International Carbon Sequestration Meeting

The Conservation Technology Information Center (CTIC) and United Nations carbon offset meeting paves the way for paying farmers to capture greenhouse gases

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Supported by science and spurred by emerging markets, more than 80 participants in an international workshop on carbon sequestration called on world policy-makers to focus research and create fair-priced carbon offset markets that would pay farmers to adopt conservation agriculture practices that will capture carbon in the soil.

Carbon offset markets would allow farmers to sell the service of capturing and storing – sequestering – carbon from the atmosphere. In turn, that would help offset the levels of greenhouse gases emitted by human activity, essentially locking up enough carbon in the soil to cancel out airborne emissions of tons of carbon dioxide, methane and nitrogen oxide. Currently, carbon credits from industrial sources are widely traded, but soil carbon has generally not been a marketable commodity.

The meeting – called the Conservation Agriculture Carbon Offset Consultation – was hosted by the Conservation Technology Information Center (CTIC) and the Food and Agriculture Organization of the United Nations (FAO) at the Purdue University campus October 28 through 30. Bringing experts from an array of disciplines, from soil science to economics, to focus on carbon sequestration was a bold move to use science and markets to promote opportunities for farmers around the world.

"To create working markets for farmers' efforts to capture atmospheric carbon, we need to understand the science of how carbon acts in the soil, and the science behind no-till systems," said Karen Scanlon, executive director of CTIC. "With that insight, we can quantify the effect that farmers have with specific practices and on specific soils, and create a fair compensation structure for those effects."

Working Meeting

After sharing their research results and field experiences from six continents, the participants spent several hours at the end of the meeting's third day in a lively discussion, hammering out a position statement call-

ing for the inclusion of soil carbon in worldwide carbon offset markets.

"This has been one of the better meetings I've been to because the focus has been on 'this is what we know, these are the answers we have, this is what we can accomplish today,' rather than focusing on the problems we have and what we don't know," said Dan Uthe, an industrial process consultant with Novecta in Johnson, Iowa.

The first day of the consultation was dedicated to exploring the science of soil carbon sequestration in the soil. Researchers from the South American tropics, the Australian bush, the Midwestern United States and China presented the results of their studies on how soil carbon levels responded to various tillage regimes. Not surprisingly, there were no simple answers.

Changes in soil carbon are small – imagine finding half a tonne of carbon in a mass of soil one hectare in area and 1 metre deep. Complex chemistry dictates that the soil can only sequester a limited amount of carbon per year, and that after a certain number of years – scientists believe it is 15 to 20 years – a field reaches a plateau.

To make it even more complex, the soil's capacity to store carbon depends on soil type, tillage system, the use of cover crops, cropping history and how much carbon it lost in the first place. Research from highly degraded soils in South America put into improved pasture showed dramatic jumps in carbon levels after five years – much higher storage than Midwestern soils in the U.S. Deep-rooted pasture plants also have the capacity to place carbon deeper into poor South American soils than annual crops do in cooler climates with richer ground. However, Corn Belt farms have the capacity to capture and store significant amounts of carbon, too.

"The higher the clay content, the more capacity there is to store carbon," said Charles Rice of Kansas State University.

Which Practices Help?

The less tillage used, the better the sequestration of the carbon, according to many scientists at the meeting. Though there were lively discussions on definitions of terms such as "conservation agriculture" and "no-till," the data showed that tillage burns soil carbon and releases greenhouse gases. The difference in the amount of crop residue required to rebuild soil carbon stocks also varied widely. Joao Carlos de Moraes Sa of the University of Ponta Grossa in Brazil pointed out that tropical Brazilian soils consume 9 to 14 tons of crop residue per hectare each year – often in a matter of months – while Rice's studies in Kansas showed that three tons of residue per hectare in his state was enough to yield an increase in soil carbon.

In Brazil, Telmo Amado of the Federal University of Santa Maria plants corn and a deep-rooted, perennial pasture grass called *Brachiata* together for great sequestration results. Tightly planted corn quickly grows tall, while shaded *Brachiata* sends roots deep into the soil. The result is a tremendous amount of

biomass above and below the ground – a cash crop, a grazing opportunity and plenty of residue for carbon-fixing microbes.

