

Global climate change and its effects on agriculture

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ARTICLE ID: 082

Introduction

Scientists' observation shows changes in earth's climate across the whole climate system. Even a small change in earth's temperature leads to very harsh outcome such as 1.5°C of global warming results in shorter cold seasons and longer warm season and increasing heat waves. Whereas 2°C change in global warming leads to heat increases beyond the threshold of agriculture and health. Scientists are observing alarming change in earth's climate which drastically affect the agriculture and leads to increase in food insecurity in the upcoming future due to increased food prices and reduction in food production. Global warming is not only about temperature but it also affects several other natural processes like intensification of water cycle, affect rainfall pattern, increase in sea level, amplification of permafrost thawing etc. Rising sea level in coastal areas leads to complete degradation of agricultural land and Warmer climate results in origin of different pests and diseases. Global food security is a state when 'all people, at all times, have physical and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life' (FAO, 1996). Our global agricultural practices are sufficient to feed the current world population but still more than 10% population is undernourished. Continuous increase in worlds population will increase demand of livestock production by 70% between 2005 to 2050. In order to stabilise climate change we need strong, rapid and sustainable reduction in greenhouse gases and liming net zero carbon dioxide level. Agriculture also contributes a significant amount of share in GHGs emission like nitrous oxide releases from soil, fertilisers and manures whereas methane produces by ruminant's animals and paddy rice filed. Both of these gases lead to significant amount in greenhouse gases emission. Major policies reforms are required within and beyond the agriculture sector



to strengthen productivity without relinquishing climate change adaptation.

Climate change and agriculture

Our nation follows industrial model of agriculture which heavily relies on fertilizers and pesticides that makes our agriculture system susceptible to climate change. Drastic combination of climate change with already vulnerable industrial system creates a chaotic condition for farmers. Climate change could be due to natural as well as artificial cause. Natural causes like volcanic eruption, solar activity, ice cap distribution, westerly waves and atmospheric waves and sea water temperature whereas artificial causes include deforestation, acid rain, depletion of ozone layer by freon gas, carbon dioxide emission and agricultural production activities. All these causes lead to increase in greenhouse gases which results in global warming. Global warming is continuous increase in earth's temperature due to greenhouse effect initiated at the time of industrial revolution.

Climate change drastically affect the agricultural industry as the selection of crop is totally dependent on the climate of specific region. Impact of climate change on livestock include change of flowering and harvesting seasons, quality change and also affect the area suitable for cultivation. Impact of global warming on the agricultural sector is both positive and negative depending on the severity of global increase in temperature. Positive impact includes increase in productivity due to the increased carbon dioxide concentration, increase in productivity at low temperature rise, increases the possibility of cultivating variety of crops, extended growth period and also reduction in heating cost for protecting cultivation. Negative impact includes reduction in crop productivity due to temperature rise, quality degradation, increase in the number of weeds, blights and pest, increase in disasters related to agriculture like flood and drought condition and increase in soil erosion. In sum the climate change creates opportunities as positive impacts but off course it also costs a lot as negative impact so one should keep in mind while formulating adaptation strategies that it can maximise opportunities and minimize the costs, and that's how one could create a sustainable agriculture development.

Impact of climate change on Indian agriculture



Continuous increase in Indian population over years might disturb food security once again in the future due to greater food demand. Demand for pulses, fruits, vegetables is also expected increases very sharply in the coming time. Further effects of gradual increase in temperature and environmental degradation are visible in areas which had been largely benefitted from green revolution. The situation of north-western India is of great concern due to rapidly decline in soil fertility, change in water table depth, rising salinity, increase in number of pesticide resistant harmful pests and degradation of irrigation water quality. Now the farmers have to apply more fertilisers to obtain the same yield as achieved 20-30 years back. In the 21st century India has to deal with both poverty reduction and environment protection simultaneously so in order to implement the strategy for sustainable agriculture development two important drivers of agricultural change must be consider one is globalisation and second is climate change.

Mitigation and adaptation strategies for the sustainable agriculture

Mitigation and adaptation are interconnected to each other, mitigation is considered as one of its belongings so adaption is an important counter measure against degrading environment. Mitigation strategies for the agriculture majorly include advancement in cultivation system through enhance irrigation and fertilization control to reduce the major greenhouse gases like methane, nitrous oxide and improvement in the carbon fixing technologies in the farmland soil. Adaptation according to UNFCC is a “regulating process of ecological and socioeconomic systems to reduce possible damages from actual and expected climate change that is, actions taken to help communities and ecosystem cope with changing climate conditions”. Adaptation measures include research and development, infrastructure management, economic means related to carbon grants, legal and institutional improvement, enhance public relation education, continuous monitoring, and technology and management applicable to farm households.

Conclusions

Climate change is a reality. We have to deal with it. If one analyses different studies related to climate change, we can see its severe effects on varied fields. Its effects can easily be noticed in environment. Unseasonal rains, increase in number and intensity of tropical



storms, prolonged drought conditions, prolonged heat conditions etc impacted the normal life functions of many communities/countries. This also affect the agriculture in direct or indirect manner. Various reports suggests that climate change will affect the quality and quantity of various crops. In serious situation this can also affect the food security of concerned region. It is also reported that impact of climate change will not be same for every sector and region. The possible effects would be high in tropical regions as compare to temperate regions. So, proper plans should be made according to the area.

As far as India is concerned it seems like it will face great challenge due to climate change. Most of the agriculture is dependent on monsoon rains. Its unevenness and variation in timing is impacting the agriculture and will also impact in future. The occurrence of hailstorms, cyclones, flash-floods, have increased much and have great impact on agriculture. These challenges have potential to lessening the income of farmers in the country.

To minimise the effect of agriculture on environment is also important. So, agriculturists should adopt climate smart agricultural practices. Crop rotation, minimising tillage, integrated approach for minimizing use of chemicals and natural resources, livestock waste management etc are some of the practices. Integrating different fields of agriculture which can use their by-products and work co-efficiently will definitely help in reducing some of the potential effects on environment. Developing of relevant good irrigation infrastructure will also help in reducing the effect of possible global warming. We need to stop the desertification of useful lands which can be exploited for agriculture. Planting of tree species near farm lands is good option to maintain soil biodiversity, which also effect the soil quality and help in avoiding soil erosion in certain cases. Role of honey bees in agriculture is well known and highly acknowledged. Various groups also highlight that change in climate and use of some insecticides impacts the population of these creatures which will absolutely affect the yield in coming years. So proper bee saving-rearing procedures should also be seen while planning out climate change challenges for agriculture.

Different ways to tackle the impact of climate change is need of hour. As human population is increasing and we cannot bear the yield loss for very long durations and need proper balance between requirement and supply because change in this chain may increase the risk of food availability for all globally especially in poor countries. Better germplasm (which can



tolerate stress) which is biotechnologically manipulated or selected through regular breeding programs can also help a lot in dealing with stress conditions. Different scientists working efficiently in selecting the right gene or group of genes in plants which can help in making stress resilient if not resistant crops. These all with improved technologies related to agriculture will certainly help us in dealing with changing scenarios.

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