

Carbon Farming with Vegetables

Nishtha Naudiyal¹ and Sheetal Rana²

¹Deptt. Of Environmental Science, G.B Pant University of Agriculture & Technology,
Pantnagar (263145), Uttarakhand

²Deptt. Of Vegetable Science, G.B Pant University of Agriculture & Technology,
Pantnagar (263145), Uttarakhand

ARTICLE ID: 12

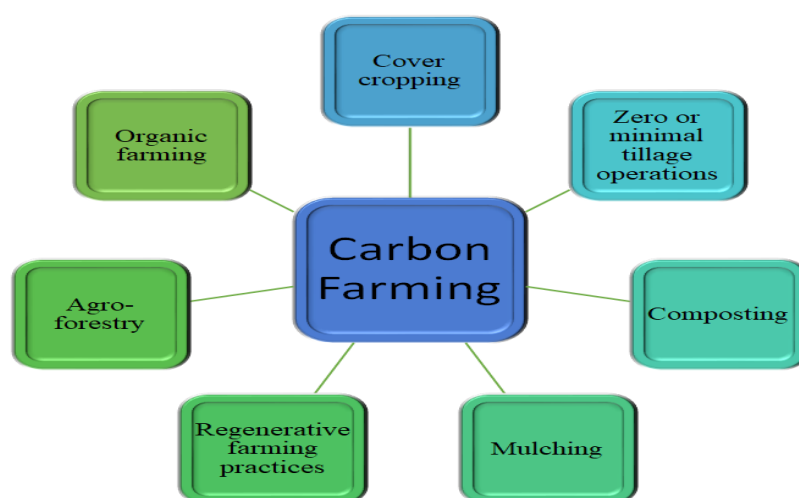
Carbon farming adoption is one of the highly effective strategies to accomplish the objectives outlined in the National Mission for Sustainable Agriculture (NMSA) launched in the year 2014-15, while concurrently tackling the pressuring issue of accelerating greenhouse gas (GHG) emissions. The ever-increasing population, urbanization and industrialization have resulted in the increase in the demands for not only food but also the yearning for uninterrupted access to seasonal tastes. Furthermore, declining transportation barriers emanated a notable uptick in export and import of agricultural commodities. This ensure tremendous pressure to ramp up the crop production which in turn surges carbon dioxide (CO₂) emissions from transportation; making our most cherished food items perilous to the environment when their sourcing is unsustainable. For instance, the transportation of tea, avocados, coffee, cheese etc. has far reaching implications to the changing climate, resource depletion and ultimately endangering human health.

Food's carbon footprint is linked with the food supply chain which is contributed from growing, processing, storage, transportation, distribution, preparation, consumption and sometimes disposal. It is being estimated that a quarter of the world's GHGs emission emerges from food, agriculture and related industries with only 6% contributed to transportation. The principal contributor is the change in the land use pattern, alteration or degradation or deterioration of forest-land to create farms or fields to make way for agricultural use. The top culprits responsible for carbon emission in food industry, listed in the descending order includes beef, cheese, dairy, chocolate, farmed shrimp, coffee, palm oil and rice. Many of these items are prominent part of our diets, necessitating a reduction on our leaning on their consumption. In Brazil, low GHGs emission foods such as fruits and vegetables which require less energy, land and water resources when grown sustainably. This has not only motivated the producers to get profitable, diversified and highly demanded agricultural products but also

prompted the government to provide incentives to the farmers who are willing to adopt these practices.

About one-third of all the GHG emissions caused by anthropogenic activities are associated with food. The biggest difference hinges with the climate change is how the food is been produced. A study conducted by Stone and his team near Des Moines revealed that small-scale production of head lettuce, onions, carrots, tomatoes etc. can foster more resilient, less wasteful and better climate communities while maintaining the stupendous productivity when compared to the traditional large-scale production methods. MasterChef's, an Irish catering company, with an ambition to become world's first "farm-to-table" company, solidifies its aim of being a closed-loop, carbon neutral and zero-waste enterprise. The initial step of their strategy involves planting of a wide range of vegetables viz. turnips, carrots, broccoli, kale, parnships, leeks, cabbage and potatoes. Dining at "farm-to-fork" restaurants and growing one's own kitchen gardens can be significant in curbing carbon emissions.

Carbon farming practices offer multiple benefits and are viable in production of vegetables organically. These practices encompass a range of methods viz. cover cropping, zero or minimal tillage operations, composting, mulching, regenerative farming practices, agro-forestry and committing to organic gardening. Nuzzling to these strategies have a positive impact not only in mitigating GHG emissions and the impacts of climate change but also improving soil health, its fertility, water infiltration, improving nutritional value, promoting biodiversity conservation, individual & community well-being and creating green jobs opportunities.





Organic farming plays an important role in addressing climate change by reducing atmospheric GHG emissions through amplifying carbon sequestration. Recent studies regarding carbon footprint in organic vegetable production has revealed notable cutback in the energy input in organically produced vegetables of about 50%, 65% and 27% for carrots, onions and broccoli, respectively when compared with the conventional methods. Moreover, significant abatement in the GHG emissions (CO₂ equivalent/kg) has been observed in case of organically grown tomatoes, leek crops and potatoes. The potential of carbon sequestration for organic farming is capable of offsetting 40-70% of the annual agricultural GHG emissions globally.

