Science Societies

Diversifying beyond the corn–soybean rotation is possible, but comes with obstacles

By Tanner Ehmke

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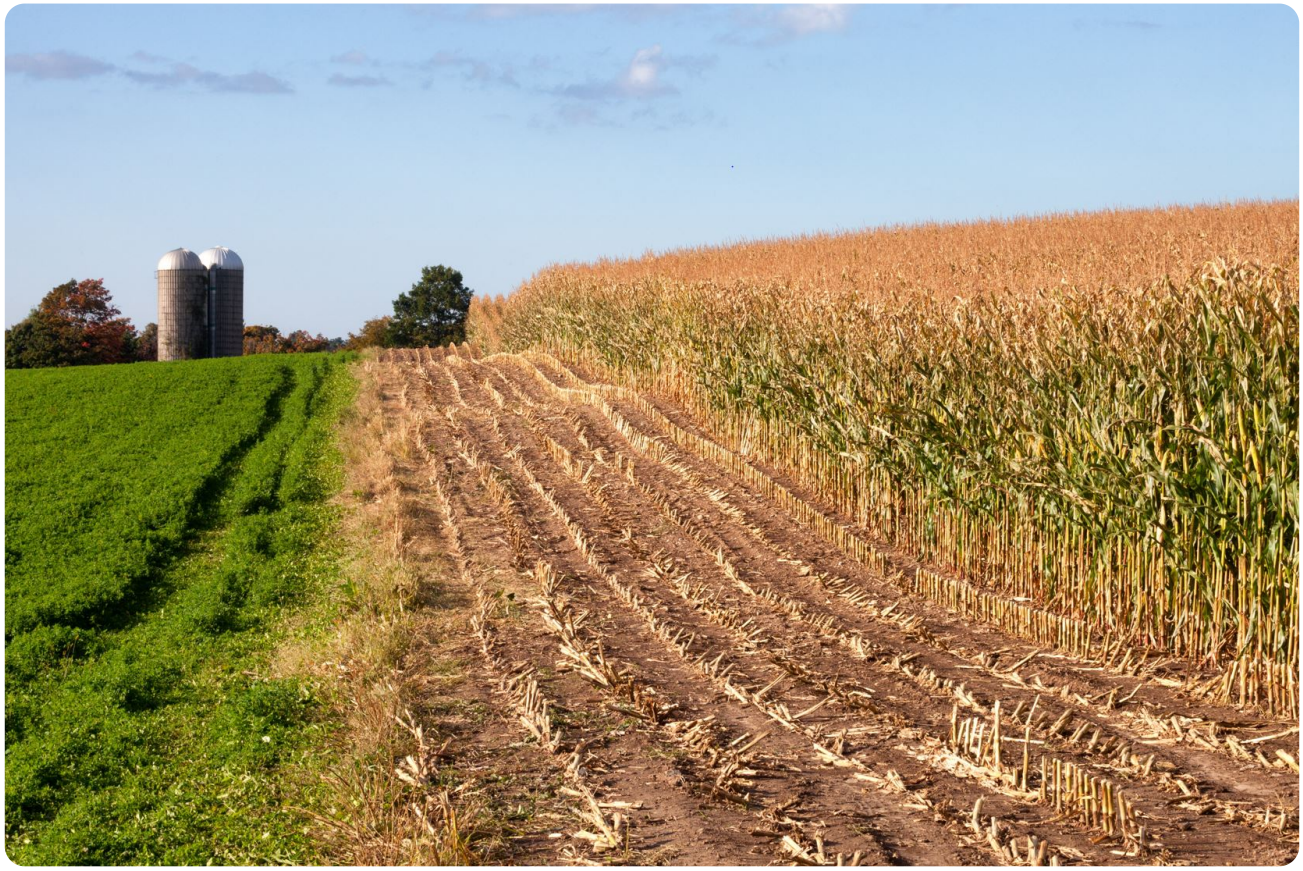


There are numerous benefits to more diverse rotations, but breaking out of the two-crop corn–soybean rotation is not easy. Photo by the University of Nebraska–Lincoln CropWatch and courtesy of Javed Iqbal.

The crop rotation is the uncontested top crop rotation in the U.S. Today, corn and soybeans together occupy more than half of all principal crop acres planted in the U.S. In the Corn Belt states of Illinois, Indiana, and Iowa, scarcely any rotation involves a crop outside of corn and soybeans. Farmers, though, have a strong interest in breaking out of the simple two-crop rotation and are knowledgeable about the numerous agronomic and environmental benefits of diverse rotations, but leaving the corn–soybean rotation isn't easy. Earn 0.5 CEUs in Crop Management by this article and taking the quiz.

