

**Project Objective:** Explore the system of relay cropping to determine when and where it is profitable and to develop guidance on best practices in Iowa.

### Project Insights:

1. Combined soybean and small grain bushels exceeded sole soybean bushels at all but one site.
2. Fields in central and southern Iowa are more accommodating for relay production, achieving a higher percentage compared to sole soybean yields.
3. With \$10/bu soybeans and \$12/bu small grain (grown for clean cover crop seed), relay cropping generated \$877 of revenue per acre compared to \$667 per acre for sole crop soybean.
4. If the small grain is sold as a commodity at \$5.25/bu, it was \$81/ac less profitable than sole crop soybean.

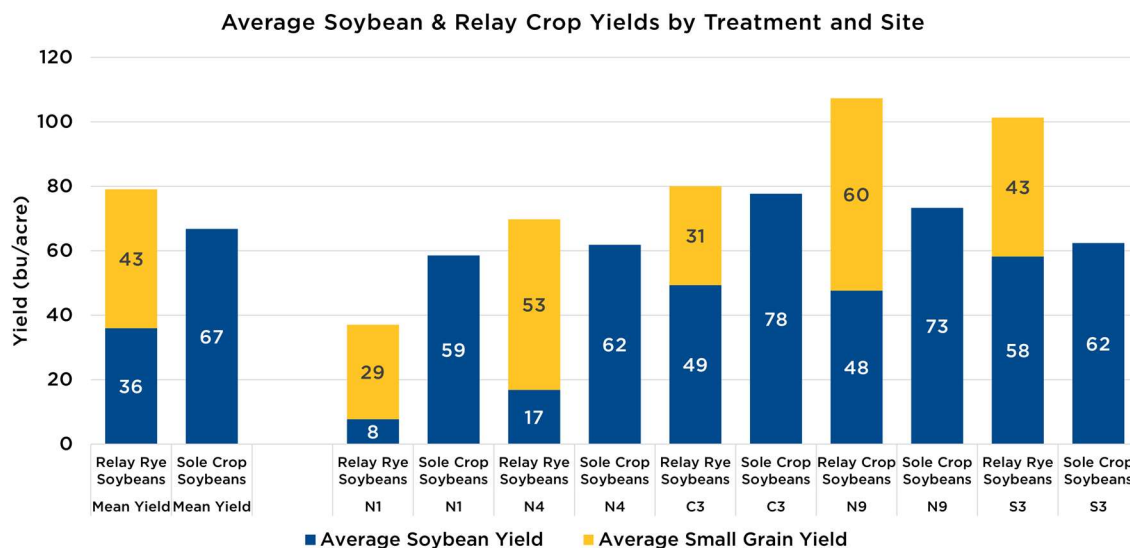


Figure 1: 2024 Combined grain yield (bu/acre) in relay crop strips is on average greater than sole crop soybeans. Site N9 relay crop was wheat instead of cereal rye. The site identifiers below each bar reference site location and latitude.

### Project Discussion

Relay intercropping is a relatively new practice in Iowa row crop agriculture. Unlike double cropping where two crops are grown sequentially during the same crop season, relay intercropping manages both crops in the same field at the same time during part of the growing season. This practice enables farmers in more northern latitudes to harvest two crops in the same growing season. The caveat is that two crops will compete for nutrients, moisture, and sunlight throughout the period in which their growth stages overlap within the field.

Aside from the potential of increased revenue from a two-crop system, relay intercropping maintains living roots in the soil all year long. This reduces soil erosion and scavenges nutrients that have not been utilized by the previous crop, helping to keep excess nutrients out of Iowa streams and rivers.

Farmers working with ISA RCFI are seeking to identify optimal seeding and fertilization rates, row spacing, and ideal planting dates for both crops in the system to maximize harvest return. Each crop needs to be managed individually, as well as within the system, to increase the likelihood of success. As might be expected, farmers testing the practice typically see a reduction in yield in both relay crops, but the degree to which that happens varies greatly between sites.

