



## Growing a Greener Tomorrow: The ABCs of Carbon Farming

(\*Chinni Venkata Sai Bharath<sup>1</sup>, B. Mounika<sup>1</sup> and Kotha Shravani<sup>2</sup>)

<sup>1</sup>PhD Scholar, Department of Agricultural Extension Education, NDRI, Karnal

<sup>2</sup>PhD Scholar, Department of Agricultural Extension Education, IARI, New Delhi

\*Corresponding Author's email: [bharathchinni1@gmail.com](mailto:bharathchinni1@gmail.com)

### Abstract

Concern over climate change has drawn attention to an idea of carbon farming. “The rate at which greenhouse gases (GHGs) are building up in the atmosphere is frightening. About 34% of the world's emissions of GHGs come from agriculture and food production. Therefore, carbon farming can play a crucial role in addressing and combating climate change by reducing these emissions. By sequestering carbon in agricultural soils and plants, soil acts as a carbon sink helping to counteract the detrimental effects of excessive atmospheric carbon dioxide and enriching the carbon content in the soil. It gives farmers a chance to take part in carbon credit markets and earn extra money through carbon trading, apart from confronting climate change. Several business opportunities are booming with respect to carbon farming, which when utilized properly brings fortune to the farmers by strengthening their financial condition. However, to maximize the adoption of carbon farming techniques, issues like lack of awareness, initial investment costs, knowledge gaps, technical support and the requirement for supportive policies must be addressed. Overall, carbon farming is an approach to sustainable agriculture that simultaneously addresses food security and the mitigation of climate change.

**Keywords:** carbon credit, carbon farming, carbon trading, greenhouse gases etc

### Introduction

Global warming is considered as one of the greatest challenges for mankind. Greenhouse gases (GHGs) are accumulating in the atmosphere at an alarming rate, necessitating an immediate worldwide reaction (Sapkota and White, 2020). Agriculture and food production account for around 34% of global greenhouse gas emissions. As a result, it has a crucial role in reducing GHG emissions and working toward net zero emissions (Asher, 2021). Increase in global surface temperature is creating significant socio-economic challenges. To resolve the problem caused by greenhouse gases, two international treaties namely, Kyoto Protocol (1997) and the Paris Agreement (2015) came into operation with an aim to address global climate change by reducing greenhouse gas emissions.

So, in this instance for reducing greenhouse gas, as aimed by the above two international treaties, carbon farming can be a solution that can play a significant role in addressing climate change by reducing emissions.

### What is Carbon Farming?

“Carbon farming refers to land use and farm practices to sequester carbon in natural sinks, such as vegetation and soil or to abate agricultural production's contribution to greenhouse gas emissions”.

- (Tang *et al.*, 2019)

## What is Carbon sequestration

The technique of removing and storing atmospheric carbon dioxide is known as carbon sequestration.

The two fundamental keys to support carbon sequestration in soils is minimization of soil disturbance and increasing inputs of organic matter.

For greenhouse gas emissions, agriculture can serve as both a source and a sink. The use of fertilizers, crop intensity and tillage are three practical components of agriculture that have impact on carbon sequestration. Tillage and soil carbon are inversely correlated. Less soil carbon will be sequestered in the soil as tillage increases and vice versa. Fertilizers can affect soil carbon in both favourable and unfavourable ways. By adding additional organic matter to the soil, they can contribute to the sequestration of more carbon. Employing too much fertilizer can raise nitrogen oxide levels, which can degrade soil carbon and reduce the soil's ability to store carbon.

### Carbon sequestration techniques in Agriculture:

1. **Cover crops:** Planting cover crops during fallow times, such as legumes, clovers or grasses, can increase the amount of organic matter in the soil and help to sequester carbon.
2. **No-Till Agriculture:** No-till or reduced-till agriculture causes the least amount of soil disturbance during planting, preserving soil carbon.
3. **Crop Rotation:** Rotating your crops helps improve the soil's health and the sequestration of carbon.
4. **Managing peatlands:** Peatland management strategies such as re-wetting, afforestation and sustainable land use will minimize greenhouse gas emissions by avoiding the release of stored carbon, lowering methane generation and reducing wildfires in peatlands.
5. **Conservation Tillage:** Tillage reduction and mulching techniques help to reduce soil erosion and carbon loss.
6. **Rotational Grazing:** Rotational grazing involves dividing pastures into smaller paddocks and regularly rotating livestock between them. This practice prevents overgrazing and allows grasses to recover between grazing periods. As grasses grow and die back, their root systems continue to add organic matter to the soil, increasing carbon storage below ground.
7. **Wetland Restoration:** By encouraging the development of wetland plants and preserving peat soils, wetland restoration initiatives have the potential to store large amounts of carbon.
8. **Biochar application:** Carbon sequestration and soil fertility can both be increased by adding biochar, a type of charcoal to the soil.
9. **Agroforestry:** When trees and agricultural crops are combined, carbon can be stored in both the biomass above and below the ground.

