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Impact of Climate Change on Crop Production: Climate Resilient Agriculture Is the Need of the Hour

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Abstract : Climate change is considered one of the major environmental problems of the 21st century and a lasting change in the statistical distribution of weather patterns over periods ranging from decades to millions of years. Agriculture and climate change are internally correlated with each other in various aspects, as the threat of varying global climate has greatly driven the attention of scientists, as these variations are imparting a negative impact on global crop production and compromising food security worldwide. The fast pace of development and industrialization and indiscriminate destruction of the natural environment, more so in the last century, have altered the concentration of atmospheric gases that lead to global warming. Carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (NO) are important biogenic greenhouse gases (GHGs) from the agricultural sector contributing to global warming and their concentration is increasing alarmingly. Agricultural productivity can be affected by climate change in 2 ways: first, directly, by affecting plant growth development and yield due to changes in rainfall/precipitation and temperature and/or CO_2 levels, and second, indirectly, there may be considerable impact on agricultural land use due to snow melt, availability of irrigation, frequency and intensity of inter- and intra-seasonal droughts and floods, soil organic matter transformations, soil erosion, distribution and frequency of infestation by insect pests, diseases or weeds, the decline in arable areas (due to submergence of coastal lands), and availability of energy. An increase in atmospheric CO_2 promotes the growth and productivity of C3 plants. On the other hand, an increase in temperature, can reduce crop duration, increase crop respiration rates, affect the equilibrium between crops and pests, hasten nutrient mineralization in soils, decrease fertilizer- use efficiencies, and increase evapotranspiration among others. All these could considerably affect crop yield in long run. Climate resilient agriculture consisting of adaptation, mitigation, and other agriculture practices can potentially enhance the capacity of the system to withstand climate-related disturbances by resisting damage and recovering quickly. Climate resilient agriculture turns the climate change threats that have to be tackled into new business opportunities for the sector in different regions and therefore provides a triple win: mitigation, adaptation, and economic growth. Improving the soil organic carbon stock of soil is integral to any strategy towards adapting to and mitigating the abrupt climate change, advancing food security, and improving the environment. Soil carbon sequestration is one of the major mitigation strategies to achieve climate-resilient agriculture. Climate-smart agriculture is the only way to lower the negative impact of climate variations on crop adaptation before it might affect global crop production drastically. To cope with these extreme changes, future development needs to make adjustments in technology, management practices, and legislation. Adaptation and mitigation are twin approaches to bringing resilience to climate change in agriculture.

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