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## Simple Techniques of Eco-Friendly Farming to Reduce Agricultural Carbon Footprints

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India having 1.4 billion inhabitants possesses the world's largest agriculture sector to support the needs of its citizens. Having 307.42 million, the livestock industry is the largest, and 58% of the population is employed in agriculture, with having large area planted to rice, wheat, maize, pulses. About all the resources produce a carbon footprint (including methane, greenhouse gases, and carbon dioxide), which increases the temperature of the world; recent data have revealed that world temperature is rising drastically, up to 50°C. The IPCC (2007) estimates that there is a 0.74°C rise in the global mean surface air temperature. It is predicted to rise by 0.3 to 2.5°C over next 50 years and 1.4 to 6.4°C over next century (IPCC, 2007), as well as the warming is expected to continue beyond 2100 (Pachauri, 2013). Availability of CO<sub>2</sub> (Carbon dioxide), N<sub>2</sub>O (Nitrous oxide), CH<sub>4</sub> (METHANE) is increasing by 145, 30, 15 percent in the industrial revolution in the past (IPCC, 2007).

The lower carbon foot print in the agriculture is determined by the practices followed in agriculture. Enteric fermentation, cultivation of rice, agricultural crop residue, manure management, along with emissions from the soil are all major contributors to the agriculture sector. The carbon footprint reduces quality of air, water and increases erosion of water, soil. The carbon footprint decreases favorable conditions of crop and their yield. It decreases soil fertility and structure of soil. The climate changes cause flooding, tsunamis, drought excessive in some areas.

### Introduction

The main goal of eco-friendly farming is to reduce carbon footprints and minimize the release of greenhouse gases, such as methane and carbon dioxide. Sustainable agricultural practices provide long-term benefits to farmers while also helping to decrease emissions and protect the environment. These gases contribute to the depletion of the stratospheric ozone layer. When the ozone layer thins, harmful UV radiation can reach the Earth's surface, causing damage to forests, vegetation, and agricultural crops. As a result, this increase in harmful rays can lead to decreased crop yields. This leads to increase temperature as the earth receives sunlight in form of short wave radiation, earth releases long wave radiation. Thus these radiation causes temperature changes in the atmosphere.

Climate change provides harsh environmental conditions for agriculture crops to grow, promotes erosion of water and soil, and increases desertification. This leads to food scarcity and hunger which leads to deficiency in their growth. This affects the health of people and has an impact on the lifecycle of the people. The climate change resulting from hurricanes, drought, and floods in some areas which leads to erosion of soil and water, destruction of natural resources such as Forest, Vegetation, and Destruction of infrastructure. This leads to migration of the people from one place to another for the opportunities and good life. This has impact on the condensation of people which leads to competition and unethical practices among the people for the gains. The change causes economic collapse and leads to the collapse of the government and disaster in the life of the people. They use sustainable

practices which help reduce carbon footprints. The India's pledge of Panchamrit (five-fold strategy) to fight against climate change, was announced throughout the 26<sup>th</sup> Conference of the Parties (CoP26) which reduced carbon footprint by shifting to non fossil fuel energy by reaching 500 gigawatt by 2030.

The Key factor of Indian agriculture is more than 58% contributing almost 20% to the total GDP, it is main source of livelihood for the rural population. But it is also the world's third largest generator of greenhouse gases. The major contributors to carbon footprint in Indian agriculture are Enteric Fermentation, Rice Cultivation, Soil Direct Emission, Manure management, Burning of Agriculture residues.

**Enteric Fermentation:** This contributes about 54.6% of emissions from Indian agriculture. Enteric fermentation occurs when food that is consumed by ruminants occurs in the rumen, where complex carbohydrates are converted and produce methane in this process. Methane is a potent greenhouse gas. It is released into the atmosphere, and the Indian livestock sector releases near about 12Tg of CH<sub>4</sub>. Compared to CH<sub>4</sub> emissions from the US livestock industry (7.85 Tg yr<sup>-1</sup>), this is substantially higher (Hristov et al., 2014). Around 50percent of India's overall CH<sub>4</sub> emissions from all industries and 78percent of country's total CH<sub>4</sub> emissions from the agriculture sector come from the livestock industry (Swamy and Bhattacharya, 2006).

**Rice cultivation:** About 17.5% of emissions from the agriculture sector are attributable to this. The field was flooded during rice cultivation, which resulted in submerged conditions for soil organisms. Carbon footprint-like greenhouse gases, such as NO and CH<sub>4</sub>, are released. Over 10percent of the world's methane emissions are caused by this major worldwide contributor. The south east nation contributes major as major rice bowls 25 – 33%, The rice is major crop in Southeast Asia like (India, Indonesia, Thailand, Philippines, Vietnam, Bangladesh, and Myanmar) and Asia like China, which collectively produces 82.05percent of global rice production as well as 78.23percent of global consumption of rice.

**Soil Emission:** The emission from the soil emits different greenhouse gases. During flooded conditions, it releases methane produces methanogens. The soil releases carbon dioxide through tillage operations and by decomposition of organic matter in the soil. It also releases nitrous oxide by the process, as the crop requires nutrients for growth when applying nitrogen to the soil; the microorganism present in the soil performs the nitrogen cycle. The crop takes nitrogen in the form of nitrate, nitrite. During the process, nitrous oxide is released by the process of nitrification and denitrification.