## Carbon Footprint

The term "carbon footprint" should refer to a measurement of the overall quantity of CO<sub>2</sub> emissions, both directly and indirectly produced by an activity or accumulated over a product's life cycle.

### Importance of Carbon Footprint calculation:

- This allows to recognize the most important emission sources hot spots.
- The data use in calculations allows planning, monitoring and control of any emission reduction measure activity.
- Identify opportunities to reduce energy or process costs.
- Provide information to stakeholders.

## Carbon markets

Carbon markets are trading systems in which carbon credits are sold and purchased. Companies or individuals can use carbon markets in order to make up for the emissions of greenhouse gases by purchasing carbon credits from entities that remove or reduce greenhouse gas emissions.

**Types of Carbon markets:** The regulatory compliance market and the voluntary market are the two different forms of carbon markets.

**1. Regulatory compliance market:** The Clean Development Mechanism (CDM), Joint Implementation (JI) and EU Trading System (ETS) are the three Kyoto Protocol mechanisms that are most crucial under this market. Governments and businesses who must legally report their GHG emissions use the compliance market, which are governed by mandatory national, regional or global carbon reduction regimes.

**2. Voluntary market:** The trading of carbon credits occurs voluntarily on the voluntary market. The private sector primarily drives the voluntary market by launching several carbon offset initiatives and it is the primary purchaser of voluntary carbon credits (VER). The primary motivations for purchasing carbon credits are corporate social responsibility (CSR) and public relations.

## Carbon Credits

"Carbon credits are a financial instrument that represents a ton of carbon dioxide (CO<sub>2</sub>) or other greenhouse gas emissions reduced or removed from the atmosphere. They provide an economic incentive for industries and individuals to reduce their GHG's emissions."

- Sandor, R. (2007).

The right to emit 1 tonne (1,000 kg) of CO<sub>2</sub> or the equivalent amount of another greenhouse gas (GHG) is granted through carbon credits, which are tradable certificates or licenses. They function as a type of **climate currency**.

Farmers can earn carbon credits by employing sustainable agriculture methods on their farm. While companies or countries can earn credits by leading a project that lowers greenhouse gas emissions from the environment.

While carbon credits in compliance markets are referred to as "**Certified Emission Reductions**" (CER), whereas carbon credits in voluntary markets are referred to as "**Verified Emission Reductions**" (VER). This represents the various procedures and legal frameworks that these carbon credits are subjected to.

## Carbon Trading

"A system designed to minimize carbon emissions, where businesses (or nations) buy and sell carbon credits is called "Carbon Trading".

-Paul, A. (2010)

Carbon trading refers to the means of generating income through the sale of carbon credits. It is referred to as a "Cap and Trade" system, which refers to a legally enforceable method that places a ceiling or limit on overall emissions while allowing businesses to trade allocations. It helps the countries or industries which cross its maximum limits of carbon emission and need further carbon credits. Such industry or country buys extra units of CERs of carbon credits from the countries or industries that have already saved carbon credits in their pocket.

## Benefits of Carbon Farming in Agriculture

Carbon farming in agriculture has a wide range of advantages, which includes

- **Climate Change mitigation:** Carbon farming reduces global warming by absorbing and storing carbon dioxide in plant biomass and soil.

- **Increased Biodiversity:** Techniques like intercropping, crop rotation etc helps to boost biodiversity on farms. Pollinators, natural pest predators and the resilience of the entire ecosystem can be benefited.
- **Better Soil Health:** Soil health is improved by carbon farming practices like cover crops and limited tillage.
- **Reduced Soil Erosion:** Strong soils have a lower erosion risk. Agroforestry and cover crops are two techniques that can shield land from wind and water erosion and stop silt from washing into nearby waterways.
- **Increased Crop Yields:** Carbon-rich soils are better able to hold onto rainfall, which is essential during droughts. Additionally, increased nutrient availability promotes plant growth.
- **Enhanced Carbon Credits:** Carbon farming techniques can earn carbon credits, which allow farmers to participate in carbon trading and earn more money.
- **Climate Change Resilience:** Carbon-rich soils are better able to tolerate climate change effects, such as harsh weather conditions. This can strengthen farming operations' resilience and reduce their susceptibility to crop failures.

