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Carbon Farming: Need of Future

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Abstract

Concern over climate change has brought the concept of carbon farming into the limelight and 25 countries pledged to pursue it during the Paris climate change or COP 21 agreement with the United Nations Framework on Climate Change (UNFCCC) in December 2015, dealing with greenhouse gas emissions, mitigation and adaptation. The main aim of carbon farming is to apprehend the unwanted carbon dioxide (CO₂) from the atmosphere which is accountable for global warming and if carbon farming is combined with greater reduction in fossil fuels emission then it can help us in bringing back from the brink of disaster and return our atmosphere to the “magic number” of 350 parts per million of carbon dioxide.

Introduction

“The Carbon Farming Solution is a befitting tribute to the 2015, International Year of Soils.” - Dr. Rattan Lal

Carbon is one the structural element which is required for the growth and development of plants. Carbon farming or carbon sequestration is set of farming methods which helps to store carbon inside the soil and in crop biomass by reducing the release of green house gases into the atmosphere. It is an emerging and complex economic sector. Carbon farming involves implementing practices that are known to improve the rate at which CO₂ is removed from the atmosphere and converted to the plant material or soil organic matter (SOM). Sequestering profound quantity of carbon can help in returning a livable climate to the world (Becker and Lawrence, 2014). Use of machineries for various agricultural operations such as tilling the land, sowing, harvesting, threshing, fossil fuel based fertilizer, herbicides, pesticides overgrazing of results in significant emission of carbon dioxide. Agricultural activities contribute 14% of Global Green House Gases (GHG) emissions. In India 28% of the national GHG emissions is from agriculture sector. Agriculture sector, which is one of the most important sector has ability to transform net emitter of CO₂ to a net capturer of CO₂. India is the third largest emitter of greenhouse gases in the world. A recent study indicates that greenhouse gas emissions from the agricultural sector in India would be 515 MtCO₂e per year by 2030. Simultaneously it indicated that Indian agriculture has the potential to mitigate 85.5 Megatonne CO₂ equivalents (MtCO₂e) per year without compromising food production and nutrition.

Natural and artificial processes are involved in removing the carbon from earth's atmosphere and storing them either in soil or liquid form for decades or centuries. Agriculture's answer to combat climate change is “carbon faming” which meets the theme of sustainable agriculture while meeting the need of human beings simultaneously. Carbon farming is successful when carbon gains resulting from enhanced

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land management and/or conservation practices exceed carbon losses (IPCC, 2007). Studies indicate that use of compost instead of chemical fertilizer and conversion of manure and other organic wastes into high-quality compost, avoids the release of methane into atmosphere and helped in restoration of carbon in soils of cropland and grasslands, it also improves the water holding capacity, soil porosity, water use efficiency etc. Fossil fuels and dead plant biomass forms organic matter and stores a considerable amount of carbon in the soil. Mitigation measures have been found to be technically feasible but it needs government effort (policies and incentives) to be implemented wide scale adoption. It would also help India in meeting its food security goals while reducing gross greenhouse gas emission.

Carbon farming has potential to mitigate the effects of climate change and reducing the havoc caused by release of CO₂ in coming days. In India, a new project on carbon farming was launched by Shekar Bhadsavale and Emmanuel D'Silva in two districts of Maharashtra starting with 20 farmers in year 2019. The selected farmers were mostly small land holders having less than one hectare of land, follow no-till practice for cultivating crops like rice, string beans and other cover crops. Several farmers have reported that practice of no-till rice cultivation has increased income and agriculture production.

"Practicing Saguna Rice Technique (SRT), a form of zero-till conservation agriculture will not only increase the farm yield and income, will also improve soil health by storing more organic carbon in the soil." - Shekar Bhadsavale

Saguna Rice Technique has been accepted by more than 1,000 farmers in different states of India. Emmanuel D'Silva had initiated carbon credit programs through tree plantations in 44 tribal villages a decade earlier.

Reviews on Carbon Farming

In many developed countries farmers are practicing carbon farming. They are avoiding land preparation before and after crop cycle instead using Angus cattle, hogs, Katahdin sheep and chickens for trampling and eating the crop leftover into their field and seed drill for sowing/ planting succeeding crop among the residue present on the soil surface.

Carbon farming presents solutions, practices and latest research on how farmers and ranchers can play a preeminent role in addressing climate change and ensuring food security by stewarding working landscapes to sequester carbon. It can be encouraged and enabled through different agri-environment scheme. These schemes have dominated features of rural policy over 30 years in Europe and other developed countries. In India there is urgent need to develop some schemes and strategies which would help in ameliorate the potential effect of climate change.

