

# Research and technology integral for climate resilient agriculture



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*By 2050, fewer people would be at risk of hunger if improved agricultural technologies are adopted, according to the Food and Agriculture Organisation. As agriculture is inseparably linked to climate, agriculture technologies would play a central role in minimizing the impact of weather on plant breeding as well as ensure increased productivity at lower investment.*

**T**he world has begun experiencing severe and widespread effects of climate change on the agriculture ecosystems, which are manifested in the form of negative impact on the productivity of crops, livestock, forestry, fisheries.

Agriculture activities are prone to numerous risks and uncertainties, which have a negative impact on plant growth and productivity, and ultimately food production. Broadly, they can be divided into three major sections.

First is biotic that include pests and diseases, second is abiotic that encompasses physical conditions such as temperature, humidity, precipitation, and last one is the prevailing economic and cultural conditions. Most of these risks have climatic components and will be affected by climate change in relation to intensity, scope and frequency. But to ensure food security in the face of

climate change, we need to take an urgent action to build resilience into agricultural production.

## Resilience to the rescue

The primary objective of increasing resilience of crops is to increase and stabilise productivity as well as increase the benefits to cultivators. About 70 per cent of the poor people in India live in rural areas and most of them are partly or completely dependent on agriculture and allied activities for their livelihoods. We need to think beyond the traditional wisdom and incorporate technology and advanced data tools in order to protect the agriculture sector and food security from the wrath of climate change. Humans cannot have a control on the weather phenomenon. Thus, we need to boost research into plant breeding and find out innovative ways to cultivate crops, which would withstand the adverse climatic conditions.

Indian agriculture is staring at the harsher prospects of its vulnerability to long-term climate change, says the India's Economic Survey of 2017-18. It details how between 1970 and the current decade, the average temperature increased by about 0.45 degrees and 0.63 degrees in the kharif and rabi seasons respectively, while kharif rainfall decreased by 26 millimetres and rabi rainfall by 33 millimetres during the same period. These changes have already caused reduction in the productivity of major crops such as rice, sorghum, wheat, and chickpea among others. The International Maize and Wheat Improvement Centre has warned that the Indo Gangetic plains, which produces 15 per cent of the world's wheat, would see over 50 per cent farmlands becoming too heat stressed to produce wheat by 2050. All this demands that we focus more on science and technology to find solutions.

## Upping the game

The mission to build strong climate resilient mechanisms starts with the development of new seed varieties that germinate and sustain crops even in dry, saline climate conditions and endure



### Top 15 measures identified by the global agriculture MACC\* to address climate change

1. Adopt zero-emissions on-farm machinery and equipment
2. Employ greenhouse gas-focused genetic selection and breeding
3. Improve animal health monitoring and illness prevention
4. Improve fertilization practices in rice cultivation
5. Apply nitrification inhibitors on pasture
6. Optimize the animal feed mix
7. Scale low- and no-tillage practices
8. Expand use of animal feed additives
9. Improve rice paddy water management
10. Reduce nitrogen overapplication in China and India
11. Expand use of anaerobic manure digestion
12. Expand adoption of controlled-release and stabilized fertilizers
13. Expand use of feed-grain processing for improved digestibility
14. Expand adoption of dry direct seeding in rice cultivation
15. Expand uptake of technologies that increase livestock production efficiencies

\* McKinsey's global agriculture marginal abatement cost curve (MACC)

### Agri production vs Climate change

Simulation studies using integrated modelling framework showed that rainfed rice yields in India are projected to reduce marginally (<2.5%) in 2050 and 2080 scenarios while irrigated rice yields are projected to reduce by 7% in 2050 and 10% in 2080 scenarios. Climate change is projected to reduce wheat yield by 6-25% towards the end of the century with significant spatio-temporal variations.

Source: Ministry of Agriculture and Farmers Welfare

droughts and incessant or erratic rains. Genetic modification through hybrid breeding or gene editing can help us transfer or develop sought traits into the target plants. With the evidence of

rapid climate change is compelling; gene editing appears to be the best tool to reduce the time for accomplishing the change in crops sooner. It would be helpful in developing varieties that are climate resilient, require lower inputs, give higher yield and immune to various diseases. The agri research bodies must undertake research and present the solutions, which would certainly find confidence in the government. It is necessary to push for institutionalisation of the advanced technological interventions in the seed sector.

### Adopting precision techniques

Moreover, there is a need to shift from traditional farming techniques to precision farming to be able to switch to low-input, high-efficiency and sustainable agriculture. The precision farming involves advanced crop management practices such as smart water and nutrient management, improving pest management, creating better facilities for weather forecasts. Farmers alone cannot do this. Here comes the proactive role to be played by private players especially startups, which can provide farmers end-to-end solutions. There already are startups in the agri-tech sector that cater to demands of custom hiring of farm equipment, end-to-end integrated solutions among others. Entrepreneurship must be encouraged as they do not just provide agricultural solutions but help create rural employment as well.

Big data analytics can be used to crowdsource and interpret a variety of primary agronomic management and socioeconomic data for climate resilient agriculture. Other important tools such as artificial intelligence, geo-tagging and satellite monitoring can do wonders for propagation of sustainable agriculture. The deeply entrenched network of cellular technology is an advantage for agri businesses to reach out to farmers and provide services. Nowadays, farmers can be seen using mobile apps to get updates about crops and prices. It should help government agencies and businesses to understand the issue well.

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