But just growing biomass isn't enough, says Amado. "One side of the equation is introducing this carbon," he noted. "The other side is how we stabilize it in the soil. Both physical and chemical protections are important."

That means protecting the soil surface with plenty of residue, maintaining soil structure by no-tilling or minimizing tillage, keeping soil microbes healthy (again through minimal soil disturbance), fertilizing crops adequately, avoiding soil compaction and rotating crops. "It's really site-specific, and we really need to understand the crop system we're talking about," said Amado.

Got to Pay

Building carbon levels in the soil delivers a variety of important benefits, from improved soil quality to better water-holding capacity, higher fertility and resistance to erosion. Still, the biggest enticement to sequestering carbon will be creating markets through which farmers can sell the service they provide.

"I think what we're really looking for as a farm organization, or society in general, is some way to reward farmers and ranchers for doing things like storing carbon and some other environmental practices," said North Dakota farmer Dale Enerson, who serves as director of the Carbon Credit Program for the National Farmers Union in Jamestown, N.D.

The National Farmers Union has served as an aggregator of carbon credits, collecting pledges from 3,700 growers in the U.S. to sequester carbon on 1.9 million hectares of cropland and rangeland and selling the bundle of carbon credits on the Chicago Climate Exchange (CCX). Participating growers received an average of $1.20 per ton of sequestered carbon. Official CCX estimates for carbon sequestration range from 0.5 to 1.5 tonnes per hectare on no-tilled cropland, 2 tonnes per hectare on long-term grassland (such as CRP ground) and 0.3 to 1.3 tonnes on rangeland with enhanced management practices.

In a pioneering carbon offset trading program in Alberta, Canada, 47% of the offsets are from agricultural land. On the Chicago Climate Exchange, 25.5% of the offsets have been purchased from farmers. In Canada, provincial carbon offset trading in Alberta and Saskatchewan are paving the way for nationwide caps on industrial greenhouse gas emissions that will kick in on 1 January 2010. Capping emissions will boost the market for tradable carbon offset credits, and agriculture wants to be part of the package.

Preparing soil carbon offset credits for a full-scale, regulation-driven market will require policymakers to sort out an array of issues, ranging from how long the contracts should be, who owns the carbon (the operator or the landowner), how practices are verified, and how to handle situations in which an operator releases carbon by disturbing the ground in violation of his contract.

"These cross-cutting issues can be worked out by working together," noted Don McCabe, an Ontario farmer who serves as vice president of the Soil Conservation Council of Canada, "because at the end of the day, it's the same science. We're starting to see the ball running down the hill. We've got to keep it rolling."

Though voluntary markets have kept the value of a ton of sequestered carbon low – prices on the Chicago Climate Exchange have ranged from 90 cents to $7.50 per tonne, and Alberta prices have ranged from $6.00 to $12.00 – McCabe believes a free market in which buyers are motivated by regulatory emissions caps could reach $65.00 per tonne by 2020.

That would be music to the ears of farmers – and the participants in the October meeting. "There has to be a fair-price incentive," said Rattan Lal, director of the Carbon Management and Sequestration Institute at The Ohio State University, "and $2 or $3 or $4 per acre in the market isn't going to do it."

Meeting sponsor Theodor Friedrich, senior officer for Crop Production Systems Intensification in the FAO's Crop and Pasture Service at the organization's world headquarters in Rome, Italy, said the program exceeded his expectations.

"We had a very good, sound gathering of experts and we had an unexpectedly high degree of coinciding views and agreement, and that allowed us to come up with a fairly punchy, clear and concise document with relevant recommendations," he said. "I could imagine that this meeting, the outcome and the proceedings being produced might be future references to further our objective to get soil carbon into the international carbon trading markets."

The Conservation Agriculture Carbon Offset Consultation was hosted by the Food and Agriculture Organization of the United Nations (FAO) and the Conservation Technology Information Center (CTIC), with sponsorship from Agrotain, Mosaic, Syngenta, the National Corn Growers Association, Case IH and the Indiana Soybean Association. Further information on the consultation, no-till farming and carbon sequestration is available at CTIC's web site, www.conservationinformation.org.

Tony Vyn of Purdue describes the university's 33-year-old no-till plots to a group of soil carbon experts from around the world.

Photo: Richard Fowler