In 2024, soybean yields in relay soybeans were on average 44% of sole soybean yields. This varied between 13% and 65% at individual sites. Combining soybean yield with small grain yield produced more bushels per acre at four out of five sites in 2024 (see Figure 1).

With soybean market prices at \$10.00 per bushel and rye clean cover crop seed prices at \$12.00 per bushel, relay cropping gross revenue outperformed solo soybean cropping by \$210.00 per acre this year (see Figure 2). Actual ROI after cost of production will vary by site. If rye was sold as a commodity for \$5.25 per bushel, however, the relay system revenue would be \$81.00 less per acre than sole crop soybean, despite the greater combined grain yield.

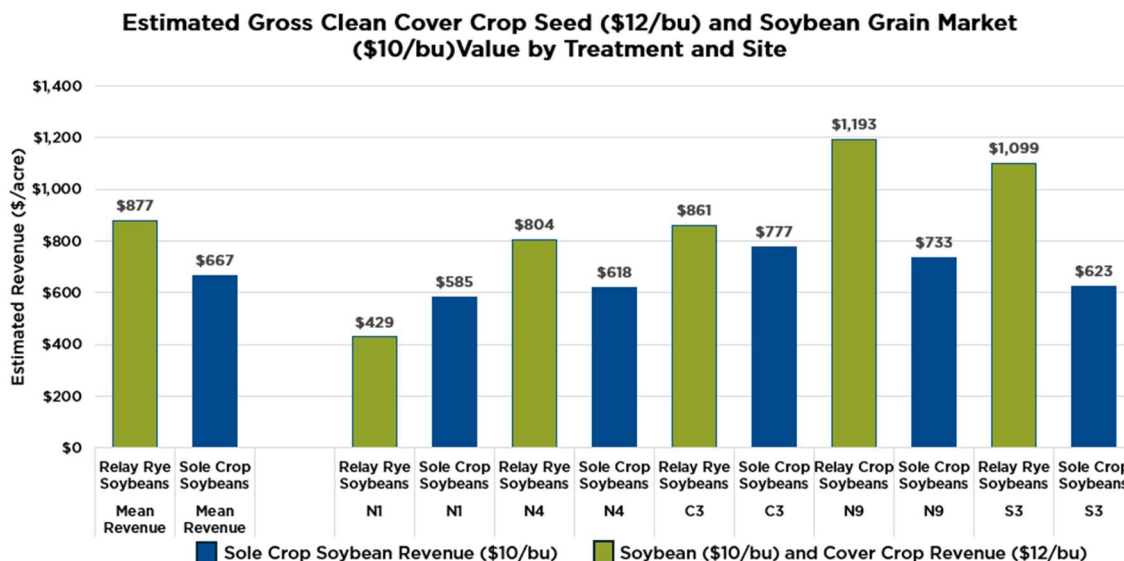


Figure 2: With soybeans at \$10/bu and small grain at \$12/bu, relay cropping soybeans has the potential to generate added value. Prices used in this graph are for marketing the small grain as cover crop seed rather than as a commodity. Site N9 relay crop was wheat instead of cereal rye. The site identifiers below each bar reference site location and latitude.

There were five trials conducted in 2024. Three sites were within the northern three tiers of counties (N), one trial was within the central three tiers of counties (C) and one site was within the bottom three tier of counties (S) in the state (see Figure 3).

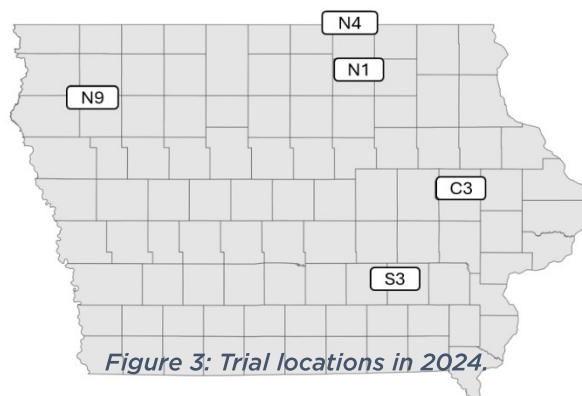


Figure 3: Trial locations in 2024.