The corn–soybean crop rotation is the uncontested top crop rotation in the U.S. Today, corn and soybeans together occupy nearly 180 million acres each year—more than half of all principal crop acres planted in the U.S., according to USDA-NASS.

In the Corn Belt states of Illinois, Indiana, and Iowa, scarcely any rotation involves a crop outside of corn and soybeans where the two crops are planted on more than 90% of the total crop acreage. In fact, USDA no longer reports how many wheat acres are grown in Iowa or how many oat acres are in Indiana. Reporting barley acres in the

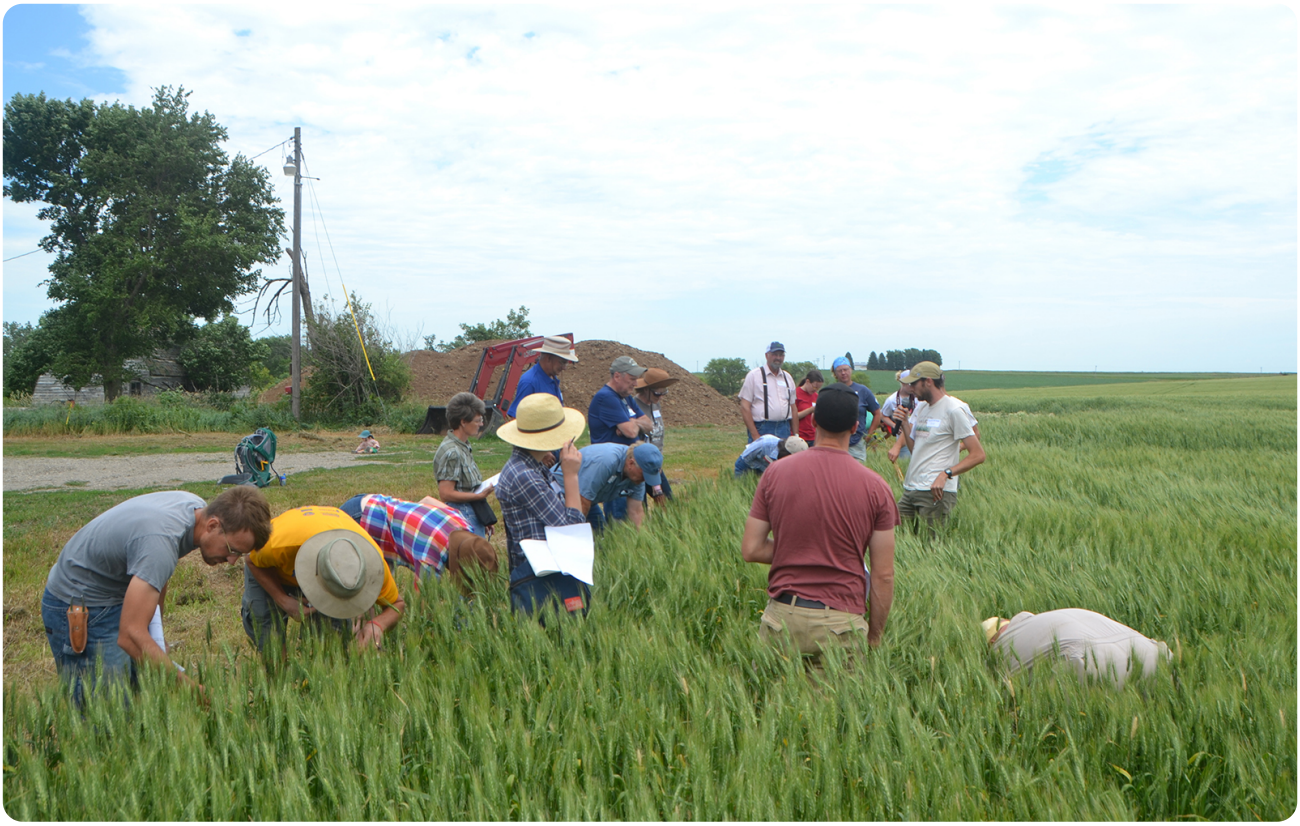
three states stopped altogether over 40 years ago.

Farmers, though, have a strong interest in breaking out of the simple two-crop rotation and are knowledgeable about the numerous agronomic and environmental benefits of diverse rotations, according to university surveys of farmers across the Corn Belt. Farmers even express boredom with doing the same two-crop rotation year after year.

