Reviving Feed and Seed Markets to Grow Small Grains in the Cornbelt: A Market Solution for Climate and Water Protection in Agriculture

Even though planting small grains into corn and soybean rotations breaks pest cycles and increases weed control while improving soil health and water quality these crops are still scarce in the Cornbelt.

Today, farmers primarily plant soybean opposite corn across the Cornbelt (states in Figure 1), but this has not always been the case. Previous to the 1960s the common crop rotation in states that drain into the Upper Mississippi River Basin included corn, a warm-season crop, planted opposite cool-season grasses and legumes. But since the 1970s, soybean, a warm-season legume, has replaced cool season crops in the rotation. Previous to the 1970s, small grains like oats in Iowa and northern Illinois; winter wheat in central Illinois, Indiana and Ohio; and barley in Minnesota and Wisconsin dominated the landscape. Small grains were traditionally established as nurse crops for cool-season legumes like red clover and alfalfa. Other times, small grains were sole-seeded and followed by leguminous summer cover crops. Planted acres of red clover in 1969 were 251,512 acres across 12 states in the Cornbelt. Alfalfa was planted on over 13.7 million acres in those same states (USDA NASS 1959-69). Today, nearly 36.3 million acres of soybeans are grown in Illinois, Iowa, Indiana, Minnesota, Ohio, and Wisconsin, occupying much of the acres grown opposite corn (USDA NASS 1982-2012).

Why did US corn farmers almost completely stop growing small grains and legumes and replace them with a warm season legume (soybean) over the past 50 years? The short answer is markets.

**On-farm Secondary Feed Markets:** Farms were overwhelmingly powered by horses up until 1945. By the 1960s their labor had been almost entirely replaced by tractors. Horses eat high fiber grains like oats and hay. This strong on-farm feed demand drove farmers to raise cool season crops and provided an outlet for them. Farmers grew small grains for food grade markets for processing into cereals, oatmeal, malting barley or bread. If a crop didn’t make food grade standards, the farmer could easily feed those small grains on-farm and retain much of their value for farm income.

A second reduction in demand for small grains occurred as livestock moved indoors and off the farm. Since the 1980s, livestock production has consolidated, with strong vertical integration where animals are owned and their feed is controlled by the animal processor. Poultry and swine producers overwhelmingly operate in these vertically integrated systems. Since 1969, the number of hogs in Iowa and the number of farms raising them has inverted. The 2012 census reported that hogs sold increased 136% since 1969 – nearly one and half times more animals – but raised on just 6,600 farms compared to 88,000 in 1969 (USDA NASS 1959-69; USDA NASS 1982-2012). The majority of the feed going into the hog ration is milled at central facilities and determined by a handful of company swine nutritionists. Poultry producers
also receive feed, care for animals and maintain buildings but do not make direct decisions on what feed grains are included in the finishing rations of these animals.

Dairy and beef cattle have been the last to move towards vertical integration in the Cornbelt. However total ruminant livestock numbers have decreased over time as cattle are moved into larger feedlots and into drier climates in states like Colorado. Total beef and dairy inventory in the Cornbelt states has declined about 35% since 1982, removing over 2.5 million cattle and cows from the landscape (USDA NASS 1982-2012). Despite lower populations in the Cornbelt, cattle owners had the most freedom to integrate small grains into feed rations until the ethanol boom. Ethanol by-products like dried distillers grains and solids (DDGS) have become so abundant in the past five years that ethanol companies found ways to create a secondary market for these byproducts in cattle feed. Cattle feeders who still controlled rations found DDGS to be a very abundant and very low priced feed alternative to small grains. This has lead to the latest reduction in small grains being fed to livestock in any significant way across the Cornbelt. Only in cases of organically raised animals or animals destined for premium markets like Niman Ranch or grass fed markets are small grains any significant part of a livestock ration.

Cover Crop Seed as a Secondary Market:

The move to corn and soybean rotations has had a negative impact on water quality, soil health, and greenhouse gas production. Because soybeans and corn are both warm season plants, every winter the ground is left bare and vulnerable to soil erosion and nutrient leaching for four or five months, one third to one half of the year. This is resulting in a water quality crisis. Agriculture accounts for over 70% of the nitrogen (N) and phosphorus (P) that enters the Gulf of Mexico via the Mississippi River, nutrients that have already created a nearly 5000-km² low-oxygen, or “hypoxic,” zone that threatens marine life in one of the nation’s largest and most productive fisheries (White et al. 2014).

To combat the negative soil and water impacts of this rotation, NRCS and organizations like PFI have promoted the use of cover crops to cover soil with living roots during these off times in the growing season. In the Cornbelt, located in the Upper Midwest, the crops most suitable for growth from November-March/April are small grains like winter rye, winter wheat and triticale. If farmers are concerned about managing the cover crop before planting the cash crop in the next spring, they may apply oats or barley early into still-growing corn and soybeans to cover the ground in the fall and then winter kill before next spring’s planting. As farmer adoption of cover crops has increased across the Cornbelt, so has demand for seed from these small grain crops – providing another potential secondary market for small grains growers. But despite the efforts of NRCS and PFI, cover crop adoption remains low: only 2.6% of corn and soybean acres in Iowa are planted with cover crops, and 7.1% in Indiana and 2.3% in Illinois respectively (EWG 2017). This is due to a number of factors, but a primary one is that with low commodity prices for corn and beans from 2014-2017 farmers can’t afford the added expense of implementing cover crops on their own, especially in the first years of mastering the management of the cover crop. To combat this PFI has worked with Unilever since 2015 (buying soybeans) and Pepsi starting in 2017 (buying corn) to financially support farmers in their supply sheds that grow cover crops. Programs like these augment public funds available to cost-share cover crops, begin to reach more middle and late adopters of cover crops and therefore increase the total numbers of cover crop acres planted. This increase in demand for cover crop seed provides small grain growers stronger market signals.