An overview of ISA's 19 historical trials comparing relay soybean yields to sole crop soybean yields in 2020 through 2024 appears to indicate that the degree to which relay soybean yields are impacted is related to latitude (see Figure 4). The nine trials in the northern three crop districts of Iowa showed the lowest percentage of relay soybean yield compared to the sole crop soybean control strips ranging from 13-65% for an average soybean yield reduction of 56%. Trials in the central Iowa crop districts achieved 71-86% of sole crop soybean yield in relay strips for an average soybean yield reduction of 24%, and trials in the southern crop districts of Iowa achieved 63-91% of sole crop yield in relay crop strips for an average soybean yield reduction of only 12%.

If the small grain harvest from all 19 trails conducted since 2020 was marketed as cover crop seed, all but one would have generated greater revenue by more than \$50/acre than the sole soybean crop. If marketed as small grain, only seven relay system trials would have generated at least \$50/acre greater revenue than sole soybean.

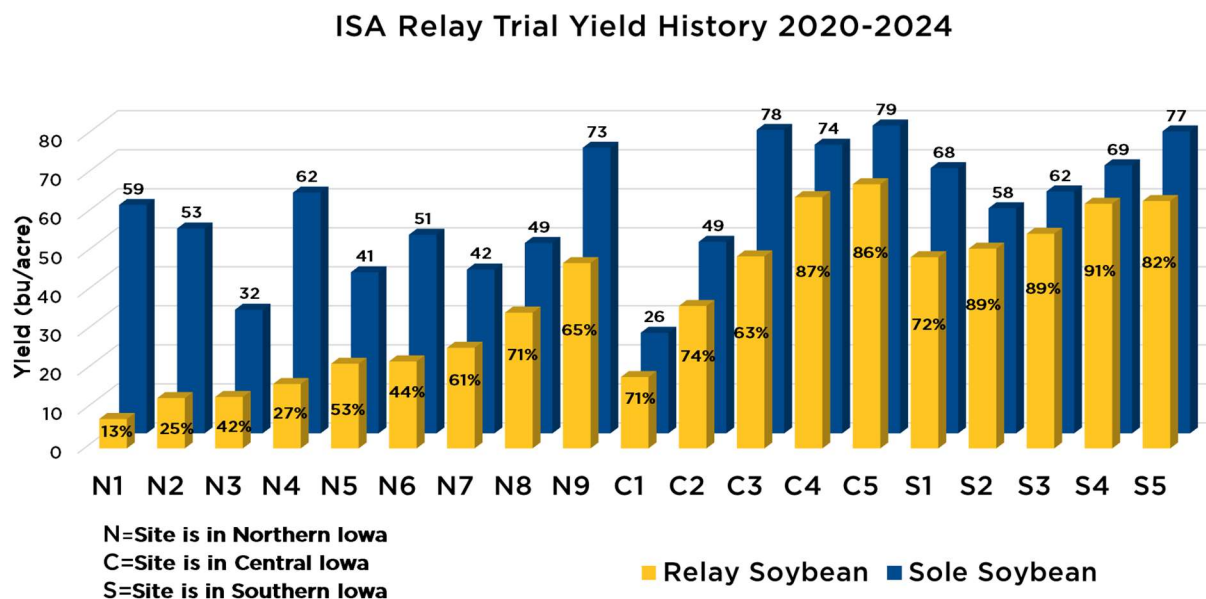


Figure 4: ISA relay vs. sole crop soybean trials between 2020 and 2024 organized by general latitude in Iowa.