However, leaving the corn-soybean rotation isn't easy.

Dr. J.G. Arbuckle, professor of rural sociology at Iowa State University who participated in a 2021 study that surveyed Iowa farmers on cropping systems and farming practices, notes that farmers are interested in diversifying away from the corn–soybean rotation and are knowledgeable about the benefits but feel very constrained.

The study, published in the journal *Agricultural & Environmental Letters* and coauthored by a team of researchers at Iowa State University, investigated farmers' attitudes and knowledge of crop rotations across the U.S. Corn Belt. The study noted that small grains in extended rotations have high potential to improve environmental quality, soil health, and economic returns to farmers over time.



Iowa farmers at a field day for small grains in extended rotations. Photo courtesy of Practical Farmers of Iowa and originally published here.

Although farmers are interested and aware of the benefits of more diverse cropping systems, leaving the corn–soybean rotation is not easily done.

“What we found was there was a strong interest among farmers in the potential for diversification and really strong awareness of soil health benefits, economic benefits, and pest and disease suppression benefits,” Arbuckle explains. “But the structural barriers to adopting some other production system, particularly in the heart of the Corn Belt, were really tough for them to get past. There’s cultural, economic and policy barriers that make it hard to choose another pathway that’s not corn and soybeans.”

Barriers

Matt Liebman, professor emeritus of agronomy at Iowa State University who also participated in the study, notes farmers are keenly aware of the agronomic benefits of crop diversity, particularly to soil quality. Farmers understand that diverse rotations reduce the need for inputs, break weed and pest cycles, and improve soil retention and health.

“Diverse crop rotations, particularly those that are integrated with livestock production, can increase soil particulate organic matter, improve nutrient recycling and nutrient retention, improve soil physical structure that increases rainfall infiltration and makes more of the soil volume available to crop roots. Diverse rotations also lead to increases in crop performance with lower inputs of fertilizer and pesticides,” Liebman explains. “In the modern context, crop rotations can be important for managing emerging pests. We have weeds that are now resistant to most of the common herbicides in corn and soybean production. And the use of rotation crops, particularly with small grains and forages, affords additional opportunities to suppress those weed populations that can’t be gained in a simple corn–soybean rotation.”

The biggest hurdle to realizing the numerous benefits of breaking away from the corn–soybean rotation in favor of a more diverse crop rotations, he notes, is based on markets.

“Marketing is a big deal,” Liebman points out. “You can take Number 2 yellow dent corn to a local elevator, whereas if you’ve got high quality oats with a high test weight, the local elevator may not have any marketing channel. So, you spend more time organizing a sales point, which may be several hundred miles away if you want to get a premium price. And we’re not talking about organic. We’re just talking about high quality food-grade oats.”

Even if you try to incorporate small grains into your rotation, your local grain elevator may not take them. Photo courtesy of Pixabay.

For Todd Steinacher, CCA in Illinois, the decision matrix on what to plant on a farmer's field always includes profitability. Small grains, he says, typically don't pencil a profit on most fields like corn and soybeans can. While there is always demand for corn and soybeans, he adds, demand for small grains like wheat and oats typically isn't strong enough in most markets to justify adding it to a farmers' rotation.

"Most elevators don't take wheat or other small grains. If I'm set up to handle 5,000 acres of corn, and I have one or two fields of wheat, where am I going to store it? You're kind of on your own," Steinacher says.

A strong demand base for corn and soybeans, partially driven by biofuel policies in the U.S., help drive the economics of corn and soybeans, Arbuckle adds. Subsidized crop insurance also lowers the revenue risk of corn and soybeans, making it even more

appealing compared with other crops.

“You’ve got the Renewable Fuel Standard to maintain demand and other policies to maintain prices in down years,” Arbuckle notes. “You’ve also got crop insurance. It’s a system that keeps them in business, but a lot of farmers wish they had more options and more ability to be creative and do something different.”

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Genetics

Quality crop genetics is another major motivator to stay with a corn–soybean rotation, Liebman notes.

“So many farmers perceive that the high quality genetics for corn and soybean production really aren’t available in places like Iowa for crops like oats, wheat, rye, or triticale,” he says. “Farmers in the central Corn Belt may look in neighboring states for seeds that may not be as well adapted to the local climate and soils.”

The lack of elite varieties of small grains adapted to local conditions makes it harder to achieve top yields needed to afford high cash rents of $300-$400 or more per acre, Arbuckle adds.

