

June, 2021

PRIVATE BENEFITS OF BUILDING SOIL CARBON

Markets for sequestered carbon have been around for many years, and the traditional supply of carbon offsets for these markets includes newly planted trees and methane digesters. However, the demand for carbon offsets is growing rapidly, and several groups are hoping to meet this demand by offering carbon contracts to farmers. In principle, the payments from these contracts represent the value that outsiders are willing to pay for reduced carbon emissions. Of course, farmers also get direct benefits from building their soils, and the value of these private benefits explain why good stewards of the land have been willing to invest in soil health before the external payments were available.

One traditional measure of soil carbon is soil organic matter (SOM). To build SOM, we have to add more plant residues back to the soil than the amount decomposed. For example, the top 6 inches of soil weighs about 1,000 tons per acre, so we have to add 10 tons of new organic material per acre to increase SOM by 1%. Although the residue from a 200-bushel corn crop weighs about 10 tons, some of the carbon in this residue is released as CO₂ by the decay organisms. So, we can only rely on part of the new crop residue to build SOM.

The rate at which SOM builds over time is driven by the same factors that affect soil biological activity, including temperature, moisture, pH, and nutrient availability. If biological activity is limited, then SOM will build at a slower rate or perhaps decline.

On the other hand, any actions you take to improve soil health can help to build SOM.

There are several important private benefits from higher SOM levels. First, biologically active soils with high SOM tend to have more air spaces or pores where water can enter the soil profile. The water infiltration rate is the amount of moisture that can enter the soil pores per hour, and recent research shows that infiltration rates can be two to three times higher in biologically active soils with more SOM.

Second, fields with higher SOM can retain more of the absorbed rainfall. As a rough rule-of-thumb, each one percent of SOM in the top 6 inches of soil can absorb up to 25,000 gallons of water per acre, which is roughly equivalent to 0.9 inches of rain. For example, soils with about 1% SOM will retain about 0.9 inches (20%) of a 4.5-inch rain, and soils with about 4% SOM will retain about 3.6 inches (80%) of a 4.5-inch rain. Corn and other crops can use more than 0.25 inches of water per day during the peak growth stages, so these additional water reserves can make a huge difference in yields during dry spells.

Finally, SOM is about five times more effective than clay particles at binding with nutrients in the soil. In particular, each 1% of SOM can hold about 1,000 pounds of total N plus other nutrients. Bacterial activity mineralizes some of this total N for use by plants during the crop season, and the amount released is higher in biologically active soils. As a rule of thumb, each added 1% of SOM can hold and release enough N to produce another 40-50 bushels of corn.

BOOST CROP YIELDS WITH CHANDLER FOLIAR

Chandler Foliar is a liquid product that contains cytokinins and other plant growth hormones, enzymes, micronutrients, and other biological compounds. The hormones promote cell division and elongation, which builds vegetative and reproductive growth. The enzymes and other non-toxic biological ingredients enhance photosynthesis and nutrient uptake to increase yields. Finally, the micronutrients in Foliar support enzyme formation and other biological functions of the plant. Foliar works best when applied before periods of fast growth or rapid cell division, and the optimal timing depends on the crop and its stage of development:

Corn -- Foliar works best on corn when applied late in the season (from tasseling to kernel set), and the reported yield gains typically range from 6-12 bushels per acre. Many people include Foliar when they make a late fungicide application.

Soybeans -- when applied at the third to fifth leaf stage or near the flowering stage, Foliar generates more nodes per plant, more beans per pod with better fill, and higher test weight and yield. To save trips, many users add Foliar to the tank when they apply post-emergence chemicals. The recommended application rate is 8 to 10 ounces per acre.

Alfalfa, grasses, and pastures -- Foliar builds quicker growth and higher tonnage after each cutting or grazing rotation, and it increases the nutrient content of the hay. The product is usually applied after the first and third cuttings at 10 ounces per acre.