## Project Results

Iowa soybean farmers are curious about the potential profitability of harvesting two crops in a single growing season. Combined soybean and small grain yields often exceed sole soybean crop yields in terms of bushels per acre. Depending on the market price of each crop, the value of the combined yield may more than offset the additional cost to plant and harvest a relay crop. ISA historical trial data that compares relay soybean yield to sole crop soybean yield suggests that the longer growing season in central and southern Iowa is more likely to produce relay soybean yields that could support this practice. Grain market prices also affect the economic outcomes associated with each cropping system. Figure 5 illustrates market conditions under which each system is likely to be more profitable based on the 2024 average yields for sole crop soybean, relay crop soybean and relay crop small grain.

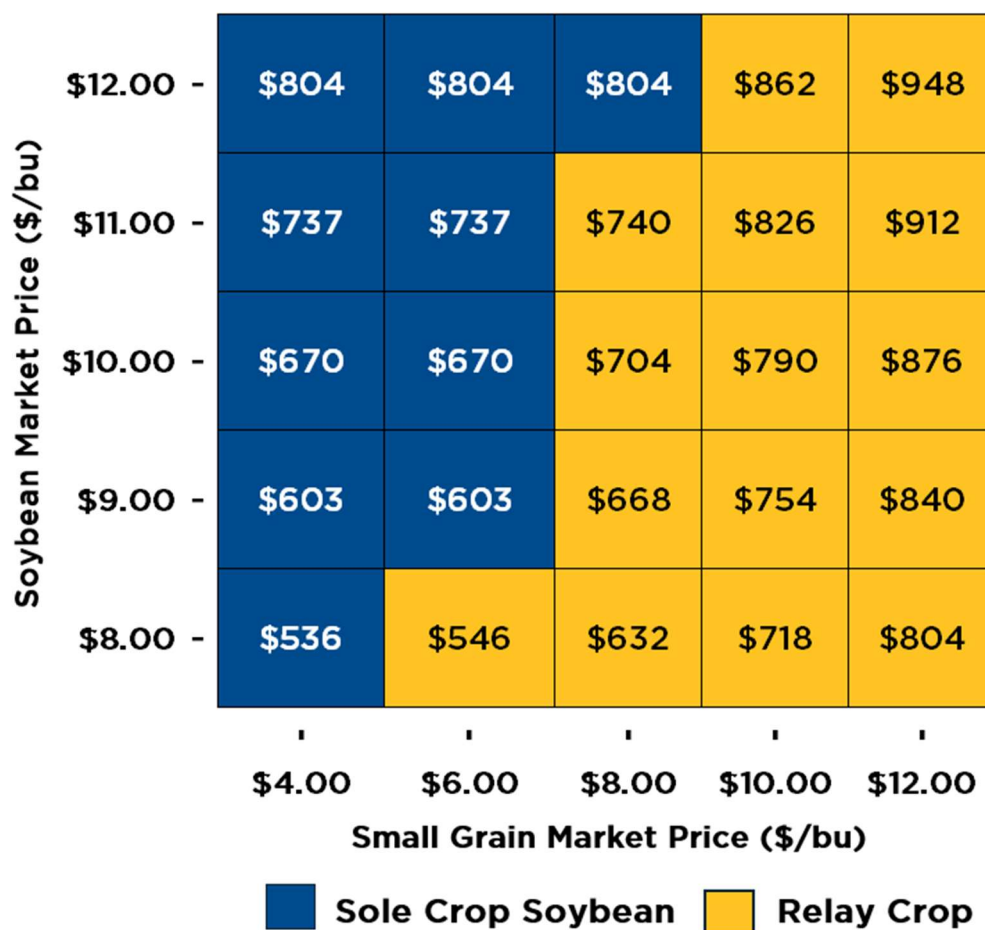


Figure 5: Sensitivity analysis of market price optimization for soybean and small grain based on average yields per system.