IN TOUCH & IN TUNE by Truterra

How is soil carbon measured? And how much is it worth?

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With the recent launch of our TruCarbon™ program, we have received a lot of questions. The two most common are 1) how do you measure soil carbon, and 2) how much is it worth? In this issue of *In Touch and In Tune* we will address these two questions at a very high level. If you want to dig deeper, you will pick up plenty of information and terms that you can google from this article or you can reach out to your Truterra™ Account Manager.

How is soil carbon measured?

Soil carbon can be measured/estimated in several ways including soil sampling, soil modeling and a combination of both. Different entities can use different methods, for accredited programs, methods must be approved by a registry such as The Gold Standard (*www.goldstandard.org*) and an independent, third-party verifier.

Soil Modeling

Soil modeling is a complex process that uses a vast amount of information that we know, along with mathematical equations and algorithms to predict or estimate how much soil carbon is present across a large geography. A few factors that soil modeling considers are:

- **Soils type maps** – A lot of work has been done across the United States (particularly by NRCS) on mapping soil types. In general, soils that are higher in clay usually have more organic matter than sandier soils and tend to hold more carbon.
- **Environmental weather data** – Accessing weather data, such as temperature and rainfall, helps to predict microbial activity and predict soil carbon.
- **Tillage** – Knowing the tillage pattern of a field helps to predict if carbon has been released into the atmosphere or stored in the soil.
- **Cover crops** – Soils that have continuous cover on them are pulling carbon out of the atmosphere via photosynthesis and storing it in the soil in the form of plant and root tissues, which decompose into organic matter.

Layering these factors (and others) on top of each other helps to predict or estimate the amount of soil carbon in a variety of scenarios without having to sample each one. An important part of the soil carbon modeling process is periodic calibration with data from soil samples. This helps to ensure the model is accurate in its predictions.

Soil Testing

An integral part of utilizing soil sampling to measure soil carbon is to develop a scientific plan for the number and intensity of samples within your plot region. While zone sampling of every field to help predict carbon would be ideal, it is both labor and cost prohibitive. For this reason, we utilize stratification sampling, which is used to get useful data, with the appropriate resolution and confidence, while holding down costs. Stratification entails dividing the soils to be sampled into zones that are likely to have similar degrees of change. For example, differences in soil types, slope and aspect, vegetation cover, or management whether past or present may be good criteria for separating land into different strata zones. There are multiple computer-based soil mapping programs that help define these different strata based on NRCS soil type maps, etc. Developing a strong sampling intensely within the different strata zone can help predict carbon changes within each strata without having to sample every acre.

Soil testing for baseline carbon information or soil model calibration is very different than a soil sample taken for a grower to help with management decisions. The two most important soil tests to determine amount of soil carbon are:

- **Soil Organic Carbon** – Soil organic carbon is derived from living plant tissue, including leaves, roots, microbes, fungi and animal carcasses. It exists in a variety of forms as a result of decay processes and microbial metabolisms. The most accurate standard laboratory test for soil carbon is dry combustion. This test heats a small dry pulverized sample of soil to around 900o C and measure the CO_2 gas that is a combustion product. The results are expressed as the percentage of carbon in the sample.
- **Bulk Density** - The density of soils can vary over a wide range. Water has a density of 1 gram per cubic centimeter. Soils can have densities ranging from .1 for light peats to 1.8 for very dense, compacted mineral soils, often with little pore space for water and air. Organic matter is lighter than most mineral matter, so if organic matter increases in a soil, the density will likely decrease. The test for bulk density is simple: oven-dry a sample of known volume to remove all moisture and weigh it. The bulk density is the dry weight in grams divided by the volume in cubic centimeters.[1]

Total Carbon vs. Carbon Removal

It is important to know the difference between total soil carbon and "additional" storage based on a practice change. Total carbon is all of the carbon that is measured in the soil. The increase in "additional" soil Carbon is the incremental increase in carbon stored in the soil based upon a practice change such as reduced tillage or adoption of cover crops. In order to measure the additional carbon, we would need to measure (by model or sample) the amount of carbon in the soil before the practice change and after the practice change. Many companies purchasing carbon credits are only interested in purchasing the incremental increase as this is a real increase in carbon sequestration due to a practice change, rather than carbon that has been in the soil for many years.

Based on computer-based models looking at practice changes of reduced-till, no-till and /or cover crops across the US Geography, we can expect to see a carbon removal of 0.2 to 0.5 tons/A/year.

How much is a carbon credit worth?

Just like used cars and everything else, it depends on who is buying it and who is selling it. A carbon credit can be sold for as little as $3 or $4/ton or as much as $47/ton, with the majority of credits falling in the $10 to $15 range. The Microsoft offer of $20/ton of offset carbon is a very generous one in the current market.[2]

[1]MeasuringSoilCarbonChange.pdf (soilcarboncoalition.org)

[2]https://carboncreditcapital.com/value-of-carbon-market-update-2020/