



Impact of climate change on agriculture

Climate change refers to changes beyond the average atmospheric condition that are caused both by natural factors such as the orbit of earth's revolution, volcanic activities and crustal movements and by artificial factors such as the increase in the concentration of greenhouse gases and aerosol (1, 2). Climate change by global warming, which refers to the average increase in global temperature, has become a mega trend that will lead to significant global changes in the future. It is also anticipated that change in climatic conditions may lead to an increase in species migration pole wards (3). Climate change, which is largely a result of burning fossil fuels, is already affecting the earth's temperature, precipitation, and hydrologic cycles, potentially threatening recognized aspects of farming systems but also providing opportunities for improvements (4).

Continued changes in the frequency and intensity of precipitation, heat waves, and other extreme events are likely, all of which will influence agricultural production. Moreover, compounded climate factors can worsen plant productivity, resulting in price increase for many important agricultural crops.

Impacts of climate change (5)

Hydrology: The hydrologic cycle now includes more frequent and intense droughts and floods in many agricultural regions. These events can damage and at times even destroy crops.

Heat: Over the next 30-50 years, average temperature will likely to increase by at least 1.0°C. Anticipated regionally dependent changes include increased number of heat waves and warm nights, a decreasing number of frost days, and a longer growing season in temperate zones.

CO₂: After 3-4 decades, CO₂ concentration will increase to about 450 parts per million by volume. The CO₂ response is expected to be higher on C₃ species (wheat, rice, and soybeans), which account for more than 95% of world's species than on C₄ species (corn and sorghum). C₃ weeds have responded well to elevated CO₂ levels, symbolizing the potential for increased weed pressure and reduced crop yields.

Crop biodiversity: The distribution of wild crop relatives, an increasingly important genetic resource for the breeding of crops, will be severely affected.

Economic consequences: Price will rise for the most important agricultural crops—rice, wheat, maize, and soybeans. This, in turn, leads to higher cost of feed and therefore meat prices. As a result, climate change will reduce the growth in meat consumption slightly and cause a more substantial fall in cereal consumption, leading to greater food insecurity.

Crop loss: At elevated CO₂, increased partitioning of assimilates to roots occurs consistently in crops such as carrot, sugar beet and radish. If more carbon is stored in roots, losses from soil borne diseases of root crops may be reduced under climate change. In contrast, for foliar diseases favoured by high temperature and humidity, increases in temperature and precipitation under climate change may result in increased crop loss. The effects of enlarged plant canopies from elevated CO₂ could further increase crop losses from foliar pathogens.

How can agriculture adapt?

The study has successfully gained information on climate change adaptation strategies applied by the farmers. The most frequently observed ones were: the use of plant protection chemicals, improved varieties, increasing frequency of irrigation, land ploughing, off-farm works and improved management practices. Findings such as these are essential towards the identification and formulation of an integrated, sustainable and climate-proof farming support system (5-7).

Tools for adaptation (5)

Crop breeding for growth of new climate tolerant crop varieties is a key tool for adapting agriculture to a changing climate. History and current breeding experience indicate that natural biodiversity within crops has allowed for plant adaptation to different conditions, providing clear evidence that plant breeding has a great potential to support in the adaptation of crops to climate change.

Cropping system development is another tool that can help agriculture adapt. For example, the use of crop mixtures that have several crops growing at one time can help systems exhibit greater durability during periods of high water or heat stress.

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 behaviour over India and the other countries of the world. 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.

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