Trial Type: Management
Growing Season: 2024-2025

Project Objective: Study on multi-species cover crops in specific soybean or corn production systems with the objectives of (1) Evaluate blended cover crop contribution to cash crop performance, and (2) Evaluate soil health and nutrient cycling under a blended cover crop system.

Project Insights:

1. Significant yield losses were observed in 2024 and 2025 on soybean.
2. Yield increases were observed at sites incorporating tillage or a nitrogen inhibitor.
3. At most sites, minimal cover crop growth was observed.
4. Across all sites, average Nitrate and Potassium concentrations were lower at planting under the Improved Cropping System.

Project Summary

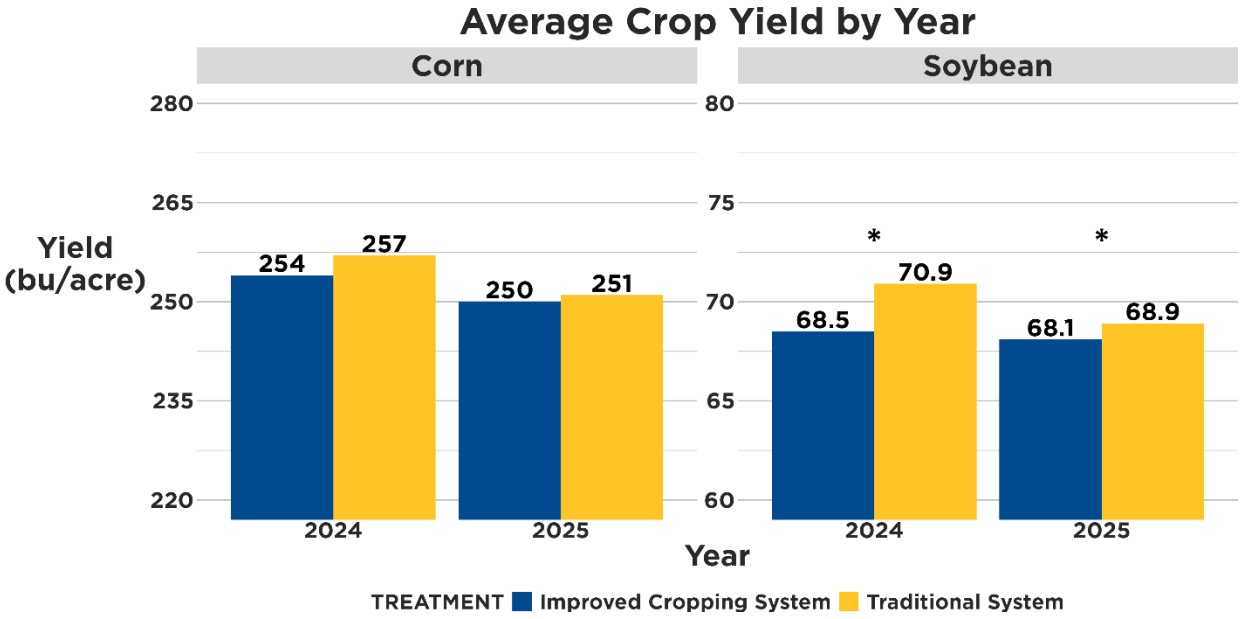

*Figure 1. Yield results for 2024 and 2025 comparing Improved Cropping System and Traditional System on corn and soybeans. An * denotes a significant difference between treatments.*

While most of the trials conducted by the Iowa Soybean Association Research Center for Farming Innovation (ISA RCFI) are looking at single products or practices, a project to combine several of the practices we've tried over the years was established in Fall 2023. Working together with Iowa State University and a group of farmers and advisors to come up with a suite of best practices, the project was set up to look at the farmers' standard practices compared to an improved set of practices. Although the practices varied among participants, cover crops were seeded in strips at every site regardless of cash crop. Species and rates used at all non-ISU sites can be found in Table 1. For the Iowa State Research Farm locations, a blend of cereal rye and

turnips were seeded ahead of soybeans, and a blend of triticale, red clover, and winter rapeseed were seeded ahead of corn. While farmers were asked to terminate when the cover crop reached 6-12" in height, this was optional with actual dates ranging from mid-April to mid-June. Farmers were also given the option to implement tillage on either cash crop and/or nitrogen inhibitors on corn. Across all sites during the first 2 years of the project, yield response has been even or slightly negative with the Improved Cropping System (Figure 1). A total of 22 sites, including 4 ISU Research Farms (Crawfordsville, Kanawha, Lewis, and Sutherland), were involved in the project so far providing 35 site years of data. Sites are spread across the state to see how this system responds to differing climatic factors (Figure 2). In 2025, we had 6 trials that were in year 1 of the study and 15 trials that were in year 2 of the study. Four additional trials have been implemented and will start year 1 in 2026.

