

**IMPACT OF CLIMATE CHANGE ON AGRICULTURAL SUSTAINABILITY**

Article Id: AL202039

Shruti Mishra<sup>1\*</sup> and Vikas Verma<sup>2</sup><sup>1</sup>Dept of Agricultural Economics and Farm Management, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh, 482004<sup>2</sup>Dept of Plant Breeding and Genetics, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh, 482004Email: [shrutimishra.jnkvv@gmail.com](mailto:shrutimishra.jnkvv@gmail.com)

**C**limate change may be defined as periodic modification of Earth's climate brought about as a result of changes in the atmosphere as well as interactions between the atmosphere and various other geologic, chemical, biological, and geographic factors within the Earth system. Climate is often defined loosely as the average weather at a particular place, including parameters such as temperature, precipitation, humidity and windiness.

Climate change has significant impact on agricultural sector in many ways, and these impacts vary from region to region. For example, climate change is expected to increase temperature and precipitation variability, reduce the predictability of seasonal weather patterns and increase the frequency and intensity of severe weather events, such as floods, cyclones and hurricanes. Some regions are expected to face prolonged drought and water shortages.

The increasing population has resulted in increased demand for food. This results in pressure on natural resources. *By 2020, pressure on India's water, air, soil, and forests is expected to become the highest in the world (World Bank).* Climate change is expected to negatively affect both crop and livestock production systems in most regions. The changing climate is also adding to resource problems, such as water scarcity, pollution and soil degradation. Climate change will affect agricultural yield directly because of alterations in temperature and rainfall, and indirectly through changes in soil quality, pests, and diseases. The yield of cereals is expected to decline in India. Extreme weather conditions such as high temperature, heavy rainfall, floods, droughts, etc. will also affect crop production.

Climate changes related to the greenhouse gas emissions (GHG) are seen as one of the major threats to sustainable human development. Agriculture contributes a significant share of the greenhouse gas (GHG) emissions that are causing climate change 17% directly through

agricultural activities and an additional 7-14% through changes in land use. It is therefore both part of the problem – and potentially an important part of the solution. (OECD, Meeting of Agriculture Ministers, April 2016). The main direct agricultural GHG emissions are nitrous oxide emissions from soils, fertilisers, manure and urine from grazing animals; and methane production by ruminant animals and from paddy rice cultivation. Both of these gases have a significantly higher global warming potential than carbon dioxide.

Climate change has created challenges for the agricultural sector – and will continue to do so. One cannot deny the relation of agriculture and climate change. The negative effect of climatic change makes farm and farm community more vulnerable to face its repercussions. The agriculture being climate based enterprise has to deal with the extreme climatic events which are unprecedented and less predictable. Climate change induced increases in temperatures, rainfall variation and the frequency and intensity of extreme weather events are adding to pressures on global agricultural and food systems.

### **Climate Smart or Climate Resilient Agriculture**

Self-initiated efforts by farmers to adapt to climate change while decreasing the GHG footprint of agriculture are unlikely to be sufficient, given uncertainties surrounding the timing and nature of climate change. The action must be undertaken, which would have to reduce the GHG emissions from agriculture and/or adaptation of agricultural production to the new conditions, so that the productivity of the sector, i.e. agriculture, is not diminished. The Climate-Smart Agriculture is a viable alternative. This term should be understood as targeting the agricultural practices to reduce its negative impact on the environment, and consequently also on the climate. Two strategies are used in the process of climate-friendly agriculture management, noting that agricultural practices can mitigate the climate changes (reduction of GHG emissions), or adapting agriculture to the already noticeable changes (development of soil and water quality, sustainable agronomy, animal breeding, or crop rotation).

The Food and Agricultural Organisation (FAO) defines Climate-Smart Agriculture (CSA) as an approach that helps guide actions needed to transform and reorient agricultural systems to effectively support development and ensure food security in a changing climate. It takes into consideration the diversity of social, economic and environmental contexts, including agro-ecological zones. Implementation requires identification of climate-resilient technologies and practices for management of water, energy, land, crops, livestock, etc at the

farm level. It also considers the links between agricultural production and livelihoods. Testing and applying different practices are important to expand the evidence base and determine what is suitable in each context.

### Initiatives taken towards sustainable agriculture in country

1. **The National Water Policy (2002)** stresses that non-conventional methods for utilization of water, including inter-basin transfers, artificial recharge of groundwater, and desalination of brackish or sea water, as well as traditional water conservation practices like rainwater harvesting, including roof-top rainwater harvesting, should be practiced to increase the utilizable water resources. Many states now have mandatory water harvesting programmes in several cities.

