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Climate change and food security

Rice production in India could decrease by almost a tonne/hectare if the temperature goes up 2^{0}C, while each 1^{0}C rise in mean temperature could cause wheat yield losses of 7 million tonnes per year. A recent national conference on food security and agriculture deliberated strategies to protect agriculture, food and nutrition security in the time of climate change. **Suman Sahai** reports

A two-day national conference was organised by Gene Campaign and ActionAid on 'Ensuring Food Security in a Changing Climate' to generate greater awareness about this crucial issue and to develop recommendations for future action. The conference, held on April 23 and 24, in New Delhi, brought together over 200 participants from 22 states. Scientific and technical experts from government and non-government organisations, grassroots-level community organisations, civil society groups, members of government departments, scientists, farmer organisations, officials of state governments, diplomats, international organisations and concerned citizens discussed the impact of climate change on agriculture and deliberated the strategies needed to help protect agriculture, food and nutrition security, as well as rural livelihoods

According to climate estimates, developing countries in the tropics are more susceptible to climate change damage than temperate countries. Agriculture in the productive areas of Africa and South Asia will be amongst the worst-affected. According to some estimates, almost 40% of the production potential in certain developing countries could be lost.

Changes in rainfall patterns and temperature regimes will influence the local water balance and disturb the optimal cultivation period available for particular crops, thus throwing food and agricultural production out of gear. The worst brunt of climate change will be borne by farmers in dryland regions where agriculture is rainfed, conditions are marginal and only one crop is grown per year.

In South Asia, the biggest blow to food production is expected to come from the loss of multiple cropping zones. The worst-affected areas are predicted to be the double- and

triple-cropping zones. To offset most of this loss, an effort must be made to convert today's single-cropping areas into two-crop zones. This can first and foremost be done by efficient water harvesting and equitable management.

Coping with the impact of climate change on agriculture will require careful management of resources like soil, water and biodiversity. Making agriculture sustainable is key, and is possible only through production systems that make the most efficient use of environmental goods and services without damaging these assets. If climate change impacts can be incorporated in the design and implementation of development programmes right away, it will help to reduce vulnerability, stabilise food production and secure livelihoods. A large-scale climate literacy programme is necessary to prepare farmers, who are today bewildered by the rapid fluctuations in weather conditions that affect their agriculture. Their traditional knowledge does not help them manage these recent anthropogenic changes.

Developing countries face a substantial decrease in cereal production potential. In India, rice production is slated to decrease by almost a tonne/hectare if the temperature goes up 20C. By 2050, about half of India's prime wheat production area could get heat-stressed, with the cultivation window becoming smaller, affecting productivity. For each 10C rise in mean temperature, wheat yield losses in India are likely to be around 7 million tonnes per year, or around $ 1.5 billion at current prices.

To cope with the impact of climate change on agriculture and food production, India will need to act at the global, regional, national and local levels.

Recommendations for action

Global

India must negotiate hard against the post-Copenhagen 'pledge and review' framework for emissions and try to get global temperature rise capped at 20C. If this is not done, the impact on agriculture and food security in developing countries will be devastating. Rising temperatures will be beneficial for agriculture in cold temperate regions since warmer conditions will allow their single-crop zones to become two-, even three-crop zones. Given that agriculture is the lifeline of the developing world and will bear the worst brunt of climate change, India must insist that developed countries reduce their own agriculture emissions while at the same time paying for adaptation, especially in the agriculture sector, consistent with the 'polluter pays' principle.

Regional

Regional cooperation at the SAARC level is necessary to protect the Himalayan ecosystems and minimise glacial melt. Negotiations on river waters emanating from the Tibetan plateau are urgent so that flows in our major rivers like the Ganga and

Brahmaputra are maintained to support agriculture. Regional strategies for mitigation and adaptation across similar agro-ecologies will help all countries of the region to protect their agriculture and food production.

National

Adaptation strategies have long lead times and need to be started ***now***. Appropriate policy and budgetary support for mitigation and adaptation actions is needed. Multiple food and livelihood strategies are required in rural areas to minimise risk. Food inflation must be contained at all costs. It will worsen with climate change, as more frequent and unpredictable drought and floods will result in shortfalls in food production. Just one bad monsoon in 2009 led to a reduction of 15 million tonnes of rice and 4 million tonnes of pulse production, causing prices to go through the roof. A carefully planned programme for strategic research, along with dedicated funding, is needed to develop solutions to cope with the impact of global warming on crops, livestock, fish, soil, etc.

Local

The real action for both mitigation and adaptation will have to be at the local level. The pursuit of sustainable agricultural development at the local level is integral to climate change mitigation, and combating the effects of climate change is vital for sustainable agriculture. Location-specific technologies will need to be developed at the level of the agro-ecological unit, to make agriculture sustainable and minimise losses to food and nutrition.