Ahead of Corn	
Triticale	78.10%
Hairy Vetch	15.60%
Winter Camelina	6.30%
Seeding Rate: 32-56 lbs/acre	

Ahead of Soybean	
Cereal Rye	47.60%
Triticale	47.60%
Winter Camelina	4.80%
Seeding Rate: 30-50 lbs/acre	

Table 1. Cover crop seed mix rates and seeding range by crop for farmer managed sites.

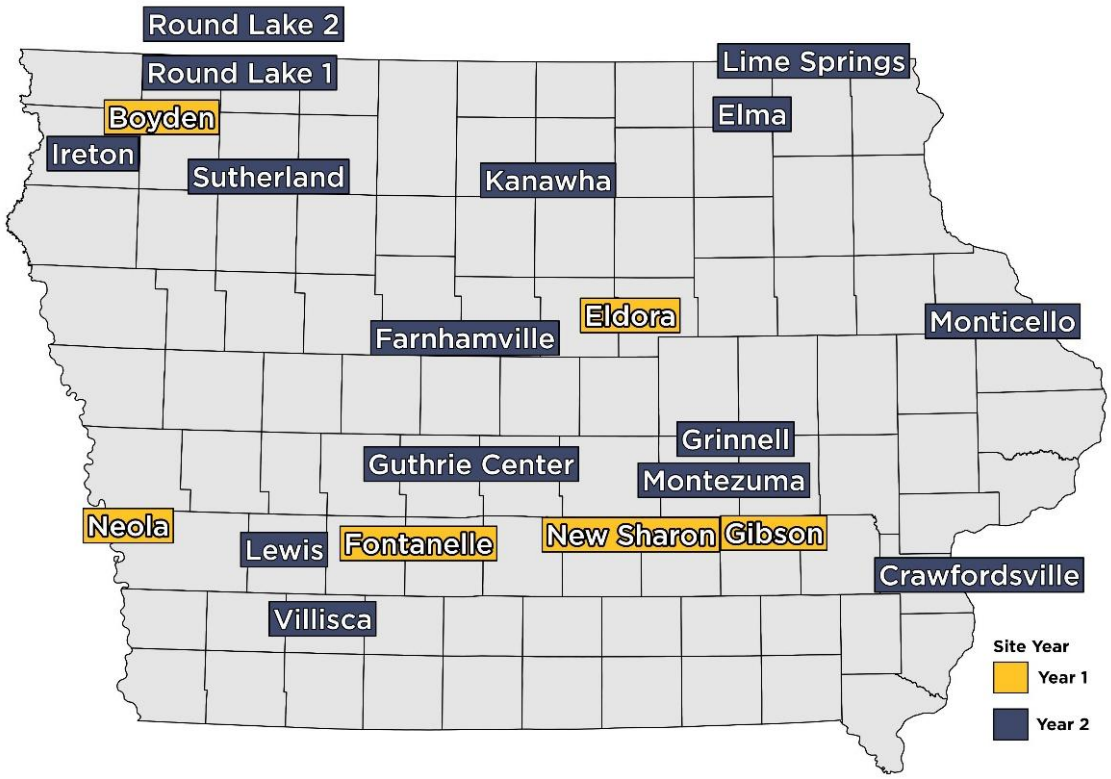

Figure 2. Trial locations in 2025. Yellow indicates sites in Year 1, and blue indicates sites in Year 2.

Cover Crop Comparison

At sites where no other management changes were made and the only comparison was cover crop vs no cover crop, the Improved Cropping System had an average negative response (Figure 3) on both corn (-2.3 bu/acre, 5 site years) and soybean (-0.8 bu/acre, 8 site years). While termination timing varied widely across sites, this did not appear to impact overall yield differences seen at the individual sites.

