

# COVER CROP FACTS

## Cover Crops and Carbon Sequestration

An overview of cover crop impacts on U.S. cropland carbon sequestration.



Photo Credit: Edwin Remsberg

### ABOUT COVER CROPS

Cover crops are tools to keep the soil in place, bolster soil health, improve water quality and reduce pollution from agricultural activities.

- They include cereals, brassicas, legumes and other broadleaf species, and can be annual or perennial plants. Cover crops can be adapted to fit almost any production system.
- Popular cover crops include cereal rye, crimson clover and oilseed radish. Familiar small grain crops, like winter wheat and barley, can also be adapted for use as cover crops.

### Rapid Growth in Cover Crop Acreage

In 2012, the USDA reported 10.3 million acres of U.S. cropland planted to cover crops.<sup>1</sup>

- Recent surveys by SARE and the Conservation Technology Information Center (CTIC) suggest that cover crop acreage is increasing by 15 percent per year.
- These results suggest that 20 million acres (8.1 million hectares) across the United States are likely to be planted in cover crops by the year 2020.
- With about 267 million acres of row crop agriculture in the United States, the potential for cover crop adoption is much higher than what has actually been achieved to date.<sup>2</sup>

Learn more at [www.sare.org/cover-crops](http://www.sare.org/cover-crops)

### The Soil as a Carbon Reservoir

Sequestering atmospheric carbon (CO<sub>2</sub>) in the soil helps to offset greenhouse gas emissions, such as the carbon dioxide emitted by cars, power plants and other burning of fossil fuels. The soil has significant potential to store carbon<sup>3</sup> and to mitigate the effects of climate change. Farmers, scientists and policymakers across the globe are particularly interested in the potential contribution of agricultural practices, like cover crops, to the sequestration of carbon in the soil.<sup>4</sup>

### Cover Crop Contributions to Carbon Sequestration

Cover crops are an important soil carbon sequestration strategy. The roots and shoots of cover crops feed bacteria, fungi, earthworms and other soil organisms, allowing soil carbon levels to increase over time. Some farmers think of this sequestration as “restoring” their soil carbon to the level that it was before cultivation or the initial plowing of the soil for agricultural production. Others are calling themselves “carbon farmers” or expressing the importance of soil health in general by referring to their responsibility to care for the “herds” of microorganisms in the soil.

Though research has addressed the effect of cover crops on carbon sequestration on a global scale, the impact across the United States has not been thoroughly assessed. To address this question, a review and analysis was conducted of five literature sources that included data from 26 separate research trials.<sup>5</sup> Each trial was required to have a minimum soil sampling depth of two inches and to have included soil carbon measurements before cover crop management began. For each research trial, a baseline method of analysis was used to understand the carbon sequestration factor associated with cover crop use. Those factors were then aggregated and the low, median and high values obtained.

The results of the analysis showed that, at the high value, **cover crops can sequester approximately 60 million metric tons of CO<sub>2</sub>-equivalent per year when planted across 20 million acres (8.1 million hectares), offsetting the emissions from 12.8 million passenger vehicles.**<sup>6</sup>



Photo Credit: Edwin Remsberg

## Achieving a Greater Understanding of What's Possible

Through this analysis, it became clear that there are some important research needs that must be met to more clearly address the effect of cover crops on soil carbon.

- **Sampling at greater depths:** The average soil sampling depth referenced in this study was 14.8 inches, but research has shown the need for soil samples to be taken at depths of at least 30 inches to accurately understand the response of soil carbon to management practices.<sup>7,8</sup> Otherwise, results may fail to account for 30 percent to 61 percent of the carbon stock that exists deeper into the root zone.<sup>9,10</sup>
- **Pre-treatment measurements needed:** Standard practices must be put into place that encourage researchers to take baseline, pre-treatment measurements of soil properties, including soil carbon content. If not, the sequestration potential of various management practices cannot be accurately determined.

## Digging Deeper

Planting practices are changing so that cover crops can be grown for longer period of time with increased biomass accumulation. Practices such as interseeding cover crops into standing cash crops or “planting green” (planting a cash crop directly into a living cover crop) can extend the cover crop growing season, allowing for greater root and biomass growth.<sup>11</sup> As cover crop acreage increases and more farmers adopt practices that maximize cover crop growth and ground coverage, the potential for biological carbon sequestration will grow.

<sup>1</sup> Myers, R. and C. Watts. 2015. Progress and perspectives with cover crops: interpreting three years of farmer surveys on cover crops. *J. Soil Water Conserv.* 70(6): 125A–129A.

<sup>2</sup> Acreage 06/20/2016. National Agricultural Statistics Service. <http://www.usda.gov/nass/PUBS/TODAYRPT/acrg0616.pdf>.

<sup>3</sup> Batjes, N.H. 1996. Total carbon and nitrogen in the soils of the world. *Eur. J. Soil Sci.* 47:151–163.

<sup>4</sup> Lal, R. 2015. Cover cropping and the “4 per Thousand” proposal. *J. Soil Water Conserv.* 70(6): 141A.

<sup>5</sup> This review was part of a larger assessment of cover crop effects on soil carbon, which assessed the results of 22 different studies and 78 total research trials, and explored cover crop impacts on preventing soil loss and associated emissions.

<sup>6</sup> Greenhouse gas equivalencies calculator. Environmental Protection Agency. <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>.

<sup>7</sup> Lal, R. 2006. Carbon management in agricultural soils. *Mitig. Adapt. Strat. Glob. Change* 12: 303–322.

<sup>8</sup> Olson, K.R. and M.M. Al-Kaisi. 2015. The importance of soil sampling depth for accurate account of soil organic carbon sequestration, storage, retention and loss. *Catena* 125: 33–37.

<sup>9</sup> Follet, R.F. 2009. US agriculture's relationship to soil carbon. *J. Soil Water Conserv.* 64(6): 159A–165A.

<sup>10</sup> Jobbágy, E.G. and R.B. Jackson. 2000. The vertical distribution of soil organic carbon and its relation to climate and vegetation. *Ecol. Appl.* 10(2): 423–436.

<sup>11</sup> Report of the 2016–2017 Cover Crop Survey. Joint publication of the Conservation Technology Information Center and the North Central Region Sustainable Agriculture Research and Education Program. Conservation Technology Information Center. <http://www.sare.org/Learning-Center/Topic-Rooms/Cover-Crops/Cover-Crop-Surveys>.