

Impact of Climate Change and Sustainable Agriculture

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Recently, 17 Sustainable Development Goals were adopted by the Member Nations of the United Nations. Goal 13 urges countries to take urgent action to combat climate change and its impacts following the Conference of Parties to the UN Framework Convention on Climate Change in Paris. Member Nations of the UN will have to finalise their strategies for making their respective contributions to both adaptation and mitigation of climate change. The areas of special concern to us in India, where agriculture is the predominant source of livelihoods, are unfavourable changes in mean temperature, excess or deficit in rainfall, more uncertain weather behaviour including extreme weather events, sea level rise, and more frequent and severe coastal storms and tsunamis. From the action taken so far by all nations, particularly by developed countries, it seems likely that the mean temperature will rise by 3°C by the end of this century.

The rise in mean temperature of the order of 2 to 3°C will lead to a reduction in the duration of the wheat crop in North India, resulting in a loss of 6 to 7 million tonnes of wheat every

year. Certain regions of the world like Siberia or Northern Canada will benefit from a small rise in temperature since this will help to prolong the duration of the crop. Thus, climate change will have both common and differentiated impact. In keeping with its policy that India will assist in arriving at a mutually agreed reduction in green house gas emissions, the Government of India had announced on October 1, 2015 the following two major decisions.

1. Reduce by 2030, the emission intensity of the GDP by 32 to 35 per cent from 2005 level.
2. Generate about 40 per cent of electric power installed capacity from non-fossil fuel based energy resources by 2030 such as nuclear, solar, wind, biomass and biogas.

The areas of particular concern to our country are a rise in mean temperature and a possible rise in sea level. We have to take anticipatory action to insulate lives and livelihoods particularly in vulnerable areas from the adverse impact of unfavourable climate. Our strategy should be to maximise the production benefits of good monsoons and minimise the adverse impact of climate change. Although, the consequences of a rise in temperature and poor or excessive precipitation will be general, the

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action plans, both for adaptation and mitigation have to be local. We will have to establish at the Panchayat level, Climate Risk Management Centres and train a cadre of Community Climate Risk Managers.

An area where urgent action is needed is the conservation of Climate Smart Millets and their reintroduction in the diet. Millets and other underutilised crops are more tolerant to drought and heat and are also nutritious. Farming systems for adaptation to climate change will have to be designed by ICAR, Agricultural Universities and Krishi Vigyan Kendras and popularised through local men and women trained to become Climate Risk Managers. There will be a need for anticipatory research in several areas of farming which will need change. For example, in crops like wheat and rice, the breeder should shift attention to per day productivity from per crop productivity, since the duration of the crop is likely to get reduced. We are one of the leading countries in the production of potatoes. This has been possible due to the production of seed tubers during the aphid free season. Aphids serve as vectors of virus diseases and hence, the aphid free season helps farmers to produce disease free seed tubers. If the mean temperature goes up, this advantage will be lost and we will have to raise potato crop from true sexual seeds. Research on such problems needs strengthening.

Another area which will require anticipatory attention is the preparation for more frequent floods and hailstorms. Fortunately, genes are available now which can help plants like rice to grow over the flood level. Such elongation genes will have to be introduced in all flood prone areas. The greatest challenge will be coastal areas since we have nearly 7500 kms of shoreline as well as the Andaman and Nicobar and Lakshadweep Group of Islands. In these areas, mangrove forests should be conserved and their area be increased. Mangroves serve as bioshields. Also, nearly 97 per cent of the global water resource is sea water. There is scope now for biosaline farming involving both halophytes (salt tolerant plants) and marine aquaculture. Over 150

years ago, the farmer of Kuttanad in Kerala perfected the method of cultivating rice below sea level. This requires both salinity management and varieties like *Pokkali* which are salinity tolerant. In recognition of this innovative and important contribution of the farmers of Kuttanad, FAO has declared the Kuttanad Farming System as a Globally Important Agricultural Heritage Systems (GIAHS). The Government of Kerala has decided to establish an International Research and Training Centre in Below Sea Level Farming in Kuttanad for the purpose of equipping coastal communities in the science and art of biosaline and below sea level agriculture. Such a Centre will also be of interest to areas like Sunderbans and countries like Maldives.

Another consequence of sea level rise will be the need for finding alternative places of living to those who are living near the sea. Planning will have to start to provide suitable places to live to such climate refugees. The M S Swaminathan Research Foundation has established in Vedaranyam in Tamil Nadu, a Genetic Garden of Halophytes in order to conserve halophytes and make them available to breeders for designing climate smart coastal agricultural methods. There is also need for agriculture to make a contribution to reducing green house gas emissions. Several steps can be taken by the local climate risk management centres with the active participation of local communities. Involvement of women is particularly important since they suffer the most from the adverse impact of climate change, as for example in areas like collecting drinking water, fuel wood, fodder etc. Hence, all the programmes relating to climate change adaptation and mitigation must be gender sensitive.

Among the mitigation steps which can be taken, reducing deforestation and promoting afforestation in a people centred manner will help to reduce the CO₂ burden in the atmosphere. Methane, which is another green house gas can be used to promote biogas plants. This will help to both prevent methane accumulation in the atmosphere and at

the same time, provide fuel and fertilizer to the farmer. Nitrous oxide emissions as a result of fertilizer application can be reduced through the use of neem coated urea. In fact, at the local level, the most effective method of contributing to low carbon development pathway is the principle- "a biogas plant, few fertilizer trees and a farm pond in every farm".

The Climate Risk Managers at the local level should be both rural women and men. They can be the leaders in promoting climate smart farming systems which should include pulses among the crops. Pulses can help to fix nitrogen in the soil and at the same time provide protein rich food.

Along the coast, there is now a possibility for mobilising information technology. For example, mobile phones can be used to provide information to small scale fishermen data on wave heights from different distances from the shoreline as well as information on where the fish are. Such fisher friendly applications of the internet and mobile telephony can help to serve as transformational agents in the areas of artesanal fisheries. Small scale fishermen got particularly afraid following the titanic Tsunami of December 26, 2004, but they now go with great confidence in their small boats to do Ocean fishing.

Climate change can be a mega catastrophe if we do not take action now, both in the area of adaptation and mitigation. Anticipatory preparation to potential changes in temperature, precipitation and sea level can help to introduce new technologies in farming. The technological transformation of small scale agriculture and fisheries can be a beneficial outcome. Climate change has already increased the volatility of prices of agricultural commodities. In the future, it will be difficult to import food grains at an affordable price. Therefore, the future will belong to the nations with grains and not guns. An uncommon opportunity now exists for converting a potential calamity like climate change into a tool for achieving the goal of sustainable agriculture. □

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