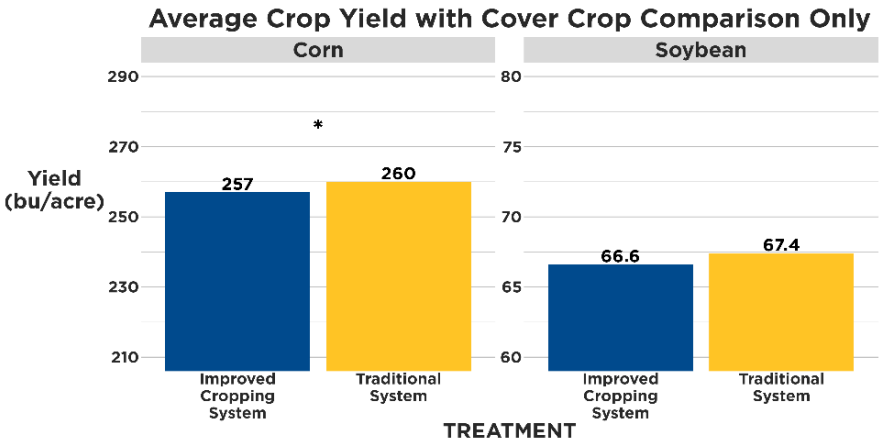

*Figure 3. Corn and soybean yield at sites with only a cover crop comparison. An * denotes a significant difference between treatments.*

Satellite imagery was collected close to the cover crop termination date and used to help quantify ground coverage by calculating normalized difference vegetation index (NDVI) values for each of the sites. Given differences in the practices between locations, sites that only had a cover crop comparison were used in the analysis. Across all sites, calculated NDVI values for the cover crop strips ranged from 0.14 to 0.68 with the highest values occurring at the Montezuma site terminated in late May (Figure 4). Because NDVI was calculated from imagery as close to termination as

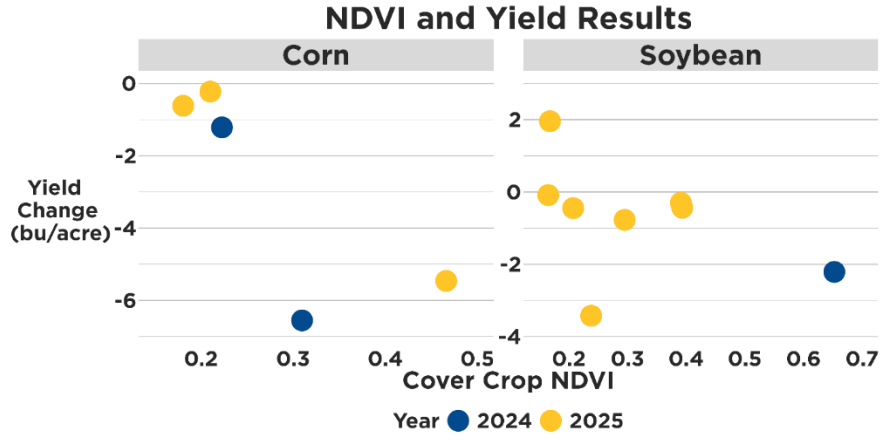

Figure 4. Calculated NDVI values for cover crop strips and yield differences per year in corn and soybean at sites with only a cover crop comparison.

possible, some results like those observed at the highest corn site in 2025 were likely influenced by the emerging cash crop. At the Guthrie Center site where the highest values in corn were observed, termination did not occur until beginning of June when the corn crop was actively growing. These results were similar to what we saw in the Long-Term Cover Crop project where increased cover crop growth can negatively impact yield.

Cover Crop and Maturity Group Comparison

At Iowa State Research Farms, the Improved Cropping System practices were slightly different than what farmers were asked to do. In addition to cover crops, maturity group comparisons were also implemented on both soybean and corn. Four research farms (Figure 5) have been involved in the project for 2 years each, with Lewis Research Farm corn yield removed due to severe greensnap and lodging which impacted overall yield.

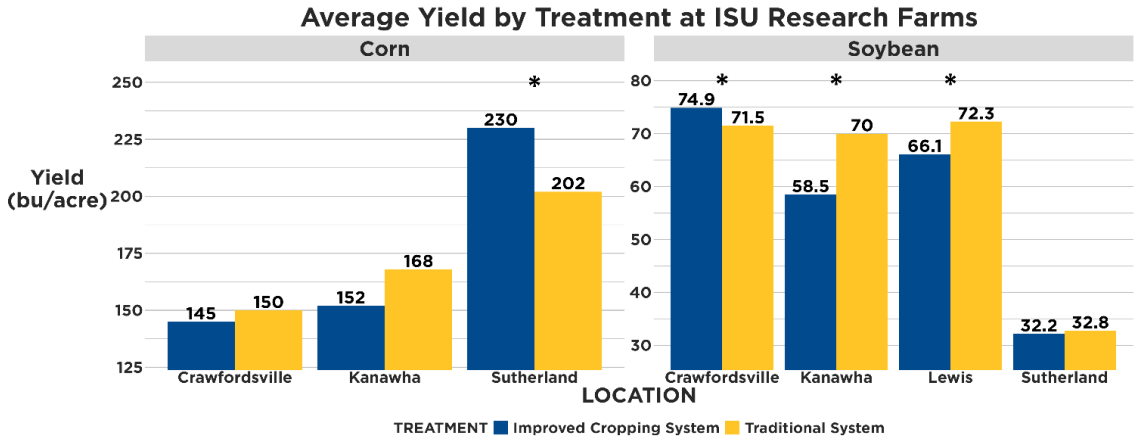

*Figure 5. Corn and soybean yield at Iowa State Research Farms. An * denotes a significant difference between treatments.*

