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Does Agriculture Can Be Carbon Neutral

Agriculture is a source and sink to green house gases (GHGs). Fuel, inorganic fertilizers, pesticides and intensive tillage that are used in agriculture emit GHGs that can result in climate change. It is a well-known fact that climate-smart farming will increase agricultural production by reducing carbon emissions. Some of measures for offsetting carbon emissions are: fossil-free farming, using renewable energy, preventing nutrient loss, improving carbon sequestration, and maintaining biodiversity. Farmers can therefore advise to adopt these practices to protect the environment and render agriculture carbon neutral.

INTRODUCTION

Agricultural production depends directly on the climatic conditions of the region. Ensuring food security under changing climate conditions is a key focus of the 21st century. It is a known fact that green house gases (GHGs) emissions contribute to climate change. India is the third largest emitter of GHGs after China and United States. The majority of GHGs emissions are generated through the production and use of agricultural inputs such as water, fertilizers and pesticides, farm machinery, soil disturbance, residue management and irrigation. Climate change threatens Indian agricultural production with frequent droughts, heat waves, and erratic rainfall. These impacts may result in significant risks to farming operations. India could see a 40% decrease in agricultural productivity in the 2080's. Rising temperatures will affect wheat-producing areas, placing hundreds of millions of people on the brink of chronic hunger. To meet the demand for around 9 million people by 2050, all the countries in the world have to increase food production by cutting down the GHGs from agriculture. India's annual GHGs emissions from agriculture and livestock stood at 481 mega tonnes of CO₂ equivalent, of which 42 percent came from crop production and 58 percent was emitted from livestock. Livestock production was the largest source of emissions, followed by rice, which was the largest emitter among crops with 52% of all crop-related emissions. The state, Uttar Pradesh became the largest GHGs emitter in agriculture and livestock, followed by Telangana, Andhra

Pradesh and Madhya Pradesh. At the same time, GHGs emissions from rice fields were highest in the largest rice-producing states such as Andhra Pradesh, West Bengal, and Assam. India has the potential to cut 18 percent of its annual GHG emissions arising from agriculture and livestock, reports a team of researchers from the International Maize and Wheat Improvement Centre (CIMMYT of the CGIAR) and its partners. The reduction potential represents 85.5 mega tonnes of CO₂ equivalent per year could be achieved by implementing just three measures at no cost: efficient use of fertilizer, zero-tillage practice, and efficient use of irrigation; particularly in paddy field.

WHAT IS CARBON NEUTRAL?

Whether you use the terms “carbon neutral”, “net zero” or “climate neutral” in your target, they all reflect the same intent to reduce or eliminate your organization's impact on the climate system. In most cases, these terms are interchangeable, but there are differences in how they are defined and in terms of how goals are to be achieved. In particular, carbon neutrality is defined as a balance between emitting carbon and absorbing carbon from the atmosphere in carbon sinks. Achieving net zero emissions involves offsetting GHGs emissions through carbon sequestration.

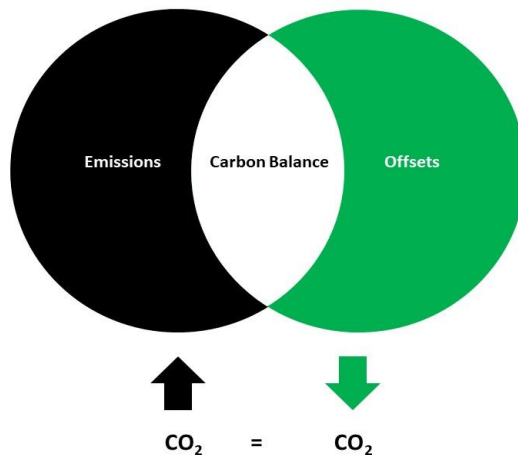


Figure 1. Sketch diagram of carbon neutral

EFFECTIVE MEASURES TO MAKE AGRICULTURE CARBON NEUTRAL

Many promising technologies and tools are reported to cut agricultural emissions, but very few are actually

permanent. Here are a few effective measures to cut carbon emissions.

CHANGING TO FOSSIL-FREE FARMING

Most of the agricultural machinery runs on fossil fuels. Using biofuels and electricity from renewable sources could cut GHGs emissions from agriculture by 10%. Also, currently agriculture relies mainly on inorganic fertilizers due to faster result and easy to apply in the fields. However, inorganic fertilizers are an important climatic culprit and it is highly dependent on the natural gas. Therefore, the application of more organic fertilizers, such as animal manure, vermi-compost, green manure or inorganic fertilizers produced from green energy sources could dramatically reduce emissions from agriculture.

PRODUCING GREEN ENERGY FROM FARMLAND

Farmers can be encouraged to grow bioenergy crops so that we can produce bioethanol from grain and plant residues through fermentation and distillation. Bioethanol may be used to power agricultural machinery. However, the debate takes place at the expense of ethanol produced from crops and crop residues. So it's really important to understand that biofuel has to be combined with other sources like solar, wind, and waste.

MINIMIZING NUTRIENT LOSSES

Conventional intensive cropping systems that use a lot of inorganic fertilizers and tillage operations lead to the loss of nitrogen through volatilization and leaching. Nitrogen loss can be controlled using precision agriculture, use of slow release fertilizer such as coated urea, low-emission slurry, liming and drainage measures.

EMPOWERING FARMERS TO STORE CARBON IN THEIR LAND AND IMPROVING BIODIVERSITY

The soil is one of the largest carbon reservoirs on the planet after the ocean and has tremendous potential to extend its role in capturing carbon dioxide from the atmosphere. Intensive tillage releases GHGs emissions and reduces soil organic carbon resulting in soil infertility. Thus, the promotion of no-till systems among farmers and the cultivation of perennial crops may store soil carbon. Biodiversity also plays a critical role in the

conservation of ecosystems. Higher mean temperatures and changing habitats are steadily reducing biodiversity. The inclusion of flower, shrub or tree areas in the growing system can help to maintain or improve local biodiversity. This also prevents soil erosion and enhances carbon sequestration.

DEVELOPING BIOLOGICAL PLANT PROTECTION MEASURES

Sustaining or increasing crop yields without using high inorganic inputs is another effective measure to reduce carbon emissions. The crop protection measure is important for the stable crop production, which is mostly done using chemical pesticides and by intensive soil tillage. The promotion and success of biological control of pests, diseases and weeds are the most difficult challenges ahead. Early detection through bio-control will further improve agricultural sustainability. For example, the application of cabbage moth-eating bacteria to control pests at an early stage of cabbage leaf consumption. However, care must be taken in choosing a bio-agent that should not be harmful to other crops (for example, ladybugs that like eating plant pest aphids, but harmful to other crops).

INVESTING IN NEW INNOVATION AND TECHNOLOGY

Cutting-edge technologies can help make our agriculture system more resource-efficient and climate-friendly. Such developments like GPS data, satellite imagery, drone-borne sensors detecting field variations, can enable farmers to use fertilizers, water and pesticides in the exact required amount at the right location of the field. Advancement of a breeding program can lead to new varieties that are high yielding, disease resistant and resistant to various types of biotic and abiotic stresses.

CONCLUSION

Climate change impacts agriculture and the environment at the same time. Agriculture has been confronted with the challenge of offsetting emissions of carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O). This objective can be achieved through the efficient use of fossil fuels, the production of renewable energy, the reduction of nutrient loss, the improvement of carbon sequestration and biodiversity, as well as the development and use of intelligent technologies for climate change. The challenges facing agriculture are numerous and complex. But with the adoption of good technologies, knowledge and goals, there is every reason to believe that carbon neutral agriculture is possible.