The voluntary carbon market, valuing approximately \$ 1 billion in 2021, has intrigued multinational corporations worldwide. The projects used to generate carbon credits not only have circumscribed projects related to renewable energy, reforestation but also the concept of “carbon farming”. In COP27 UN climate summit held in Egypt in 2022, a consortium of 12 agribusiness enterprises pledged to boost regenerative agriculture with main focus on carbon removal. Some of these companies are well known to us such as PepsiCo, McDonald’s and Mars. Early findings from California have showed that regenerative agriculture practices in almond orchards can result in 30% rise in soil carbon sequestration than long-established methods. Microsoft has recently committed in purchasing carbon credits worth \$ 2 million from an American farming cooperative further signaling to the growing carbon markets.

From financial perspective, carbon markets proffer farmers the chances to generate auxiliary earnings by implementing agricultural practices in vegetable production that focuses on sequestration of soil organic carbon and consequently reducing emissions. Lauren Miller, an Executive Vice President with Grassroots Carbon, a firm that connects businesses seeking in acquiring soil carbon credits with regenerative agricultural operations remarked, “Suddenly everyone is hearing about soil carbon storage.” He further added, “Farmers should be aware of this as another revenue stream.” ProducerPay collaborated with Allcot to create a carbon offset program tailored specifically for fruits and vegetables, creating fascinating financial incentive for producers to decrease their carbon footprint. Selling of carbon credits has already been started on few farms, including Kellogg, General Mills, and has captured the imagination of climate activists, corporations and farming communities.



India during COP26 held in Glasgow (2021) announced to commit to reduce 1 billion tonnes of its carbon emissions by 2030. The objective is to decrease carbon intensity of its GDP by 45% by 2030 and achieving net zero emissions by 2070. Being 2nd largest producer of staple crops, fruits and vegetables globally, agriculture contributes to more than 50% of the total carbon emission from the country and therefore addressing this sector is of utmost importance. With the application of appropriate techniques and technologies, India's soil has the potential to sequester up to 102 billion tons of carbon, which could offset 4% of the average annual GHG emissions in the country. Nurture.farm generates India's 1st agriculture related carbon credits, offering farmers incentives to utilize its innovations. Other companies like CropIn, is using artificial intelligence to digitize and inform decision-making on the farms which will contribute to more sustainable agricultural practices.

Soil carbon sequestration opens up new possibilities for climate positive agriculture. A new path of options opens for agricultural communities in creating climate friendly agriculture and eventually flourishing their livelihoods with the integration of recently developed technology and internet connection coupled with carbon credits. As consumers, it is our responsibility to demand transparency regarding the provenance of our food, the location of its production, and the techniques used to generate it. By encouraging the creation of carbon offsets from soil carbon sequestration with the goal of trading these carbon offsets while providing wholesome food, all of these initiatives strive to increase agriculture's contribution to climate mitigation. By supporting the offset generation through carbon absorption in soil and ultimately trading these offsets while concurrently providing wholesome food, these programs collectively aim to increase agriculture's contribution to climate mitigation.

In conclusion, using carbon farming techniques presents a viable method to both lessen climate change and revolutionize the production of fruits and vegetables. These methods improve soil health, water retention, and overall agricultural sustainability in addition to lowering greenhouse gas emissions. With the use of carbon farming, we open the door for more durable and ecologically friendly fruit and vegetable production, assuring a greener, healthier future for our world and our plates.

References:

Fritsche, U.R.; Eberle, U.; Wiegmann, K.; Schmidt, K. Treibhausgasemissionen Durch Erzeugung Und Verarbeitung von Lebensmitteln; Arbeitspapier; Öko-Institut eV Darmstadt: Darmstadt, Germany, 2007; Volume 13.

<https://iopscience.iop.org/article/10.1088/1755-1315/724/1/012025/pdf#:~:text=At%20a%20soil%20depth%20of,compared%20to%20conventional%20farming%20systems.>

<https://theprint.in/environment/reward-indian-farmers-with-carbon-credits-net-zero-hinges-on-climate-friendly-practices/964344/>

<https://www.downtoearth.org.in/blog/agriculture/food-miles-here-is-how-we-can-reduce-them-80209>

<https://www.fairplanet.org/story/7-foods-with-high-carbon-footprints/>

<https://www.greenbiz.com/article/farmers-can-now-grow-fruits-vegetables-and-carbon-credits>

<https://www.irishcentral.com/culture/food-drink/master-chefs-farm-carbon-neutral>

<https://www.mdpi.com/2073-4395/13/9/2406>

https://www.postguam.com/entertainment/lifestyle/us-carbon-farming-takes-root---but-do-the-economics-add-up/article_550310d6-7a9d-11ed-bfa3-6fab4a590772.html

<https://www.un.org/en/climatechange/science/climate-issues/food>

<https://www.washingtonpost.com/climate-environment/2023/05/16/climate-victory-gardens-regenerative-gardening/>

<https://www.washingtonpost.com/climate-environment/2023/05/16/climate-victory-gardens-regenerative-gardening/>

Smith, P.; Powlson, D.S.; Smith, J.U.; Falloon, P.; Coleman, K. Meeting Europe's Climate Change Commitments: Quantitative Estimates of the Potential for Carbon Mitigation by Agriculture. *Glob. Chang. Biol.* 2000, 6, 525–539.