



Cover crops before soybean improve soil health

Iowa and Illinois Nutrient Reduction Strategies have identified cover crops as a key strategy to reduce nutrient loss and maintain the freedom to operate. But how can cover crops consistently benefit farmers and the environment? It starts with soybeans. Our United Soybean Board (USB)-funded project has shown that cover crops before soybeans produce 300% more biomass than cover crops before corn (Fig. 1). This extra biomass increases nitrogen retention by 100% (Fig 2) and speeds soil health improvement without negatively affecting soybean yield (Fig 3).

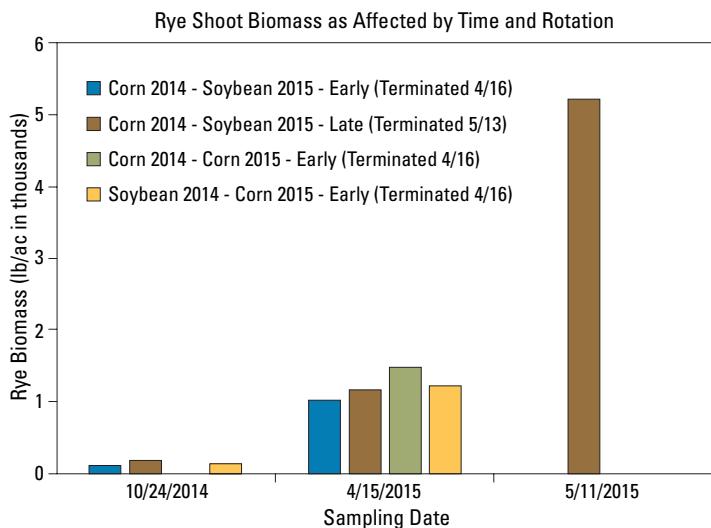


Figure 1. Rye biomass differences due to crop rotation and time

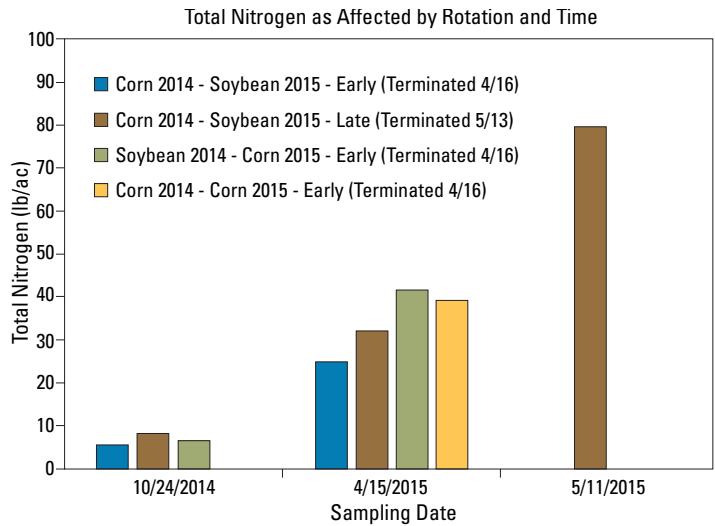


Figure 2. Nitrogen retention differences due to crop rotation and time

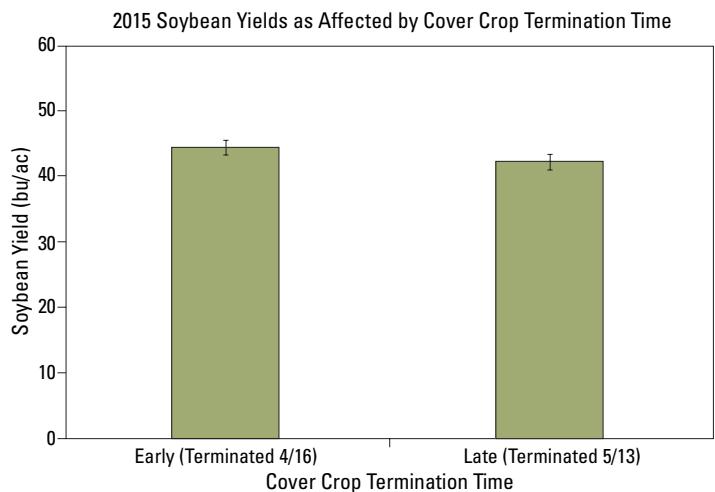


Figure 3. Soybean yield after early and late terminated cover crop plantings



Early (left) and late kill cover crop treatments



Planting soybean into rye cover crop

The more cover crop biomass production, the greater the benefits to farmers and the environment

Identification of management decisions that maximize cover crop biomass without affecting yield can make cover crops an economical choice that benefits crop production. Cover crop biomass production is positively associated with nutrient retention, soil health and pest/weed management. However, these benefits are rarely observed because cover crops have not been optimized to the corn-soybean system.

Our work with USB has shown that cover crops before soybeans are easier to manage and more successful than cover crops before corn because they have more time to grow. Cover crops produce more biomass before soybeans for two reasons: 1) soybeans are planted on average three weeks after corn and; 2) cover crops can be terminated as little as one day before soybean planting without impacting soybean yield whereas, cover crops must killed at least 10 days before corn planting to avoid corn yield loss.

In fact, our results show no difference in soybean yield following a cover crop killed *three weeks prior* to soybean planting vs. a cover crop that was killed *one day* before soybean planting

The future

Now that we have documented the importance of soybean for cover crop success, we seek to optimize cover crops within the corn-soybean system to maximize farmer return on investment in cover crops.

We propose that high cover crop biomass production can reduce or eliminate cover crop costs by: 1) retaining nutrients

in the soil; 2) improving soil health; and 3) reducing the need for pest/weed management. Our current work has shown that a short period of extra growth can increase nitrogen retention by 30-60 lbs per acre. Cereal Rye cover crop use is also credited with reducing the loss of soil phosphorous in row crop fields to water bodies by 50% (Iowa Nutrient Reduction Strategy). The value of these nutrients is substantial. Moreover, high cover crop biomass may suppress weed growth and may impact certain insects and pathogens.

Ultimately, we will develop web-based decision support systems that allow soybean growers to maximize cover crop benefits through interactions between corn genetics and cover crop management before soybeans. Corn genetics with rapid dry-down will save drying costs and allow earlier planting of cover crops in the fall, which is a critical period for cover crop establishment. Spring growth rates of cover crops are greatly accelerated if the cover crop has achieved sufficient growth to tiller in the fall.

By combining early dry-down corn and early cover crop planting with late cover crop kill prior to soybean, we will develop a web-based tool that allows farmers to assess the benefits of particular management scenarios. For example, farmers can alter corn maturity group and cover crop planting date to derive probabilities of corn grain yield and moisture as well as subsequent cover crop biomass production, nutrient retention and pest/weed pressure. Ultimately, farmers can ask: given particular cover crop planting and termination dates, what is the probability that sufficient cover crop biomass will accumulate to reduce nitrate leaching and external pest management inputs while building soil organic matter?

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