2. **National Mission for Sustainable Agriculture** is one the eight missions in the National Action Plan on Climate Change (NAPCC) aims to support climate adaptation in agriculture through the development of climate-resilient crops, expansion of weather insurance mechanisms and agricultural practices. The mission focuses on four areas that are relevant for the endeavours of India's agricultural sector to adapt to climate change:

- Dry land agriculture
- Risk management
- Access to information
- Use of technology

3. **National Innovations on Climate Resilient Agriculture (NICRA)** was launched during February 2011 by Indian Council of Agricultural Research (ICAR) with the funding from Ministry of Agriculture, Government of India. The mega project has three major objectives of strategic research, technology demonstrations and capacity building.

Assessment of the impact of climate change simultaneous with formulation of adaptive strategies is the prime approach under strategic research across all sectors of agriculture, dairying and fisheries. Evolving climate resilient agricultural technologies that would increase farm production and productivity vis-à-vis continuous management of natural and manmade resources constitute an integral part of sustaining agriculture in the era of climate change. The four modules of NICRA – natural resource management, improving soil health, crop production and livestock – is aimed making the farmers self-reliant

4. **Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)** envisages “Per Drop More Crop”, that is, promoting micro/drip irrigation to conserve water. The scheme will be implemented by Ministries of Agriculture, Water Resources and Rural Development. Ministry of Rural Development is to mainly undertake rain water conservation, construction of farm pond, water harvesting structures, small check dams and contour bunding etc. MoWR, RD &GR, is to undertake various measures for creation of assured irrigation source, construction of diversion canals, field channels, water diversion/ lift irrigation, including development of water distribution systems.

5. **Paramparogat Krishi Vikas Yojana (PKVY)** an initiative to promote organic farming in the country through cluster-based approach. Fifty or more farmers form a cluster having 50 acre land to take organic farming. Each farmer will be provided Rs. 20000 per acre in three years for seed to harvesting crops and to transport them to market.

### Conclusion

It is clear that the occurrence of floods and droughts, heat and cold waves are common across the world due to climate change. Their adverse impact on livelihood of farmers is tremendous. It is more so in India as our economy is more dependent on agriculture. Interestingly, weather extremes of opposite in nature like cold and heat waves and floods and droughts are noticed within the same year over the same region or in different regions and likely to increase in ensuing decades. The human and crop losses are likely to be heavy. The whole climate change is associated with increasing greenhouse gases and human induced aerosols and the imbalance between them may lead to uncertainty even in year-to-year monsoon behavior over India.

Therefore, there should be a determined effort from developed and developing countries to make industrialization environment friendly by reducing greenhouse gases pumping into the atmosphere. In the same fashion, awareness programmes on climate change and its effects on various sectors viz., agriculture, health, infrastructure, water, forestry, fisheries, land and ocean biodiversity and sea level and the role played by human interventions in climate change need to be taken up on priority basis.

In the process, lifestyles of people should also be changed so as not to harm earth atmosphere continuum by pumping greenhouse gases and CFCs into the atmosphere. Also, there is need to guide farmers on projected impact climate change and sensitise them on probable mitigation and adaptation options to minimize the risk in agricultural sector.

## Way Forward

Policy reforms as suggested by OECD, Meeting of Agriculture Ministers, April 2016.

1. Wider social, economic and environmental policy settings – such as trade, investment, infrastructure, and education policies – should consistently support sustainable productivity growth, in combination with adaptation and mitigation efforts.
2. There is a need to reform misaligned and distortive agricultural policies that encourage unsustainable intensification and the overuse of natural resources and potentially damaging inputs.
3. Policies that aim to address climate change should emphasize outcome-based farmer incentives and knowledge transfer systems.
4. Governments should ensure the provision and dissemination of relevant and up-to-date information on resource use efficiency and risk management.

## References

Accessed [www.fao.org](http://www.fao.org) on 20 Dec 2019.

Accessed [www.worldbank.org](http://www.worldbank.org) on 20 Dec 2019.

Agovino, M., Casaccia, M., Ciommi, M., Ferrara, M., & Marchesano, K. (2019). Agriculture, climate change and sustainability: The case of EU-28. *Ecological Indicators*, 105, 525-543.

Akinnagbe, O. M., & Irohibe, I. J. (2014). Agricultural adaptation strategies to climate change impacts in Africa: a review. *Bangladesh Journal of Agricultural Research*, 39(3), 407-418.

Climate Change and its impact on agriculture- A Report by MANAGE (<https://www.manage.gov.in> › studymaterial › CCA-E)

Żukowska, G., Myszura, M., Baran, S., Wesółowska, S., Pawłowska, M., & Dobrowolski, Ł. (2016). Agriculture vs. Alleviating the climate change. *Problemy Ekorozwoju*, 11(2).

OECD, Meeting of Agriculture Ministers, April 2016.