Foliar may be applied by itself or in a tank mix, and it is compatible with most liquid fertilizers and pesticides. We recommend applying Foliar with 10-15 gallons of water per acre. For the 6 to 12 ounce application rates, Foliar costs about \$5.50-11.00 per acre at the full retail price. Also, you can save money by buying in larger containers (30 gallon drums or 275 gallon totes) or during our seasonal discount programs.

NET RETURNS FROM CHANDLER FOLIAR

The expected net returns from applying Chandler Foliar to corn and soybeans are reported in the following table. The returns are based on the latest projected farm prices for corn (\$5.50) and soybeans (\$13.00). The product cost is based on the full retail price of Foliar purchased in 2.5 gallon jugs, and the net returns will be higher if you buy 30 gallon drums or 275 gallon totes.

The recommended application rate for Foliar on corn or soybeans is 10 ounces per acre, so a 2.5 gallon jug will cover about 32 acres. The current price for Foliar is \$295 per jug, so the product cost is \$9.22 per acre. We also include \$5 per acre for application cost, but you can save an extra trip across the field by applying Foliar along with pesticides or foliar fertilizers. Finally, we use conservative expected yield gains that are less than our recent field results:

	Corn	Soybeans
Yield gain	+8 BPA	+4 BPA
Revenue gain	\$44.00 / A	\$52.00 / A
Cost per acre	\$14.22	\$14.22
Net return	\$29.78 / A	\$37.78 / A

Finally, you could also use Chandler Organic in place of Chandler Foliar to achieve these returns. Chandler Organic has similar yield benefits but a lower per-acre cost (\$8.60) because it contains less nitrogen in order to meet the national organic certification standards (OMRI).

2022 NATIONAL NO-TILL CONFERENCE

For the second year, we have signed on to support the National No-Till Conference as a major sponsor. The conference will return to its traditional in-person format on January 4-7, 2022, and the location is the Galt House Hotel in Louisville, KY. We are really looking forward to the next no-till conference, and we hope you can make it!

NOTES FOR NEW USERS OF CHANDLER SEED TREAT

We have many new users of Chandler Dry Seed Treat and Liquid Seed Treat in the past few years. If you are relatively new to these products, we have assembled the following list of items to check when you are scouting your fields so you can evaluate their performance. The following field notes apply equally to Dry Seed Treat and Liquid Seed Treat because both products tend to generate the same outcomes.

Visual differences -- in some cases, you may see clear evidence of the benefits provided by Chandler Seed Treat before harvest. These differences include faster emergence (usually 1 to 2 days), darker color, more uniform stands, faster growth, and earlier maturity. However, you may see fewer early differences among treated and untreated plants, especially if early-season growing conditions are very good.

Count plant populations -- treated seeds tend to have higher germination rates, so your emerged plant population (plants per acre) should be close to the planted population. For example, we have seen an average increase of about 2,000 plants per acre in treated corn and soybeans over the past several years.

Evaluate the root system -- carefully dig up the roots of treated and untreated plants and wash or brush excess soil from the root ball. Treated plants typically have broader and deeper root systems with deeper tap roots and many more of the fine feeder roots that bring nutrients into the plant. For legumes like soybeans, we often see 20 to 40% more nodules on treated plants.

Compare plant sugar levels -- we use a refractometer to check plant sugar levels at the base of the stalk and near the ear or grain head. On average, treated crops have 30 to 40% more plant sugar than untreated crops. Higher plant sugar levels protect seedlings from early-season frost and winter kill. Also, most insects cannot digest plant material with sugar levels over 10%, so the higher plant sugar levels deter insect damage.

Split open corn stalks -- the xylem structure in a plant stalk moves water and other nutrients from the roots to the growing parts of the plant. At each node, corn plants have filters in the that capture small particles and harmful microbes that enter the plant through damaged or dead roots. The filters protect the plant from these invaders, but any blockages in the filters also slow water and nutrients movement within the plant and hamper future growth.

To evaluate the overall health of the plant and root system, you can split the corn stalk from the root crown to the top of the plant and examine the filters at each node. If the plant roots are healthy, the filters will be open and the nodal tissue will appear white or light green. In contrast, plants with blocked filters will have a dark smudge at the affected nodes, which is a sign of poor root health. We typically find that corn treated with Dry Seed Treat or Liquid Seed Treat will have clean nodal filters, while some untreated plants have one or more dark or plugged filters.