**Crop Residue burning:** It contributes around 2.1% of total carbon footprint. The burning of crop residue has effect on quality of air. It affects the health of the people. In recent study of Delhi air quality results of burning of crop residues in surrounding northern states. This affects poor air quality and affects chronic diseases in people.

**Manure management:** Anaerobic conditions produce methane, hydrogen sulfide, and carbon dioxide, while aerobic conditions produce heat, ammonia, and carbon dioxide in manure. The manure should be properly decomposed before application, as it releases gases when it is applied.

### Simple Techniques to Reduce Carbon Footprint

**Crop Rotation:** The crop rotation should be done as predominant crop like rice, wheat is stable food but produces carbon foot print. It reduces greenhouse gas emissions and also a sustainable practice for long term and is environmentally friendly. It also reduces pest and disease incidence in the crop. The different crops have different crop deep roots and fibrous or shallow roots which help crop nutrients from different regions of soil.

**Adequate nutrient application:** Apply nutrient following of 4r

- Right source: To provide nutrients from reputed sources as requirement of crop.
- Right rate: To provide the nutrient at right amount of crop. This requirement does not cause any harmful effects to the environment.

- **Right time:** To provide nutrients at peak nutrient demand. This varies from crop to crop. Some of this includes seedling stage, flowering stage, fruit formation stage.
- **Right place:** To provide nutrients near the root zone where crop takes nutrients.

**Rice cultivation:** Henri de Laulaine discovered the System of Rice Intensification (SRI) in 1980. This method uses organic manure, planting young seedlings in a square pattern with wider spacing and frequent irrigation to keep the soil moist. The emission from rice cultivation by flooding can be controlled by alternate drying and wetting of the field. Using adequate nitrogen application with organic manure will reduce the emission of nitrous oxide (N<sub>2</sub>O). Select a seed variety that emits lower production of methane and carbon dioxide.

**Humus:** The increasing humus content depends on agricultural practice and understanding the fundamental relationship between plant and soil life. The plants interact with various microbes present in the soil as it promotes growth of the plant. The fungi present in the soil help in nitrogen fixation and fungi depend on plants it form natural symbiosis. The humus formation is used for increasing soil structure, water holding capacity, soil fertility, carbon sequestration along with control Green house gases. This includes broad crop rotation, catch crop, Nitrogen fixing legume crop, Manure, use of crop with different root depths, cropping system, vegetative cover, crop residues, minimum tillage, and Biochar application.

**Crop Residue Management:** The burning of crop residue emits higher carbon footprint. In India burning of rice stubble is widely practiced which causes lower air quality in Delhi, which affects human health. Straw should be available, and rice husks can be recycled into animal feed, growing beds for other crops that include mushrooms, inputs for the production of bioenergy, as well as organic fertilizer from the byproducts. In November 2021, World Economic forum, Nuture.Farm with Indian Agricultural Research Institute, convinced more than 25,000 farmers throughout land covering 4.20,000 acres of land to decompose rice stubble. This has controlled emission of over 1million tonnes of CO<sub>2</sub>.

**Minimum Tillage:** In this tillage, we minimize the effect of the tillage by not disturbing complete soil structure. Tillage speeds up surface runoff and soil erosion by breaking up the soil as well as altering its structure. Utilization of frequent tillage practice releases carbon into atmosphere thereby increasing carbon footprint in the atmosphere through agriculture. In this method, we minimize release of gases and direct fall of sunlight which disturbs soil microbes and leadsto soil erosion and in turn gases release atmosphere. Thus it affects soil health and increases carbon footprint.

**Renewable Energy:** The use of renewable energy controls the use of fossil fuel for power, which leads to a lower carbon footprint. The uses of Solar panels, Wind turbines, reduce the usage of based on fossil fuel use of Electrics (Pumps, Motors, Rechargeable batteries).

**Organic farming:** It promotes use of organic Manure, Pesticides, Mulches it doesnot recommend the use of synthetic products.

- **Manure:** It increases organic matter in the soil and it also helps in soil structure. It helps as source for microbes. The microbes present in the soil decompose organic matter and it also helps in increasing water holding capacity.
- **Pesticide:** The pesticide prepared which are not harmful to humans. It also reduces the chemical residue of pesticides in the field. Eg: Devine – liquid suspension of fungal spore of phytophthora palmivora effect on strangle vine. This reduces carbon footprint as it is ecofriendly.
- **Mulches:** The mulches which are used to cover the soil and eco friendly, improve soil health and are sustainable. Eg: Wood chips, straw, compost, Grass clippings, Cedar etc. which help reduce weed incidence and also help in moisture conservation. This prevents top soil erosion as it covers the direct fall of sunlight and helps in improve soil structure by decomposing.

## Conclusion

The agriculture sector contributes to global greenhouse gas emissions. In the current situation of rapid population increase and climate change, a deeper understanding of people is

occurring due to its negligence, which causes the present situation. Climate change has affected people's health, like poor air quality, incidence of new diseases, and low-quality life. The food is also manipulated by indiscriminate usage of synthetic fertilizers and pesticides, which have led to the contamination of air, water, and soil. The use of eco-friendly methods increases diversity in crops and encourages practices that do not affect the health of any being. This practice is a new way to decrease carbon footprints. This reduces the sudden temperature rise, flooding, and in many areas we can observe the melting of arctic snow, Himalaya's snow. These increase water levels which create submerged conditions which can be seen in present in Bangladesh. Due to excess rainfall creates floods. This can be reduced by increasing vegetation cover, forest area, which helps reduce carbon footprint in atmosphere.

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