Corn comparisons (3 site years) showed yield losses for the Improved Cropping System at the Crawfordsville (-5 bu/acre) and Kanawha (-16.4 bu/acre) locations, while the Sutherland location had a significant 28.2 bu/acre advantage. Note that both Crawfordsville and Kanawha planted corn in the Improved Cropping System strips that were 6 maturity group days earlier than the Traditional Strip while Sutherland planted a hybrid that was 3 days longer than the Traditional Strip. Soybean yields showed negative response with the Improved Cropping System for three of the four sites. The only site that showed a positive yield response was at the Crawfordsville location which saw the Improved Cropping System strips planted 10 days after the Traditional System strips with a variety that was 0.9 maturity group earlier. The 3 sites that showed a negative yield response were all managed with a constant planting date between the systems and had a variety that was 0.5 maturity group earlier in the Improved Cropping System. Yield at Sutherland was likely limited due to cover crop termination and soybean planting occurring in June.

Tillage Comparison

One option that farmers had was to conduct tillage within the Traditional System treatment strips. Over the first two years of the project, 6 corn sites and 3 soybean sites had a form of tillage compared to the Improved Cropping System cover crop and no-till system. Tillage types included conventional, strip-till, and vertical tillage. Looking only at sites that included a tillage pass, improved yields (Figure 6) were observed on both corn (+2.4 bu/acre) and soybean (+2.5 bu/acre). Given that slight negative yield responses are observed with a cover crop alone, the question becomes whether these differences are a response to the cover crop reducing yield or tillage improving yield. In either case, average yield was improved.

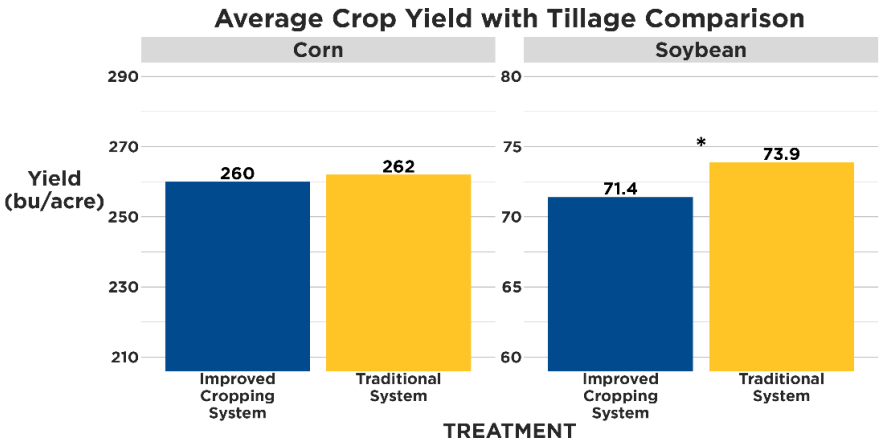

*Figure 6. Corn and soybean yield at sites with a tillage comparison. An * denotes a significant difference between treatments.*

Nitrogen Inhibitor Comparison

Nitrogen inhibitors were also available for farmers in the Improved Cropping System. While only 4 sites utilized an inhibitor, results showed the combination with a cover crop improved yields by 2 bu/acre over the Traditional System (Figure 7). Not considering the cost of cover crops, with nitrogen inhibitors costing an average of $17.50/acre, the application would require corn sales price of $8.75/bu to break even.

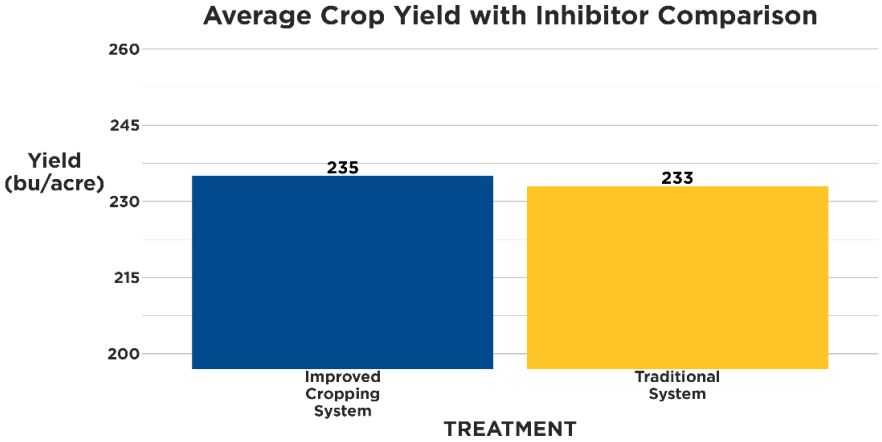

Figure 7. Corn yield at sites with a nitrogen inhibitor comparison.

