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किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद

Agrisearch with a human touch

National Initiative on Climate Resilient Agriculture (NICRA)

Indian Council of Agricultural Research

Implemented by :

Natural Resource Management Division (ICAR), New Delhi

Coordinated by :

Central Research Institute for Dryland Agriculture, Hyderabad

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Background

Climate change impacts on agriculture are being witnessed all over the world, but countries like India are more vulnerable in view of the huge population dependent on agriculture, excessive pressure on natural resources and poor coping mechanisms. The warming trend in India over the past 100 years has indicated an increase of 0.60°C. The projected impacts are likely to further aggravate yield fluctuations of many crops thus impacting food security. There are evidences already of negative impacts on yield of wheat and paddy in parts of India due to increased temperature, increased water stress and reduction in number of rainy days.

Significant negative impacts have been projected with medium-term (2010-2039) climate change, eg. yield reduction by 4.5 to 9 percent, depending on the magnitude and distribution of warming. Since agriculture makes up roughly 15 percent of India's GDP, a 4.5 to 9.0 percent negative impact on production implies a cost of climate change to be roughly at 1.5 percent of GDP per year. Enhancing agricultural productivity, therefore, is critical for ensuring food and nutritional security for all, particularly the resource poor small and marginal farmers who would be affected most. In the absence of mitigation and adaptation strategies, the consequences of long-term climate change could be even more severe on the livelihood security of the poor.

Climate Resilient Agriculture

There has been a significant rise in the frequency of extreme weather events in recent years affecting farm level productivity and impacting staple food grains availability at the national level. Within a season, severe droughts and floods are being experienced in the same region posing serious problems to the farmers, agricultural scientists and extension staff. Fall in yield leads to shortage of food grains, price rise and inflation affecting the poor most. Therefore, it is of utmost importance to enhance the resilience of Indian Agriculture to climate change. Both application of improved technologies and new policies will contribute to resilience. There is also abundant traditional wisdom among farmers to cope with climate variability which will be captured and documented in the project.

Since climate change poses complex challenges like multiple abiotic stresses on crops and livestock, shortage of water, land degradation and loss of bio-diversity, a focused and long term research is required to find solutions to the problems specific to our country. The necessary infrastructure to carry out basic and strategic research has to be put in place. At the same time, there is a scope to improve the resilience of agriculture by application of existing knowledge and technology on farmers' field as a holistic package. Hence, this integrated proposal is made both to develop improved technologies through short term and long term research and also demonstrate the existing technologies on farmers' fields for enhancing the resilience.

The scheme attempts to develop and promote climate resilient technologies in agriculture which will address vulnerable areas of the country. The outputs of the scheme will help the districts and regions prone to extreme weather conditions like droughts, floods, frost, heat waves, etc. to cope with such extremes. Although the target area of the scheme are all climatically vulnerable regions of the country, small and marginal farmers in rainfed, coastal and hill areas will benefit more in view of the focused attention in these regions.

Objectives

- To enhance the resilience of Indian agriculture covering crops, livestock and fisheries to climatic variability and climate change through development and application of improved production and risk management technologies.
- To demonstrate site specific technology packages on farmers' fields for adapting to current climate risks.
- To enhance the capacity of scientists and other stakeholders in climate resilient agricultural research and its application.

Components of the Scheme

The Scheme will be implemented for the remaining two years (2010-11 and 2011-12) of the XI Plan and likely to continue in the XII Plan with the following four components.

1. Strategic research on adaptation and mitigation.
2. Technology demonstration to cope with current climate variability in 100 vulnerable districts.
3. Capacity building
4. Sponsored competitive research to fill critical gaps

The strategic research will be carried out involving 21 Institutes of the Indian Council of Agricultural Research. At the seven core institutes, viz., CRIDA, Hyderabad; IARI, New Delhi; NDRI, Karnal; IIHR, Bangalore; CMFRI, Cochin; CIAE, Bhopal; and ICAR Complex for NEH, Barapani, state of the art research infrastructure will be established. Other 14 institutes will contribute to strategic research in specific thematic areas identified. These are CRRI, Cuttack; DRR, Hyderabad; NRCPB, New Delhi; IIVR, Varanasi; IIPR, Kanpur; ICAR-RCER; Ranchi; DWM, Bhubaneswar; NRCAF, Jhansi; PDFSR, Modipuram; NCIPM, New Delhi; IVRI, Izzatnagar; CIFRI, Barrackpore, CIBA, Chennai and NIASM, Baramati. Simultaneously the existing technologies to cope with current climate variability will be demonstrated in 100 districts through KVKs, Coordinating Centers of the AICRPDA and the TOT Divisions of the above core Institutes. Most of the State Agricultural Universities will be participating in this component through KVKs and AICRP Centers.