The high-performing technology packages and crop protectants that are paired with the corn and soybean genetics also make small grains less appealing, he points out.

“Farmers here are more reticent to plant oats and wheat because we just have different conditions that aren’t necessarily conducive given the varieties that are available,” Arbuckle says.

Improved genetics in corn and soybeans also allow farmers greater control over diseases that would otherwise be limited from a more diverse rotation, Steinacher adds.

If a farmer has farmed a corn-on-corn rotation for many years, diseases will start to live in the soils, he explains. Changing hybrids, changing the male and female plant populations, and using tillage can help minimize the impacts of soilborne diseases if a farmer doesn’t want to rotate into another crop, he adds.

And, yields have also improved dramatically for corn and soybeans because of genetics, he notes.

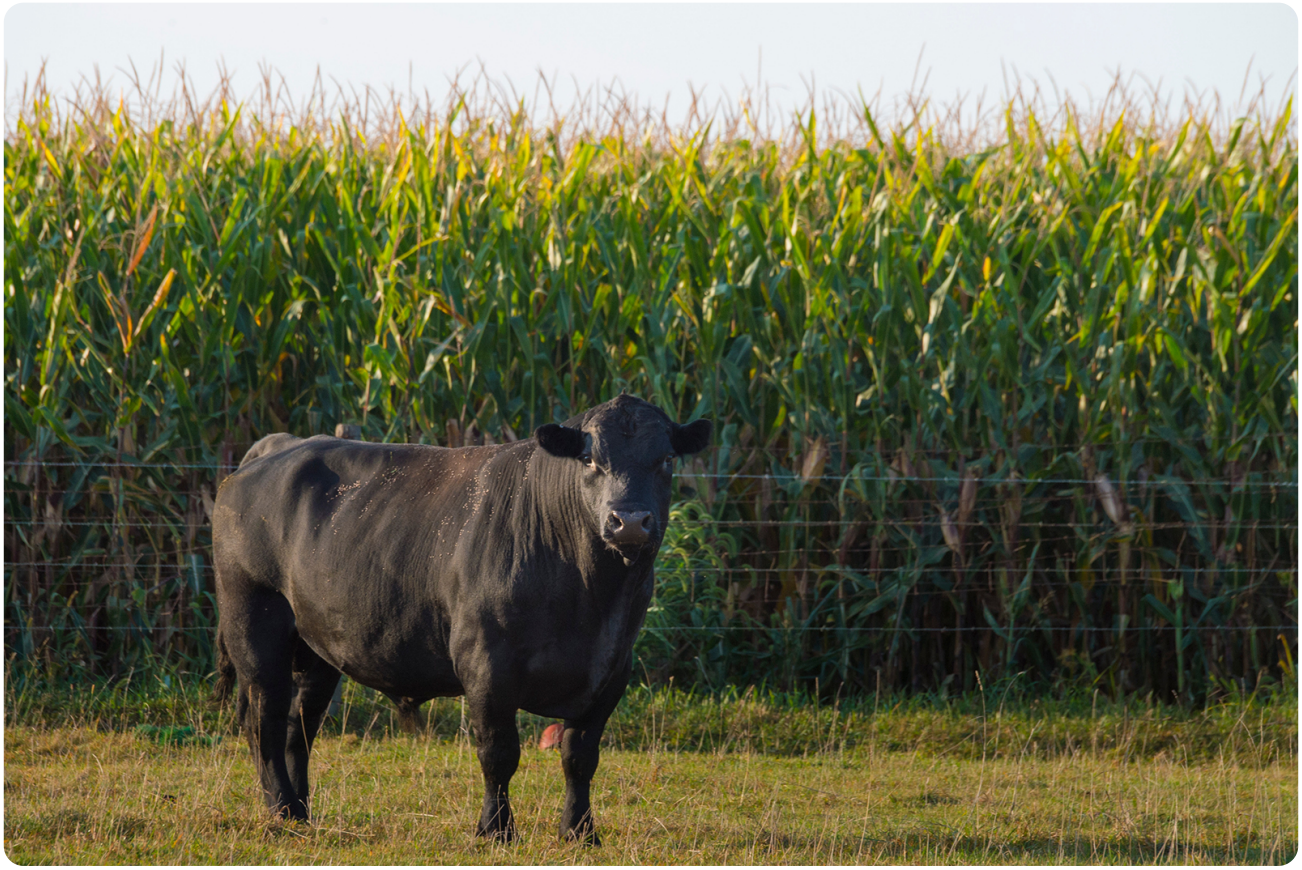
“We’re getting close to 100-bushel soybeans, and that helps with the profitability,” Steinacher says.

