Sustainable Agriculture-A key to minimizing the contribution of agriculture towards climate change.

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Abstract - Agriculture is one of the most primordial activities carried out by humans. Traditional agricultural practices were very basic in nature and thus involved use of natural resources and systems that had little to no impact on nature and environment. With the advent of technology and modern agricultural practices the impact of agriculture on environment has become deteriorating and such practices are contributing towards climate change. According to a report by The Carbon Brief, agriculture is responsible for around 16% of India's GHG emissions. Of this, 74% is due to methane produced from livestock (largely cows and buffalo) and rice cultivation and the remaining 26% comes from nitrous oxide emitted from fertilizers. Sustainable agriculture through traditional practices as well as science backed modern systems can help to reduce this impact on climate and environment and thus help us to achieve global goals. In this review paper we will highlight negative impacts of agriculture on environment and discuss how sustainable agricultural practices can minimize these impacts.

Keywords: Climate Change, Sustainable Agriculture, Green House Gases etc.

I. INTRODUCTION

Modern agricultural practices, food production and animal farming causes land use change patterns. This leads to deforestation that results in soil and water erosion. Deforestation and land use change causes more surface exposure and warming. CO_2 is released by agriculture during the burning of fossil fuels and crop residues, which is one of the many GHGs that contribute to global warming. According to a report by IPCC in 2013 agriculture forestry and the change of land use accounted for 25% of human induced GHGs emissions.

Organic and inorganic material provided as inputs or output in the management of agricultural systems are typically broken down through bacterial processes, releasing significant amounts of CO_2, CH_4, and N_2O to the atmosphere (Smith P. et al., 2014).

Like most developing countries, India is predominantly an agrarian economy (India, MoAFW 2016). On one hand, the agricultural sector is the most important contributor to climate change, but on the other hand, it is also the most affected by it. Farmers with small and medium landholdings are most vulnerable to climate change (N K Patra et al., 2017). India's National Action Plan highlights sustainable agricultural practices that can help mitigate emissions (India, PMCCC 2008).

Methane and nitrous oxide, two potent greenhouse gases, are released in substantial quantities by agriculture. Methane is produced by livestock as a by-product during digestion of food (enteric fermentation) and is released into the atmosphere. It can also escape from stored manure and organic waste in landfills. Nitrous oxide emissions are an indirect product of organic and mineral nitrogen fertilizers.

Agriculture is a significant contributor to anthropogenic global warming, and reducing agricultural emissions—largely methane and nitrous oxide—could play a significant role in climate change mitigation. (John Lynch et al., 2021)

India emitted 2,308 Mega-tonnes of CO_2 in 2018, according to the International Energy Agency report. Agriculture and livestock accounted for 34 Mt of CO_2 emissions which is 1.47 per cent of gross national emissions. Sustainable Agriculture through traditional practices as well as science backed modern systems can help to reduce this impact on climate and environment and thus help us to achieve global goals.
Some of the negative impacts of agriculture are summarized below:

- Degradation of land
- Soil and Water erosion
- Biodiversity extinction
- GHGs emission
- Climate change

II. SUSTAINABLE AGRICULTURE

It is a sort of farming system that does not involve the use of any chemicals and operates on the premise of conserving natural resources for current and future generations while minimizing environmental impact.

Organic farming is also more energy efficient. It is reported that the use of energy is 20 to 50% less in comparison to the

conventional farming system (Pimentel et al., 2005; Schader et al., 2011 and Muller)

Olesen et al. (2006) reported that sustainable agriculture emits lower N_2O from nitrogen application, due to lower overall nitrogen input per hectare than in conventional agriculture.

Decreasing agricultural greenhouse gas emissions is important—net food system CO_2 emissions must be eliminated, as with all other CO_2 emissions, and reducing agricultural methane and N_2O, while distinct from CO_2, is climatically beneficial and must be encouraged (John Lynch et al., 2021).