Mitigating emissions from agriculture will reduce the farmer's input costs and make the production system more sustainable. The real challenge to the agricultural future of the country, however, will have to be met by rapid and targeted adaptation strategies. Adaptation will require strategies to reduce vulnerabilities, strengthen resilience and build the adaptive capacity of rural and farming communities. Industrial agro ecosystems damage environmental goods and services and so have weak resilience.

Developing sustainability in agriculture production systems rather than seeking to maximise crop, aquacultural and livestock outputs, will help farming communities cope with the uncertainties of climate change. The ecosystem approach with crop rotations, bio-organic fertilisers and biological pest control, improves soil health and water retention, increases fertile top soil, reduces soil erosion and maintains productivity over the long term. The more diverse the agro ecosystem, the more efficient the network of insects and micro-organisms that control pests and disease. Building resilience in agro ecosystems and farming communities, improving adaptive capacity and mitigating greenhouse gas emissions is the way to cope.

Agricultural biodiversity is central to an agro ecosystem approach to food production.

Such an approach promotes soil fertility, fosters high productivity and protects crop, livestock, fish and soil resources. Diversity in livestock and fish species and breeds is as important as in crop varieties. Genetic diversity gives species the ability to adapt to changing environments and combat biotic and abiotic stress like pests and disease, drought and salinity.

Specific recommendations

Apart from the obvious focus needed on soil health, water conservation and management, and pest management, agriculture and food production ***per se*** will need to become sustainable and ecologically sound to adapt to climate change turbulence.

- A special package for adaptation should be developed for rainfed areas based on minimising risk. The production model should be diversified to include crops, livestock, fisheries, poultry and agro forestry; homestead gardens supported by nurseries should be promoted to make up deficits in food and nutrition from climate-related yield losses; farm ponds, fertiliser trees and biogas plants must be promoted in all semi-arid rainfed areas which constitute 60% of our cultivated area.
- A knowledge-intensive rather than input-intensive approach should be adopted to develop adaptation strategies. Traditional knowledge about the community's coping strategies should be documented and used in training programmes to help find solutions to address the uncertainties of climate change, build resilience, adapt agriculture, and reduce emissions.
- Conserving the genetic diversity of crops and animal breeds, and its associated knowledge, in partnership with local communities, must receive the highest priority.
- Breed improvement of indigenous cattle must be undertaken to improve their performance since they are much better adapted to adverse weather than high-performance hybrids. Balancing feed mixtures, which research shows has the potential to increase milk yields and reduce methane emissions, must be promoted widely.
- An early warning system should be put in place to monitor changes in pest and disease profiles and predict new pest and disease outbreaks. The overall pest control strategy should be based on integrated pest management because it takes care of multiple pests in a given climatic scenario.
- A national grid of grain storages, ranging from pusa bins and grain golas at the household/community level to ultra-modern silos at the district level, must be established to ensure local food security and stabilise prices.
- Agricultural credit and insurance systems must be made more comprehensive and responsive to the needs of small farmers. For instance, pigs are not

covered by livestock insurance despite their potential for income enhancement of poor households.

The following adaptation and mitigation support structures should be established at each of the 128 agro ecological zones in the country:

- A centre for climate risk research, management and extension should prepare computer simulation models of different weather probabilities and develop and promote farming system approaches which can help minimise the adverse impacts of unfavourable weather, and maximise the benefits of a good monsoon.
- A farmer field school to house dynamic research and training programmes on building soil health, integrated pest management, water conservation and its equitable and efficient use. The school should engage in participatory plant and animal breeding; there should be a focused research programme to identify valuable genetic traits like drought-, heat- and salinity-tolerance and disease resistance available in the agro biodiversity of the region.
- Gyan chaupals and village resource centres with satellite connectivity from where value-added weather data from the government's Agromet service should be made available to farmers through mobile telephony, giving them information on rainfall and weather in real-time.
- A network of community-level seed banks with the capacity to implement contingency plans and alternative cropping strategies depending on the behaviour of the monsoon.
- Decentralised seed production programmes involving local communities, to address the crisis of seed availability. Seeds of the main crops and contingency crops (for a delayed/failed monsoon, or floods) as well as seeds of fodder and green manure plants specific to the agro ecological unit must be produced and stocked.

Technical and financial investments must be made in climate adaptation and mitigation research. Some priority areas identified by the conference are:

- Evaluation of traditional varieties and animal breeds for valuable traits like tolerance to higher temperatures, drought and salinity, feed conversion efficiency and disease resistance, for use in breeding new varieties and breeds.
- Developing balanced ration and feed-and-fodder regimes that will increase milk yields of indigenous cattle and reduce methane emissions.
- Participatory and formal plant breeding to develop climate-resilient crop varieties that can tolerate higher temperatures, drought and salinity.
- Developing short-duration crop varieties (especially wheat) that can mature

before the peak heat phase sets in.

- Selecting genotypes in crops that have a higher per day yield potential to counter yield loss from heat-induced reduction in growing periods.
- Developing (the more heat-tolerant) durum wheat varieties for rabi cultivation in north India, to supplement diminishing wheat yields from existing wheat cultivars, and for durum wheat's ***chapatti***-making qualities.

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