Livestock

The decoupling of livestock from crop production has also changed crop rotations, Liebman notes. With the cattle industry having moved west over the decades, farmers

in the Midwest lost a local marketing channel for forage crops.

“Historically, a very large number of farms in Iowa had cattle or sheep, so there was a use value for small grains and forages that was immediate,” Liebman explains. “The fact now that cattle feeding has shifted westward means that producing small grains as feed concentrates and forages has a much less immediate appeal for most farmers.”



The decoupling of livestock from crop production has changed crop rotations. With the cattle industry having moved west over the decades, farmers in the Midwest lost a local marketing channel for forage crops. USDA photo by Preston Keres.

If a farmer wants to be in a three-year rotation producing small grains with red clover intercropped with corn and soybeans, the farmer lacks a convenient local use for both the small-grain and forage crops, he notes.

Cost and return

The cost savings farmers gain on reduced nitrogen fertilizer and pest and weed control and the higher corn and soybean yields that typically result from a more diverse crop rotation make diverse rotations economically competitive with the corn–soybean rotation, Liebman notes, particularly when integrated with livestock.

“If it’s done judiciously, you can cut back on inputs,” Liebman says. “And particularly if you have a use value in the feed or livestock, diverse rotations can work out.”

Moving to move diverse rotations can help farmers cut back on their fertilizer and pesticide inputs that are necessary in the corn–soybean rotation. Photo by Design Pics Inc/Alamy Stock Photo.

In economic analyses of a long-term rotation experiment in Iowa that account for the labor associated with different rotations, the profitability of diverse systems was

essentially a wash in net returns per acre when averaged over all crops of the rotation, Liebman explains.

Diverse rotations win on being low cost compared with the corn–soybean rotation, he adds.

"The strategy is not necessarily based on maximizing gross revenue," Liebman notes. "It's based on cost containment and trying to increase your profit margins by reducing how much you spend on crop inputs like fertilizer and pesticides."

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However, working against the numerous barriers to breaking out of the corn–soybean rotation requires a change mindset, Steinacher stresses. Farmers, he says, are innovative and trying new approaches with rotations by including cover crops that include soil health and reduce weed competition.

That innovation will pay off, Liebman says, with some of the challenges agriculture faces with falling commodity prices and environmental concerns in production

agriculture.

“There’s quite a bright future for more diverse systems here,” Liebman says. “When you look at the environmental constraints—water limitations in the West, water quality concerns associated with farming—and also falling corn prices, I think there might be some good opportunities in the future. We need to be prepared for that.”

Dig deeper

Check out the article from the journal *Agricultural & Environmental Letters*:

Weisberger, D.A., McDaniel, M.D., Arbuckle, J.G., & Liebman, M. (2021). Farmer perspectives on benefits of and barriers to extended crop rotations in Iowa, USA. *Agricultural & Environmental Letters*, *6*, e20049. **https://doi.org/10.1002/ael2.20049**

Self-study CEU quiz

Earn 0.5 CEUs in Crop Management by taking the quiz for the article at https://web.sciencesocieties.org/Learning-Center/Courses. For your convenience, the quiz is printed below. The CEU can be purchased individually, or you can access as part of your Online Classroom Subscription.

1. The USDA stopped reporting barley acres more than 40 years ago in which states?

   a. Illinois, Iowa, and Nebraska.

   b. Illinois, Iowa, and Wisconsin.

   c. Indiana, Kansas, and Minnesota.

   d. Indiana, Illinois, and Iowa.

2. Which of the following is NOT a benefit of adopting diverse crop rotations?

   a. Additional opportunities for weed suppression.

   b. Increases in crop performance with lower fertilizer and pesticide input.

   c. High market demand for small grains.

   d. Improved soil physical structure and nutrient retention.

3. There are many elite varieties of small grains adapted to local conditions available for farmers across the Corn Belt.

   a. True.

   b. False.

4. What has been an outcome of decoupling livestock from crop production in the Midwest?

   a. The loss of an immediate use for corn.

   b. The loss of an immediate use for forages.

   c. An increased market for small grains.

   d. More planting of red clover.

5. Which of the following factors is the LEAST likely to move more farmers to adopt diverse rotations, according to the article?

   a. Falling corn prices.

   b. Concerns over water (either quality or limitations).

   c. Desire to reduce costs.

   d. Desire to maximize gross revenue.
