

Climate-smart policies for Indian agriculture

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Climate change is perhaps the most extreme challenge in agriculture in India and across the world is facing now-a-days and has to deal within future. There have been overwhelming and growing scientific evidences to establish that the world is getting warmer due to climate change and such increasing weather variabilities and worsening extremes will impact the agriculture sector more and more adversely. The growth story of Indian agriculture since the days of food scarcity (in the mid-1960s) to the present satisfactory production level of food grains has been very impressive. In these efforts, land degradation and environmental challenges have however, emerged to thwart sustainability of agri-food systems. The frequent occurrences of natural disasters like flood, drought, storms, hails, cyclones have led to severe hardship and farm distress. Feeding a growing population and ensuring food and nutritional security in future thus becomes a daunting challenge in a changing climate. It is estimated that the requirement of annual food grains would be to the level of 450 million metric tonnes against the current production of 257 to 285 million tonne during 2012-13 to 2017-18 for a burgeoning Indian population which is projected at 1.65 billion in 2050.

Key words: Agriculture, Climate, Policies

THERE have been a growing interest in India to scientifically ascertain the impacts of agriculture sector on climate change and the impact of climate variability as well as climate change on farm sector of the economy. Studies by scientists way back in 1993 have predicted the

trend that there could be an agricultural decline with climate change, which have been subsequently confirmed by other research evidences from scientific reports. Studies carried out at the Indian Agricultural Research Institute, New Delhi have indicated

the possibility of a loss of 4 to 5 MMT in wheat production with every rise of 1°C temperature. This study has assumed that irrigation would be made available at present level, which of course may not be a possibility considering the receding Himalayan glaciers and increased



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demand of water from other sectors. *The Economic Survey in 2017-18* (it has an exclusive chapter that covers climate change and its impact on agriculture in India) has warned that 'Climate change could reduce annual agricultural incomes in the range between 15% and 18% on an average, and up to 20%-25% for unirrigated areas'. It has alarmed that stagnation of growth in agriculture gross domestic product and farm revenues in the preceding four years due to repeated monsoon failures.

The quality of food grains is also significantly affected by temperature in many crops, which could in turn have great impact on the nutritional security aspects in a developing country like India. Research showed that the decline in grain protein content in cereals could partly be related to increased carbon dioxide (CO₂) concentrations and temperature. There are also reports of quality of Basmati rice being adversely impacted due to temperature increase beyond the optimum level.

Pest and disease incidences in any crop are functions of ambient temperature and humidity. Crop - pest/ disease interactions will therefore change significantly in an era of climate change. Nagarajan and Joshi long back in 1978 had discovered different levels of rust virulence which was due to temperature - dependent movement of spores from south to north India. The yield in temperate crops like apple was seen to be directly related to climatic extremes. Average productivity of apples in the traditional Kullu and Shimla regions

of Himachal Pradesh has often been attributed to inadequate chilling in recent decades, crucial for good apple yields.

This author (as a part of his Masters Dissertation at the University of Birmingham) attempted to analyse the weather data for Odisha to find out the trend, if any on the climate variables and also to see correlation with the production of major crops. Analysis of the weather data, mainly rainfall (precipitation) figures for all districts since 1901 and temperature data since 1931 (up to 2010) was made. Crop production data (for the wet, *kharif*) for past one-and-half decades (period of pronounced climate change impacts) was taken for correlation and regression analysis of seasonal weather variables. These analyses presented interesting results. It empirically established that monsoon onset is getting delayed (than the normal date of onset) in the recent years that may adversely affect cropping system of the state. Mean annual precipitation (rainfall) and mean number of rainy days showed a decreasing trend over the last one century (since 1901). This would obviously disturb crop choice and crop planning. Although total amount of rainfall in a year has decreased over the years, occurrence of very heavy rainfall events in the state has increased in the recent period (last 15-20 years). Similarly, the mean annual maximum temperature showed an increasing trend in the analysis period with a decrease in the mean annual minimum temperature. All these results call for effective planning and

research, as temperature regimes greatly influence the growth pattern and productivity of rice and many other crops. All these scientific evidences established the fact that extreme weather events are becoming common in the entire country and thus, necessitate policy making at all levels, Union, States and the Local self-Governments, for framing and implementation of suitable strategies to arrest the trend.

