

Cover Crops

Ninety percent of grain growers use crop rotations (most of those are two-year rotations), but fewer than 7% use cover crops in their rotations and only about 1% of all cropland acres were in cover crops in 2010 (1). Most cover crops planted by Midwestern farmers are not harvested and sold. Rather, they are planted and then chopped, mowed, or plowed down.

Cover crops help build soil organic matter by scavenging nitrogen and other nutrients left in the soil and using it for growth, tying it up in the plant material of the growing cover crop. Once the cover crop is chopped, mowed, plowed, etc.; the billions of bacteria and fungi that live in the soil break down that plant material gradually. Cover cropping has multiple benefits on the farm and off the farm, many of which are difficult to represent in dollars. Cover crops keep living roots in the ground when there is no cash crop growing, which keeps soil anchored in place and reduces soil erosion. This in turn contributes to improved water quality. Cover crops help to break weed, pest and

Cover Crop Nitrogen

The amount of nitrogen available to the next crop from a plowed-down cover crop depends on timing of plow-down, type of cover crop, amount of ground cover and maturity of the cover crop, weather and soil conditions while the plowed-down crop is breaking down, and other factors.

This example is based on a hairy vetch cover crop that produces 60 lbs./acre of nitrogen (1).

- Assuming that the hairy vetch is plowed down and incorporated into the soil, about half of that nitrogen becomes available to the following corn crop (2).
- $60 \text{ lbs/acre} / 2 = 30 \text{ lbs./acre}$
- Based on 2012 fertilizer prices, the value of that nitrogen is:
 $30 \text{ lbs./acre} \times \$0.60/\text{lb} (3) = \$18/\text{acre}$

References:

- (1) **Winter Cover Crops.** 2010. Kristine Moncada and Craig Sheaffer. In *Organic Risk Management*. Eds. Kristine Moncada and Craig Sheaffer. University of Minnesota.
www.organicriskmanagement.umn.edu/winter_cover13.html (accessed 9/03/13).
- (2) **Managing Cover Crops Profitably.** 2007. Sustainable Agriculture Research and Education (SARE), USDA.
www.northcentralsare.org/Educational-Resources/Books/Managing-Cover-Crops-Profitably-3rd-Edition (accessed 9/03/13).
- (3) **Fertilizer Use and Price.** Reports from the Economic Research Service, USDA.
www.ers.usda.gov/data-products/fertilizer-use-and-price.aspx#26727. (accessed 6/11/13)

disease cycles, which results in lower crop damage and avoided costs from lower use of herbicides and pesticides. Cover crops, especially legumes, can contribute nitrogen to the next cash crop, reducing the need for purchased fertilizer (2,3). Each one of these effects may be fairly subtle and might not be seen every year; depending on weather conditions, the cover crop used, and how the cover crop is managed. Overall, especially over time, the impact of consistent cover cropping on the whole farm's system can be very positive (3).

An interesting feature of cover crops is that they are frequently aerial-seeded into a standing crop. "Flying" the seed onto the field with a small plane avoids any damage to the cash crop caused by running seeding equipment on the ground. Cover crop seeding is often done in the middle of the growing season, once the crops are already beginning to mature. As the cash crop matures, it drops leaves or leaves dry up, letting more light through the crop canopy to allow the cover crop to grow (4). The cover crop is then established at the time of cash crop harvest and may continue to grow after harvest, depending on weather conditions. Besides use with corn and soybeans, cover crops can also be effectively used with many other cash crops such as wheat, other small grains, sunflowers or other oilseeds, or vegetable crops.

If cover cropping is a practice that you want to encourage in your farm transition plan, then it is important to recognize the long-term investment nature of cover cropping in the way that you structure a rental, lease, or sale agreement. There are costs to planting and then plowing down a cover crop, and a time cost of managing a complex system. There are multiple benefits to cover cropping, but they build up over time and it may take several years to see the benefits.

Some things to consider:

- Converting all or part of a farm operation to cover cropping is a situation in which it might make sense to use a "stepped rent" together with a long-term lease, with payments lower in the first few years than in subsequent years. If the land will be sold, structuring the payments to be lower in the first few years would help encourage cover cropping.
- As the long-term benefits of cover cropping become more clear, conservation programs (public and private) are stepping in to offer incentive payments for cover cropping. Program payments can be part of the financing for a farm that uses cover cropping.
- Landowners might consider giving the farm operator a credit for the extra management work that leads to long-term improvement of the soil.
- Retiring farmers and landowners who want to see cover cropping happen on their land will also need to clearly specify this requirement in the terms of any agreement, because it isn't the easiest choice for a farmer to make when it comes to labor and management costs. See the Conservation Financing document for more information about options for rent or lease terms.