These shifts in crop rotations and how animals are integrated and fed on farms caused a critical shortage of secondary markets for small grains today. Reviving secondary markets for small grains in the form of livestock feed and cover crop seed production is a critical step to create a market-based solution to keep conservation cropping systems in place. Increasing the adoption of small grains as part of longer crop rotations in the Midwest would have the following benefits:
Economic:
- Stabilize long-term profitability of corn-soybean rotations by reduced dependence on purchased inputs primarily from improved soil quality and biological nitrogen from legume cover crops.
- Provide food and beverage companies another way to incentivize conservation cropping practices in their supply chain projects.

Agronomic:
- Kick-start soil health by greater rooting systems than corn and soybeans resulting in an increase in soil biological and therefore greater soil organic matter.
- Increased infiltration from improved soil and protected soil surface from increased cover.
- Improved soil biological activity for enhanced soil health via legumes and rhizodeposition (i.e., root exudates; fine root sloughing).
- Biological N fixation by legumes for soil fertility building and reduced fossil energy consumption.
- Disrupted pest and weed cycles by varying plant families and timing of field management activities.

Conservation:
- Improve water quality by increasing soil water uptake in the spring with cool season plants and reducing total flow at the very time our region receives its greatest rainfall.
- Decreased greenhouse gas emissions from reduced need for synthetic fertilizers with high embedded emissions in their production plus reduced loss of nitrogen that can convert to N₂O.
- Increase public approval of Cornbelt agriculture through evidence of more green fields in the winter-time leading to improved water quality.
- Greater small grain production to provide highly nutritional food ingredients for human and animal consumption of which there is market demand from US mills today.

Approach Innovation: Food, Feed and Seed Companies Collaborate Around Multi-Commodity Rotations for Soil Health

Extending crop rotation by at least a year is a low cost, high impact (multiple co-benefits) practice to adopt relative to simply promoting efficient fertilizer management and no-till. Yields of crops grown in extended rotation are typically 10% higher than those of crops grown in simple grain crop monocultures, and as much as 25% higher in drought years (SARE Crop Rotations Web).

However, uncertainty about markets for small grains and perceived high opportunity cost of crop production lost (displacing corn and soybean acres) has resulted in limited adoption (Paustian, et. al., 2016, Dinnes, 2004).

PFI model and other models like it, builds confidence in practice adoption by creating a peer-to-peer exchange for monitoring agronomic and economic costs and benefits, and setting up trials that are credible and replicable for increasing awareness between farmers and farmer advisors about how to grow better small grains and legume cover crops. However, farmers have had a tough time selling small grains within six months of harvest and some have held grain for nearly 12 months in storage. This has limited farmers' desires to go beyond 50 acres of small grain production on their farms.

Meanwhile, companies like Unilever, PepsiCo, Archer Daniels Midland, Cargill, Grain Millers, General Mills, DanoneWave, Blue Apron and Mars Petcare have invested in the farm-gate impact of their supply chains. sourcing any grain besides corn and soybeans is a main challenge for companies. Companies are good at collaborating around single commodities, but struggle to collaborate around all of the soil and climate friendly crops grown in extended rotation.
Most of the activity in improving the sustainability of the Cornbelt has been led by food and beverage Consumer Packaged Goods Companies (CPGs). Livestock, which represents about 40% of the demand for corn grain (Figure 3), has yet to adopt a leadership role. One of the main objectives of PFI and SFL’s work together is to test a new reality for animal protein in dairy, beef and pork supply chains that involves feeding small grains grown within a corn-soybean rotation to livestock, linking companies’ desire to increase sustainability in their supply chain and farmers’ desire to grow more small grain crops.

Reviving strong secondary markets for small grains in the form of livestock feed and cover crop seed in the Cornbelt, will leverage a market based solution soil health improvement. Getting to scale requires that meat and dairy companies pilot and measure the benefits and logistics of incorporating small grains into feed rations, and increase cover crop use through company investment creating demand for small grains as seed and a diversity of markets for their small grains. Public and private sector partners across the supply chain working on row crop sustainability will understand and share the significant and long-term benefits of extended rotations in terms of improvements to corn and soybean yields (resulting in long term food security), soil C sequestration, and reductions in total N loss into surface waters (Paustian et. al., 2016; Bennet et. al., 2012; Dinnes, 2004).

A Roadmap for piloting secondary small grains and cover crop markets:
1. Feed livestock small grains and complete needed analysis with protein companies to better understand the business case and barriers for scaling the volume of small grains in their feed supply chain.
2. Food and beverage companies continue to drive cover crop adoption and therefore seed demand.
3. Farmers increase acres of small grains grown as a third crop in the corn and soybean rotation through market access, farmer awareness of agronomic, economic and conservation benefits; cover crop incentivizes establishment through cost share payments; and entrepreneurial farmer aggregators to link farmers to small grains markets.

References