each plot, with perforated tile installed to drain an individual plot in line with solid tile to transport the monitored drainage further to the sampling wells where needed. Each sampling well houses three individual plot sampling basins. Electrical installation to each sampling well is scheduled to be completed in March 2023 to allow for continuous flow monitoring and flow weighted sample collection of the individual plot basins housed in the sampling wells.

Results

The crop rotation at the site is corn-soybean, with soybean planted in Year 1 (2021) and corn planted in Year 2 (2022). In the first year, baseline soil health analysis was conducted, and all plots were planted to soybean. Because of dry conditions and late planting, the first year soybean yields were low (average yield 19 bushels/acre) and water samples were not collected (tiles did not flow). Tile flow was monitored in 2022, and drainage samples were collected and analyzed. Early results hint at the potential for combined management practices of spring manure and cover crops to positively impact water quality, but continued monitoring is needed to identify treatment effects. Additionally, there was no trend in corn yield impacts with the cover crop treatments. Moving forward, this study will provide practical guidance to farmers interested in maximizing yield, resiliency to varying climatic conditions, and protecting downstream water quality.

Acknowledgements

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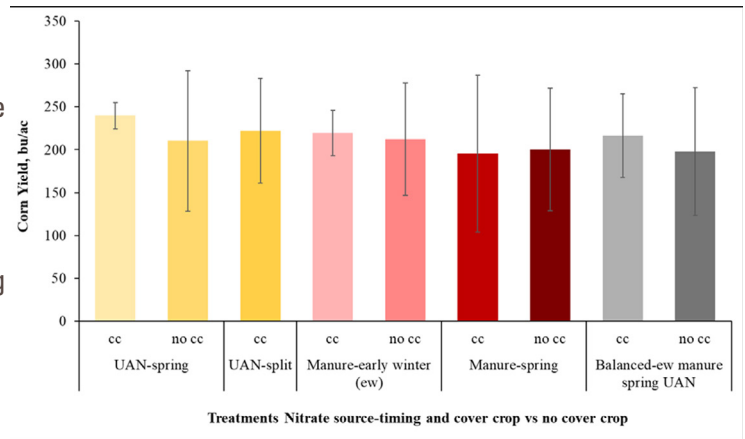


Figure 2. A comparison of average corn yields with combined fertilizer/manure management and cover crops. Yield results were similar for all treatments. Cover crops did not appear to have a large effect on crop yields, with similar or even higher yields harvested at the cover cropped plots. Error bars denote +/- one standard deviation.

Table 1. Median NO_x (nitrate+nitrite) concentrations with treatment for the 2022 drainage season. Samples were collected from early April through early July. Early results indicate lower NO_x-N concentrations with the spring manure treatments, although these differences were not significant.

Nitrate source-timing	Cover crop (yes/no)	System Treatment	NO _x (mg N/L)
UAN-spring	yes	1	13.88
	no	2	12.61
UAN-split	yes	3	13.30
Manure-early winter (ew)	yes	4	12.84
	no	5	14.40
Manure-spring	yes	6	12.07
	no	7	12.00
Balanced-ew manure spring UAN	yes	8	14.10
	no	9	13.60