Cover Crop Yield Gain

Cover crops may be especially beneficial for the subsequent cash crop yields in a drought year. Survey results in the Corn Belt in late 2012, a year of widespread drought, showed that farmers who had used cover crops in the previous season had an average of 9.6% greater corn yields and 11.6% greater soybean yields than farmers who had not used cover crops (1).

In the worst drought-affected areas, the yield increases were even higher with cover crops: 11% for corn, and 14.3% for soybean. This may have been due to greater water-holding capacity of soils in a cover-cropping system, and shading and cooling of the soil by the cover crop. Yield differences may be less dramatic or nonexistent in years with enough rainfall throughout the entire growing season. Not every year is a drought year, but many years have dry soil conditions for part of the growing season. Cover crops are good insurance against the risk of unpredictable weather.

This estimate of yield increases due to cover crops uses the Cover Crop Survey data (1), with some assumptions:

- Yield increase of 6% for corn and 11% for soybean when cover crops are used, based on survey data from farmers with less than three years of experience in cover crop use.
- One in three years might have weather conditions such that cover crop use could provide a yield boost. (On some soils and in some areas, that might be every year.)
- Five-year average corn and soybean yields and prices are from an Iowa study (2).

Example yield boost from cover crops:

- 194 bu/acre of corn x 1.06 = 206 bu/acre; 12 bu/acre gain
- 12 bu/acre x \$4.35/bu = \$52.20/acre gain from corn yield increase
- 50 bu/acre of soybean x 1.11 = 55.5 bu/acre; 5.5 bu/acre gain
- 5.5 bu/acre x \$9.95/bu = \$54.73/acre gain from soybean yield increases
- Average \$ gain from corn and soybean crops: $(\$52.20 + \$54.73)/2 = \$53.46/\text{acre}$
- Divide by three, for the one-year-in-three yield gain assumption: = \$17.82/acre

Rounded figure: \$18/acre/year estimated gain from a corn and soybean rotation when cover crops are used.

Continued on next page ...

Cover Crop Yield Gains, pg. 2

References:

- (1) **2012-2013 Cover Crop Survey.** June 2013. Steve Werblow and Chad Watts. Conservation Technology Information Center (CTIC) and North Central Region SARE. www.ctic.org/media/pdf/Cover%20Crops/SARE-CTIC%20Cover%20Crop%20Survey%202013.pdf (accessed 8/9/13)
- (2) **Energy and Economic Returns by Crop Rotation.** September 2012. Ann M. Johanns, Craig Chase, and Matt Liebmann. Iowa State University Extension. www.extension.iastate.edu/agdm/crops/html/a1-90.html (accessed 8/12/13).

Cover Cropping			
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Qualitative Benefits of the Practice	Cost of Implementation and Potential Income Loss	Potential Income Gain and Reduced/Avoided Costs	Your Judgment: Value Per Acre of This Practice on Your Land
<p>Conserves soil moisture</p> <p>Adds valuable organic material to the soil</p> <p>Scavenges and holds nutrients that might otherwise be lost from the soil</p> <p>Protects water quality by holding soil and nutrients in place</p> <p>Increases diversity of plant species on the farm and may improve wildlife habitat</p> <p>Helps reduce weeds</p> <p>May allow reduced herbicide application on the cash crop</p> <p>Helps break pest and disease cycles</p> <p>The numbers in this table are broad estimates, and you should adjust them for your farm's conditions.</p>	<p>Cost of cover crop seed blend: \$20 to \$35 per acre, depending on cover crop types chosen (4)</p> <p>Cost of aerial seeding into standing corn or soybean crop: \$15 per acre (4)</p> <p>Cost of killing the cover crop prior to planting the cash crop: \$16/acre for tillage method, \$7/acre for ground spraying, \$10/acre for aerial spraying (6)</p> <p>Management cost for dealing with a more-complex system than corn & soybean: estimate at ¼ of crop rotation "Complexity Cost," so \$15/acre (see <i>Complexity Cost text box in Crop Rotation section</i>)</p>	<p>Corn and soybean income gain from yield gains per acre following cover crop; \$18/acre (see <i>Cover Crop Yield Gain textbox</i>)</p> <p>Avoided cost of nitrogen fertilizer because of nitrogen supplied by a legume cover crop: \$18/acre (see <i>Cover Crop Nitrogen text box</i>)</p> <p>\$8.60/acre/year gain in fertilizer value of soil by saving 4.1 tons/acre/year from soil erosion; cumulative over years (see <i>Value of Saving Soil text box in Crop Rotation section</i>)</p> <p>Benefit to society: approximately \$20/acre/year gain in water quality value of soil by saving 4.1 tons/acre/year of soil from erosion (see <i>Value of Saving Soil text box in Crop Rotation section</i>)</p>	<p>Potential income gain and costs avoided: +</p> <p>Potential income loss and costs to pay: -</p> <p>Your judgment on value to your farm of qualitative benefits: +</p> <p>Value to society or environment: +</p> <p>Add up the total net value per acre per year:</p> <p>Multiply by a time frame (5 years? 10 years?)</p> <p>Total value over time:</p>