Soil Nutrient Analysis

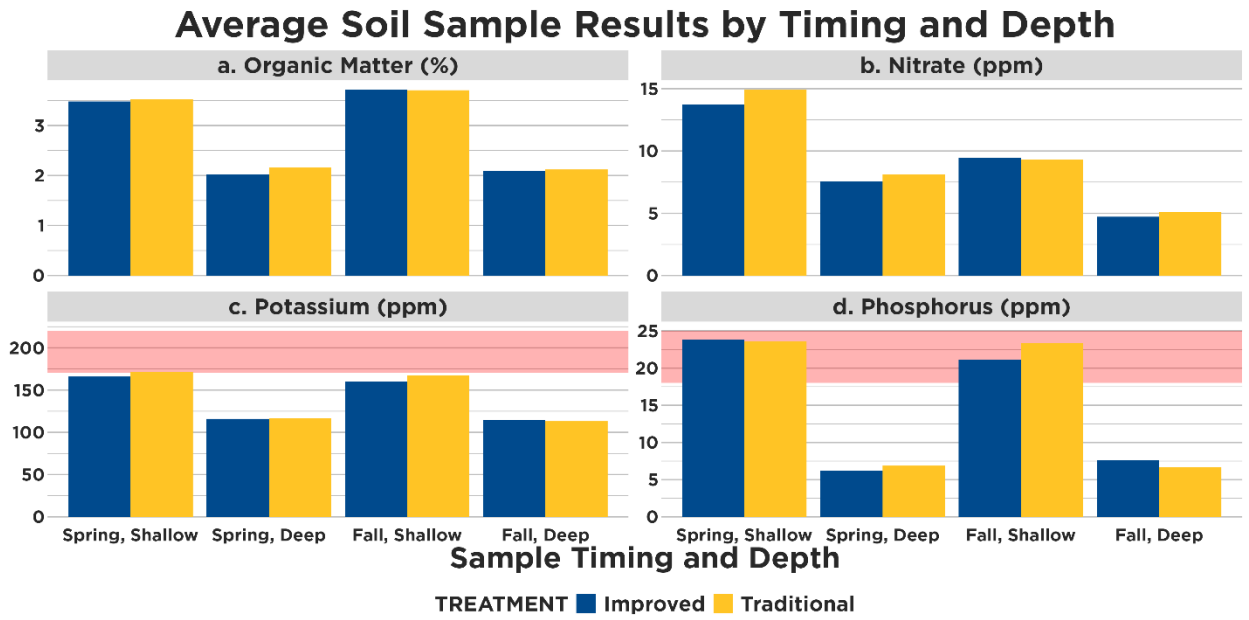

Figure 8. Soil sample results for 2024 and 2025 comparing Improved Cropping System and Traditional System at different sample timings and depths. Red bar indicates optimum fertility level.

Soil samples were collected at planting and in the Fall between 0 and 12" and between 12 and 24" depths. Soil health samples were also collected before site year 1 at each location and will be collected at the conclusion of the project. Average results for organic matter, nitrate, potassium, and phosphorus are shown in Figure 8 above. Across all sites, little or no differences in organic matter were observed between the Improved Cropping System and Traditional System. As we have observed in the long-term cover crop project, it takes several years with a high biomass cover crop to begin seeing differences in organic matter.

During the Spring sampling event, 65% of sites had lower average nitrate concentrations and 62% of sites had lower average potassium concentrations under the Improved Cropping system. At this time, average phosphorus concentration under both systems was nearly equal. During Fall sampling, concentrations of potassium and phosphorus averaged lower under the Improved Cropping System with nitrate increasing compared to the Traditional System. When looking at optimum fertility levels for potassium, 62% of sites had average concentrations below the optimum range at both Spring and Fall sampling.

Acknowledgements

This work would not be possible without the farmers implementing these trials and without the financial support of USDA-NRCS (Grant Number NR233A750011G010), Iowa Soybean Checkoff, Iowa State University, and Iowa Corn Growers Association.