In a study it was found that in North-East bamboo based agro-forestry system resulted in 0.59 Mg ha⁻¹yr⁻¹ of soil carbon

sequestration. Agro-forestry based ecosystem has been found efficient in reducing the emission while capturing more carbon dioxide by storing it in above ground and below ground live biomass. It is assumed that 50% of biomass is made/ stock of carbon.

Mitigation Measures which has Highest Potential to Reduce Greenhouse Gas Emission

- Precision nutrient management, use of slow-release fertilizer forms or nitrification inhibitors has resulted in the reduced fertilizer consumption. Efficient fertilizer use has showed highest potential in reducing GHG's in Uttar Pradesh followed by Andhra Pradesh, Maharashtra and Punjab by lowering emissions from field.
- Methane emission from wetland rice fields accounts for 6-29 % of the total annual anthropogenic methane emission, a potent greenhouse gas. Better water management practice in rice cultivation such as alternate wetting and drying has resulted in the highest mitigation potential in Andhra Pradesh, followed by Tamil Nadu, Orissa and West Bengal. In cereals, other water management practice includes use of laser land levelers, sprinkler irrigation, fertigation etc.
- Adoption of zero tillage and residue management has reduced around 17 Megatonne CO₂ equivalents (MtCO₂e) per year in rice, wheat, maize, cotton and sugarcane.

Five Tenets of Carbon Sequestration

- No-till
- Organic mulch
- Compost
- Livestock rotation
- Cover crops

Soil carbon content can be increased by including "best management practices" which are well proven conservation oriented management practices helps in building soil organic carbon. BMPs include incorporation of residue or its retention, plantation of legumes and grasses to the marginal lands, addition of compost or manures, cover crops, restricted/ modified tillage, management of grazing lands. Agro-forestry which helps in rehabilitation of degraded land, control erosion and watershed protection should be practiced at larger scale. Conversion of degraded and marginal lands into forests and perennial land use can enhance the soil organic carbon pool (Nath et al., 2015). Soil carbon stocks are reversible, gained and captured carbon can be lost if the management practices leads to build up of soil carbon are not maintained in the longer term.

Effects of Carbon Farming

- Carbon farming may increase the cost effectiveness of riparian forest restoration.
- It will help farmers to increase their income as well as store carbon in the soil.
- Carbon farming will also often improve water quality, by reducing sediment and nutrient transport into aquatic systems.
- In fire prone area carbon farming can increase the risk of fire due to loads of carbon on vegetation and soils.

Carbon Trading

- Carbon trading means trading of units of carbon dioxide reduced in the environment. Countries which reduce carbon emissions earn Carbon Emission Reduction (CER) Certificates which traded and is called carbon trading.
- Carbon dioxide being one of the important GHGs and it's role in climate change CO₂ is of strategic importance to the nations developed as well as developing and has acquired a "market value" globally for trading. The Kyoto Protocol brought the mechanism of trading carbon units as global mechanism to address the issue of reducing the emissions by the polluting industries and countries to meet the mandatory requirements.
- For trading C units one needs to establish the fact through carbon budgeting that the emissions are reduced or more C is fixed. Carbon budgeting is the sum of all exchanges (inflows and outflows) of carbon compounds between the earth's carbon reservoirs (such as land mass, water bodies, and atmosphere) in the carbon cycle.
- Carbon trading, or more generically emissions trading, is the term applied to the trading of certificates representing various ways in which carbon-related emissions reduction targets

might be met. Countries earn Carbon Emission Reduction (CER) Certificates through completion of Clean Development Mechanism (CDM) projects or in form of Emission Reduction Units (ERU) which are earned on successful completion of Joint Implementation projects.

- In India, Multi Commodity Exchange (MCX) and National Commodity and Derivatives Exchange (NCDEX) are two exchanges which deal with trading of carbon emission in the form of Carbon Emission Reduction (CER) Certificates.

Conclusion

Carbon farming is very broad and successful technology which dramatically reduces emission of carbon dioxide. It is best and safest way forward which has potential to make a substantial impact on present levels of atmospheric CO₂. Adoption of large scale carbon farming may result in reduced or stabilized atmospheric CO₂ levels but it has a finite capacity of removal of CO₂. Carbon farming or carbon sequestration goals to mitigate global climate change which significantly results in reduced climate related damages to human health.

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