Check ear fill -- prior to harvest, we count the number of kernels per ear at several locations in treated and untreated plots. The treated corn plants tend to have more uniform grain fill with more kernels around and along the length of the ear.

MID-SEASON APPLICATIONS OF CHANDLER SOIL

Some customers told us that they didn't apply their Chandler Soil this spring because it was too dry at planting time. Although microbial activity is limited under dry soil conditions, the microbe colonies will revive to mineralize nutrients and boost your soil health once soil moisture improves. So, Chandler Soil applied under dry conditions should provide the expected benefits later in the crop season.

Chandler Soil may be applied with most liquid fertilizers when you side-dress crops. Also, you can spray Chandler Soil on the soil surface after planting but before the crop canopies, and you can use conventional sprayers or irrigation equipment.

THE ABC'S OF PHOTOSYNTHESIS

During the growing season, plants absorb sunlight and use this energy to form plant sugars through the photosynthesis process. The sugars are formed by taking carbon from absorbed carbon dioxide (CO₂) and hydrogen from water taken up by the plant, and the sugars are used to create starch in the grain plus cellulose, lignin, and other structural components of the crop biomass. Also, the process frees oxygen, which is released to the atmosphere by the plant.

The photosynthesis process is controlled by enzymes. In particular, CO₂ is initially processed by a particular enzyme known as RuBisCO, and other specialized enzymes regulate all of the other processes related to plant life. To form each enzyme, plants require the presence of an associated micronutrient like boron, copper, or manganese. These micronutrients are like keys that are required to start the enzyme formation process.

Micronutrients are also required to form other biochemicals that are necessary for plant life. For example, chlorophyll absorbs the solar energy through the plant leaves. Chlorophyll does not contain iron (Fe), but iron is required to create chlorophyll. Thus, deficiencies of key micronutrients may limit photosynthesis activity and reduce crop yield potential.

Some soils are more likely to exhibit micronutrient deficiencies due to their particular structure and chemistry. For example, poorly drained soils tend to be deficient in iron (Fe), manganese (Mn), and zinc (Zn). In general, micronutrients tend to become more available as soil organic matter increases, but copper (Cu) is less available as organic matter rises. Soil pH also matters, and the optimal range for most micronutrients is between 6 and 7.

Finally, soil temperature affects nutrient availability (including micronutrients) and also the photosynthesis process. The peak availability for most soil nutrients occurs in the 60 to 75 degree Fahrenheit range.

LOOKING FORWARD TO NEXT YEAR

Last winter, all but one of the shows on our fall and winter schedule were cancelled, and we had to postpone our spring customer appreciation meetings for a second year. Fortunately, the recent openings announced by the Midwestern states have allowed the show sponsors to proceed with plans for the 2021-22 winter shows. So far, we have signed up for all of the shows we normally attend, and we are exploring some new options. We also hope this means we can get back to our usual March meeting schedule by next spring.

PREVIEW OF THE SEPTEMBER NEWSLETTER

We will issue the next newsletter in late August, and it will contain the price list for our fall discount program. The program offers up to 12% off on the Chandler crop products, and the discounts are available in September and October. We also expect to have some new test results from the soil health lab, and we will highlight the latest information on crop residue decay and nutrient recycling.

The Midwest Bio-Tech News

The newsletter is published quarterly in March, June, September, and December, and the first newsletter was published in March, 1993. An electronic archive of the newsletters published during the past 5 years is posted at our website, www.midwestbioman.com.

We only send the quarterly newsletters to past and present customers of Midwest Bio-Tech and to people who have requested additional information about our products. We do not purchase external mailing lists or gather names for the mailing list from other sources. To have your name and address added to or deleted from the newsletter mailing list, please send email to info@midwestbioman.com, call 309-659-7773, or send a letter to Midwest Bio-Tech, Inc., PO Box 156, Erie, IL 61250. Also, if you prefer to receive the newsletter in electronic form, please send us your email address.

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