In focus

A series of deep dives into AGCO Finance's whitepaper Farming for a better future.

Carbon farming: how agriculture can contribute to the climate agenda

Carbon farming is an emerging paradigm

Some early bungled attempts to create a carbon offsets trading market led to claims of greenwash. But today the market - though still small - is developing more robust platforms and checks. Carbon farming is laying the way for a significant new form of farming in which land stewards are financially rewarded for enhancing the soil's potential to act as a giant carbon sink. One estimate predicts the voluntary carbon market related to the land-based sector could be worth $50 billion by 2030.

Soil organic carbon and its storage capacity can be improved through two primary pathways. First, by increasing the application of carbon-rich inputs such as crop residue, compost and manure; and secondly, reducing the decomposition or decay rate of organic matter and soil carbon losses due to erosion through, for example, reduced tillage and crop diversity. Maximizing the soil's carbon storage capacity in this way also may reduces land degradation and increases agricultural yields and long-term profitability.

Farmers report promising results, beyond carbon credits

A study of 100 US farms by the Soil Health Institute and Cargill showed that farms that used soil health management systems such as no-till and cover crop methods increased their net income on average by $51.60 per acre for corn and $44.89 per acre for soybeans. Overall, the farmers interviewed in the study reported increased yields (67% of farmers), reduced applied fertilizers (83% of farmers), increased crop resilience (97% of farmers), increased access to their fields (93% of farmers), improved water quality (100% of farmers), increased soil organic matter (54% of farmers), and improved access to loans or better insurance terms (41% of farmers).

Currently, the world's entire food system, of which agriculture is a part, emits as much as 35% of the total annual human-generated greenhouse gases. If things continue as they are, this could increase to over 40% by 2050. The potential to reverse this dangerous trend is huge. Global soils hold three times more organic carbon than plants and twice as much as the atmosphere.

Old practices such as conventional tillage, the indiscriminate use of fertilizers and monocropping are being discouraged while farmers look to new methods (see table) that will help improve soil fertility and crop yield, while maximising the quantity of organic carbon held in the soil for the longest period of time.

The voluntary carbon market can help accelerate the transition

The carbon credits market has the potential to act as a major facilitator for scaling up carbon farming but currently there are some obstacles in the way. Farms worldwide are diverse and soil quality and its ability to store carbon varies greatly depending on climate and other regional factors.
The measuring methods of carbon credits need to be able to deal with this variability through standardized protocols.

Two other fundamental obstacles - permanence and additionality - also need to be addressed. Carbon credit markets expect the practices that lead to the storage of carbon in the soil to be permanent but individual farmers might not stick to the necessary practices as their ongoing choices and strategies change over time. Additionality relates to the fact that farmers will need to show the market that they are going beyond what they are already required to do. Both these obstacles need to be properly addressed and dealt with before the market can thrive.

A more temporary block is the problem of measuring the extent of soil carbon sequestration in each farm. Currently, monitoring, reporting and verification (MRV) is being done well in agroforestry due to the effectiveness of currently available technologies. However, we don't yet have equivalent technology for below-ground monitoring. So, markets rely on soil sampling and soil carbon modelling. These technologies will likely improve, however, so we'd expect this obstacle to be removed in the near future.

Nonetheless, in spite of these obstacles, change is already taking place. In France, for example, a government carbon offsets project using the Bas Carbone label established a MRV framework for GHG emissions with a specific methodology for agriculture, backed by an independent auditor. In February 2020, it launched a nationwide project, mainly covering dairy and beef farms, with an estimated saving of 137,000 metric tons CO_2 equivalent at the end of a five-year term. And in the US new platforms have emerged, such as Indigo Carbon, creating verified credits for soil carbon offsets covering more than 1,000 farms and 2 million acres of land. Indigo Carbon's first payments are expected to be $20 per metric ton of CO_2 equivalent.

The signs overall are that this new green market is gathering momentum and will enable farmers to trade carbon, making the sector a vital part of the effort to fight climate change for generations to come.

Different Agricultural Practices and Their Carbon Storage Potential

Type of action	Lower carbon storage potential	Medium carbon storage potential	Higher carbon storage potential
Erosion control	High erosion. No erosion management.	Medium erosion. Some erosion management.	Low to negligible erosion rates. Erosion management top priority.
Tillage	Conventional (with inversion). Deep tillage, secondary and occasional.	Conservation tillage with reduced tillage. Tillage only for special purposes.	No-tillage (direct drilling).
Irrigation	Water deficit significant part of the year, no irrigation possible.	Some water deficit. Drip irrigation possible.	No water deficit year round. Drip or sprinkler irrigation possible ('better water use efficiency).
Fertilization, organic matter management	N, S or P deficiency. Only chemical fertilizer used. Plant residue removed (burned/tilled).	Chemical fertilizer (no nutrient deficiency). Low residue removal rate, addition of untreated manure.	Combination of chemical fertilizer, plant organic matter (mulching, composting) and treated animal manure.
Selection of plant types and diversity	Monocrop plantation (annual or perennial), no rotation. No buffer areas.	Crop rotation for annuals. For permanent crops, allowance of some cover crops.	For annuals: Crop rotation with selected cover crops. For permanent and annual crops: proactive management of C:N ratio of crops and cover crops for maximization of soil carbon capture.
Livestock integration and management	No livestock.	Some livestock is integrated in the system (one type, sub-optimal grazing system).	Full integration of livestock (multi-species, optimal grazing technique and treated manure management).
Land use change	Farmed area not linked to carbon storage potential. Marginal areas under production.	Some areas are prioritized for carbon potential. Marginal areas left fallow.	Farming approach to reach maximum SOC potential ('carbon farmer'). Marginal areas managed to maximize above and belowground SOC.
Adoption of innovative approaches	Late majority (does not like to try innovative approaches).	Early majority (adopts only once most have adopted).	Early adopter (will try innovation even if others are doubting).

Recommended reading:

Farming for a better future, AGCO Finance whitepaper, December 2021.

Economics of soil health systems on 100 farms: A comprehensive analysis across nine states, Soil Health Institute and Cargill, 2021.

Lunik, E., & Raspe, O., Carbon sequestration in agricultural soils: How to unlock the green potential of the agricultural sector, RaboResearch, Rabobank, July 2021.

Toensmeier, Eric. The carbon farming solution: A global toolkit of perennial crops and regenerative agriculture practices for climate change mitigation and food security. Chelsea Green Publishing, 2016.