The threat of climate change has necessitated framing of suitable policies by individual governments and international community. The National Mission on Sustainable Agriculture as a part of National Action Plan on Climate Change since last one decade has focused to make Indian agriculture sustainable in light of likely risks arising from climate variability. The Indian Council of Agricultural Research has initiated the National Innovations on Climate Resilient Agriculture (NICRA) network project since 2011 to enhance resilience of Indian agriculture to climate vulnerability through strategic research and technology demonstration as well as capacity building of all the actors in the system. Similarly, CGIAR (Consultative Group on International Agricultural Research) Programme on Climate Change, Agriculture and Food Security is also promoting adaptable and resilient agriculture and food systems in many countries including India. The International Crops Research Institute for the Semi-Arid Tropics, the only CGIAR institute (headquarters in India), has also developed a pool of climate-smart technologies. Few such

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approaches highlighted by ICRISAT for building climate smart villages include: watershed management approach (improving rural livelihoods by rehabilitating natural ecosystems); futuristic multi-model approach (customizing adaptation packages to enhance climate resilience); digital technologies approach (by integrating climate information and eco-conservation technologies); meteorological advisory and farm systems approach (building resilience agro-ecosystems by using climate information); and the climate and crop-modelling approach (cropping advisories based on seasonal forecast).

Addressing food security and climate challenges in a 'business-as-usual' approach will make the tasks more difficult. Therefore, it's high time that rationale of climate-smart agriculture be appreciated by decision makers at all levels. There should be structured trainings to build capacity of officials of relevant Departments to sensitize them to understand diverse impacts of global climate change even at local levels. Similarly, defined institutional architecture has to be built into the Government system to sustain focus and integrate activities into ongoing schemes and programmes aligned to sustainable agriculture practices.

The hardest political problem in climate change policy framework comes from the least appreciation of a changing climate at the level of local self-governments. Till the day a village *Sarpanch* at the cutting-edge level is sensitized to tune the development strategies of a *Gram Panchayat* for adapting agriculture to climate variability, any efforts at higher levels of Governance may not bear desired fruits. The institution of a *Panchayat* in Indian context has the capacity to leverage funds from a plethora of schemes. Allocations under MGNREGA can be

purposefully utilized in climate-proofing projects such as farm ponds; soil and water management through participatory watershed approaches; plantation and agro-forestry; and many other eco-friendly activities that will adapt and build resilience to climate change.

Fortunately, the ICAR system, state agricultural universities and even the private sector were pursuing their research works to develop new and more tolerant cultivars to multiple (both biotic and abiotic) stresses. Governments at both central and state levels must enhance funding support for development of technologies and approaches that suit to the local crop and ecology in a complex scenario of climate variability. Simple and affordable insurance products should be properly implemented to create safety net for the farmers, especially the small holders who are often the neglected part of agricultural community. There is also need of knowledge sharing platforms for all stakeholders to ensure wider adaptation and mitigation to the weather variabilities. Priority has to be accorded for upscaling research on emerging areas of climate science to develop technologies that must include pest-surveillance and forewarning systems; simulation modelling and big data analytics etc.

Dr Arvind Subramanian (former India's Chief Economic Advisor) emphasised on at least three policy tools to make Indian agriculture more resilient in a changing climate. First, the urgent need to spread irrigation (to arrest fast depleting ground water resources); secondly, development of varieties and cropping techniques that are resilient to weather variabilities; and thirdly, switching over to direct transfer of agri-subsidies (on power and fertilizers) to curtail their indiscriminate use which has adverse bearing on the environment.

India has already submitted its Intended Nationally Determined Contributions to the UNFCCC (as a part of its commitments to Paris Agreement) that *inter-alia* include adoption of climate friendly practices

for a cleaner path of development. The Union Ministry of Agriculture and Farmers' Welfare delineated its intended climate actions in the agricultural sector like increasing water use efficiency; promotion of organic farming; conservation agriculture practices; plantation and agro-forestry etc. with specific targets to be achieved by 2020. If we are to achieve the sustainable development goal of zero hunger, agriculture and food system must reorient to become sustainable and enhance the agricultural productivity and incomes of small-holder farmers. India has as high as 86% of its farm households coming under small-and marginal-category (owning less than 2 ha of arable land) who are most vulnerable to the effects of climate change.

SUMMARY

The impact of climate change on the 'complex and risk prone' farming systems of India will be disastrous, if 'climate-wise' development policies are not implemented with focus and regularity. Farmers must gain access to the rich scientific knowledge recommended by various research institutions/projects through efficient dissemination of the climate-smart technologies. Moreover, agricultural practices which have smaller ecological footprints and capable of competitive economic returns should be promoted. Suitable policies and strategies (both adaptation and mitigation) in a changing climate can only be ignored at the cost of agricultural growth and economic development of India.

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