References:

- (1) **While Crop Rotations are Common, Cover Crops Remain Rare:** USDA/ERS
www.ers.usda.gov/amber-waves/2013-march/while-crop-rotations-are-common,-cover-crops-remain-rare.aspx
- (2) **Winter Cover Crops.** 2010. Kristine Moncada and Craig Sheaffer. In *Organic Risk Management*. Eds. Kristine Moncada and Craig Sheaffer. University of Minnesota.
www.organicriskmanagement.umn.edu/winter_cover13.html (accessed 9/03/13).
- (3) **Managing Cover Crops Profitably.** 2007. Sustainable Agriculture Research and Education (SARE), USDA.
www.northcentralsare.org/Educational-Resources/Books/Managing-Cover-Crops-Profitably-3rd-Edition (accessed 9/03/13).
- (4) **Aerial Seeding Cover Crops.** 2012. Allamakee Soil & Water Conservation District.
<http://allamakeeswcd.org/aerial-seeding-cover-crops/>
- (5) **2012-2013 Cover Crop Survey.** June 2013. Steve Werblow and Chad Watts. Conservation Technology Information Center (CTIC) and North Central Region SARE. www.ctic.org/media/pdf/Cover%20Crops/SARE-CTIC%20Cover%20Crop%20Survey%202013.pdf (accessed 8/9/13)
- (6) **2013 Iowa Farm Custom Rate Survey.** March 2013. William Edwards, Ann Johanns, and Andy Chamra. In *Ag Decision Maker*, Iowa State University Extension and Outreach. www.extension.iastate.edu/agdm/crops/pdf/a3-10.pdf

Further Resources:

Cover Crop Chart: An intuitive educational resource for extension professionals. 2013. Liebig, M.A., H.A. Johnson, D.W. Archer, J.R. Hendrickson, K.A. Nichols, M.R. Schmer, and D.L. Tanaka. *Journal of Extension* [Online], 51(3) Article 3TOT7. Available at www.joe.org/joe/2013june/tt7.php. (accessed 9/03/13).

Visually similar to the periodic table, the CCC includes information on 46 cover crop species and provides information regarding the suitability of these crops for addressing different production and natural resource goals.

Cover Crop Decision Tools. Midwest Cover Crops Council.
www.mccc.msu.edu/selectorINTRO.html (accessed 9/03/13).

This online resource has cover crop information specific to seven states and the province of Ontario, and allows you to enter your farm's information to build a plan specific to your farm.

Using Cover Crops to Improve Soil and Water Quality. 2009. James Hoorman. The Ohio State University Extension. <http://mercer.osu.edu/topics/agriculture-and-natural-resources/Using%20Cover%20crops%20SAG%2008%2009.pdf> (accessed 9/03/13).
The four-page publication summarizes of all the ways cover crops help farmers improve their soil and water quality with cover crops. It presents advantages and disadvantages of cover crops and lists the different effects of cover cropping on soil and water quality.

Winter Cover Crops. 2010. Kristine Moncada and Craig Sheaffer. In *Organic Risk Management*. Eds. Kristine Moncada and Craig Sheaffer. University of Minnesota. www.organicriskmanagement.umn.edu/winter_cover13.html (accessed 9/03/13).
This online manual is intended as a guide for organic and transitioning producers in the Upper Midwest, but includes a lot of good basic agronomic and soil science information that is useful to non-organic farmers as well.

Soil Health. Burleigh County, North Dakota Soil and Water Conservation District. www.bcsd.com/?id=23 (accessed 6/11/13)
This county-based program offers a number of useful resources on soil management and cover crops.

Special Report on Burleigh County's Soil Health Team.
www.landstewardshipproject.org/repository/1/676/soil_health_lsl_package_final.pdf
The Land Stewardship Project has developed a series of articles on what farmers, conservationists and scientists are doing in one North Dakota Soil Conservation District to build healthy soils using cover crop cocktails and other methods.