Sustainable agriculture offers a much-needed alternative to conventional input-intensive agriculture, the long term impacts of which include degrading top soil, declining ground water levels and reduced biodiversity. It is vital to ensure India's nutrition security in a climate-constrained World (Niti Gupta et al., Sustainable Agriculture in India, 2021)

Sustainable agriculture promotes the health of environment by following ways:-

- Saving water
- Maintaining nutritional value of soil
- Usage of natural pest to protect the crop
- Usage of minimal resources
- Preventing soil and water erosion.

III. TYPES OF SUSTAINABLE AGRICULTURE

SUSTAINABLE AGRICULTURE TYPES

1. Permaculture: It is a method of building a landscape in such a way that it functions as a complete ecosystem, providing food, housing, energy, and other resources in a long-term manner. Balcony Gardens, for example, or Backyard Farming.

2. Biodynamic farming: This is a method of soil fertility maintenance that avoids the use of chemical fertilizers and instead relies on live organisms/bio-systems.

3. Hydroponics and Aquaponics: Hydroponics is a system which involves growing plants without soil in which nutrients supply through water/aqueous solutions. Aquaponics is a method of keeping aquatic animals while also growing hydroponic plants. The fertilizer for hydroponic plants in this system is water containing waste products from aquatic creatures.

4. Urban agriculture: Backyard farms, community gardens, poly-houses, and roof top farms are examples of local food growing systems where plants and animals are grown for domestic use within a city. It satisfies the need to localize our food systems, reducing the need for storage and transportation infrastructure.

5. Polycultures and crop rotation: Polyculture refers to the practice of growing multiple crops at the same time and in the same location, either through crop rotation or by planting rows of different crops side by side for natural ecosystem diversity. It reduces the chance of diseases and pests taking hold by interrupting their development cycle by switching crops. It also cuts down on the use of fertilizers and pesticides.

6. Natural pest management: Pesticides can help with pest control, but overuse can breed pests that are resistant to them. Planting trees around the farm attracts various birds that can nest there and feed on the insects, which is known as natural pest management. Farmers can manage pests in some cases by introducing beneficial insects such as lacewings or ladybugs. Other techniques include use of oil spray and sticky traps.

7. Organic farming: This is a method of growing plants without the use of synthetic chemicals, pesticides, or insecticides, and instead relying on biological materials and systems to keep soil fertility. Soils are the primary sink for CO_2 in the atmosphere. Organic farming, through the use of organic manures, crop cover, and crop rotation, increases the carbon content of the soil and restores it for a longer period of time.

National Mission for Sustainable Agriculture: It is a mission implemented by Department of Agriculture, Cooperation & Farmers Welfare under the Ministry of Agriculture & Farmers Welfare, GoI. National Mission for Sustainable Agriculture (NMSA) has been formulated for enhancing agricultural productivity especially in rainfed areas focusing on integrated farming, water use efficiency, soil health management and synergizing resource conservation. Various schemes which are being carried out under this mission are:

- **Rainfed Area Development (RAD):** It is an area based approach aimed at conservation of soil and watershed development.
- **Soil Health Management (SHM):** It aims at promoting location as well as crop specific sustainable soil health management including residue management, organic farming practices by use of macro-micro nutrient management, appropriate land use based on land capability, judicious application of fertilizers and minimizing the soil erosion/degradation
- **Sub Mission on Agro Forestry (SMAF):** It has been implemented to encourage tree plantation on farm land along with crops/cropping system. It follows the theme of "Har Medh Par Ped".
- **Paramparagat Krishi Vikas Yojana (PKVY):** It involves promotion of organic farming by adoption of organic village by group or cluster of farmers.

- **National Bamboo Mission (NBM):** This mission promotes growth of the bamboo sector by adopting area based regionally differentiated strategy for promotion and marketing of bamboo products specially handicrafts.

IV. CONCLUSION

In respect of global warming and climate change, sustainable agriculture can be a potential strategy to mitigate consequences of climate change either by reducing GHG emissions or by sequestering CO_2 from the atmosphere in the soil. Organic farming, a type of sustainable agriculture, is beneficial both in providing safe and chemical free food as well as environment protection. Even though there is an increase in total area under organic agriculture in the country, but there is still a need for further improvement, especially in the areas of research, extension and awareness among people directly or indirectly involved in the organic farming.

V. REFERENCES

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