### Opportunities of Carbon farming in Agriculture

- Participating in carbon markets and selling their carbon credits can help farmers increase their revenue.
- Business prospects can emerge from the development of technology required for credit certification, such as those connected to the measurement, collecting, and calculation of field data, including the quantity of carbon in the soil.
- Development of the complete value chain, which links farmers who practice carbon farming with customers who value and are prepared to pay more for their produce, is one instance in this field.
- The UK-based company **Mootral**, which creates feeds that reduce methane emissions, has created a system that has been VCS-certified and is producing carbon credits because of its operations. It could be worthwhile to investigate whether an identical approach could be used in dairy farming in India.

### Challenges for implementation of Carbon farming

- **Reaching small farmers:** Even though it is widely known that commercial opportunities are more prevalent, the challenge of reaching millions of Indian farmers, where 86.08 percent of them have small, marginal holdings (less than 2 hectares) is a major task.
- **Poor awareness and Education:** In India, many farmers and various stakeholders are unaware of the potential benefits, opportunities and various techniques of carbon farming that can be practiced to sequester carbon.
- **Minimal Resources Access:** Access to resources such as better seeds, organic inputs and equipment for implementing carbon farming approaches is a great challenge.
- **Monitoring and Verification:** It can be difficult and expensive to accurately measure and verify carbon sequestration.
- **High transaction costs:** Small farmers and other stakeholders may find it challenging to engage in carbon markets due to the costs involved with measuring, validating and exchanging carbon credits.
- **Technological Barriers:** Some carbon farming techniques may call for access to cutting-edge equipment, such as remote sensing or precision agriculture instruments, which may not be widely available everywhere.

- **Lack of policy and regulation support:** For farmers and landowners, the absence of defined policies and regulations relating to carbon farming can breed ambiguity. It is crucial to create favourable regulations and rewards to promote adoption.

### Case studies related to carbon farming in India

Some start-ups and companies in India are engaged in carbon farming, like

**1. Nurture farm – 2020, Mumbai:** Nurture farm is an online platform for sustainable farming. It is the India's first firm that has succeeded in producing and selling carbon credits tied to agriculture. They are doing this by using two programs: **CRM** (Crop Residue Management) and **AWD-DSR** (Alternate Wetting and Drying and Dry Seeded Rice).

**Under CRM programme**, in Haryana and Punjab, a total of 420,000 acres from 25,000 farmers were covered. This Program has around 120,000 carbon credits in its works.

**Under Alternate Wetting and Drying and Dry Seeded Rice (AWD-DSR) initiative**, over 2,500 smallholder farmers of Haryana and Punjab have participated, which comprised 22,000 acres of rice paddy fields. This AWD-DSR project has so far generated 20,000 carbon credits.

**2. Grow indigo – 2018, Mumbai:** This Agri-tech business is a partnership between US-based indigo AG and Mahyco Grow. Its main objective is using regenerative farming techniques to benefit farmers and save the environment, which included India's first of its kind voluntary carbon markets initiative with smallholder farmers. This has so far signed up 50,000 acres in 20 districts of Punjab, Haryana, and the National Capital Region for its carbon credit program. Additionally, Grow Indigo is aiming to register more acres of crops in other states, including cotton, soybean, corn, rice, and sugar cane.

### Conclusion

Carbon farming is a win-win situation for the environment and agriculture. It provides a mechanism for farmers to actively take part in combating climate change while also enhancing the sustainability and resilience of their farms. Carbon farming is bestowed with multiple benefits includes, improving soil health, enhancing agricultural yields, maintaining food security and water quality and ultimately minimising the usage of chemicals. Carbon credits acts as a means of additional income and increases farmers revenue without harming the environment. Carbon farming is becoming increasingly important as the world struggles to deal with the problems brought on by climate change. By integrating carbon sequestration techniques, we can move towards an ecologically sound and climate-resilient farming system that is beneficial to both the present and the future generations.

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