Unique Features of the Scheme

- Critical assessment of different crops/zones in the country for vulnerability to climatic stresses and extreme events, in particular, intra seasonal variability of rainfall.
- Installation of the state-of-the-art equipment like flux towers for measurement of green house gases in large field areas to understand the impact of management practices and contribute data on emissions.
- Rapid and large scale screening of crop germplasm including wild relatives for drought and heat tolerance through phenomics platforms for quick identification of promising lines and early development and release of heat/drought tolerant varieties.
- Comprehensive field evaluation of new and emerging approaches of paddy cultivation like aerobic rice and SRI for their contribution to reduce the GHG emissions and enhance water saving.
- Special attention to livestock and fishery sectors including aquaculture which have not received enough attention in climate change research in the past. In particular, the documentation of adaptive traits in indigenous breeds will be the most useful step.
- Thorough understanding of crop-pest/pathogen relationship and emergence of new biotypes due to climate change.
- Simultaneous up-scaling of the outputs both through KVKs and the National Mission on Sustainable Agriculture for wider adoption by the farmers

TECHNICAL PROGRAM

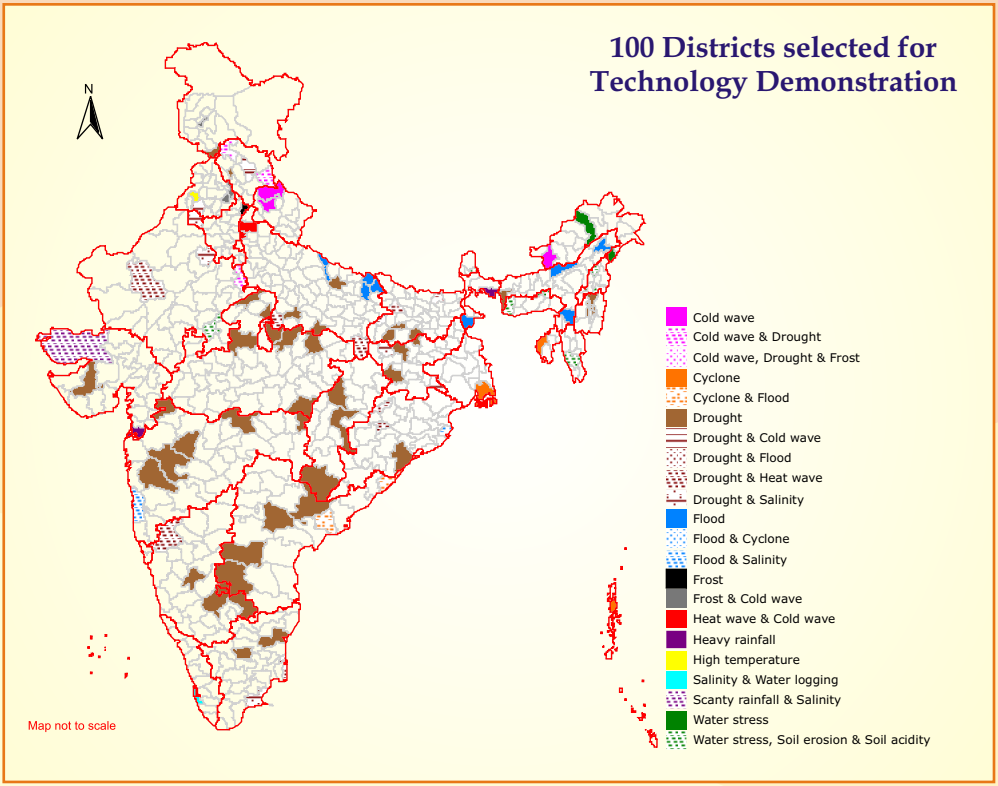
Strategic Research

Activity	Institutions	Deliverables	
		2010-11	2011-12
Vulnerability assessment of major food crop production zones to climate variability	**CRIDA** (major rainfed crop zones) **IARI** (with focus on irrigated crops - rice, wheat, chickpea)	Vulnerable crops / cropping systems and zones for respective crops identified.	Vulnerable crops/ zones prioritized and mapped.
Weather based Agro-advisories, contingency plans and identification of best-bet management practices	**CRIDA** through network of AICRPDA and AICRPAM centres	The critical food crop zones identified for strengthening online data collection and equipments installed.	Combining weather based agro-advisories with contingency plans and best bet practices field tested.
Evaluation of major food and horticultural crops for tolerance to climatic stresses and genetic enhancement of tolerance	**CRIDA, IIPR** (rainfed crops: maize/ sorghum, pigeonpea and blackgram) **IARI** (irrigated crops: rice, wheat, chickpea) **NRCPB** (thermo tolerant wheat; prospecting of genes for thermo tolerance from microbial & plant resources) **CRRI** (evaluation of key rice germplasm for tolerance to drought and submergence) **DRR** (heat tolerance and nitrogen use efficiency in rice) **ICAR-NEH** (Identification of temperature tolerant rice and maize varieties for north-east) **IIHR, IIVR, ICAR-RCER Ranchi centre** (tomato, banana, mango)	Promising material for tolerance to climatic stresses (drought, heat & floods) identified and characterized in selected crops Variation in flowering phenology of mango in relation to temperature variations in different growing areas documented.	Evaluation testing of promising material in irrigated (wheat, rice, chickpea) and rainfed crops (pigeonpea, maize, blackgram) and horticulture (tomato, banana and mango) initiated. Potentially useful genes for thermo tolerance identified.
Monitoring of GHG emissions through flux towers.	**IARI** (monitoring in large agricultural areas) **CRRI** (monitoring of GHG emissions in rice based production systems)	Flux towers installed and calibrated	Standard system of data recording setup and access to users provided.
Adaptation and mitigation through enhanced water productivity,nutrient use efficiency, conservation agriculture and agro-forestry systems	**CRIDA & DWM** (water productivity in rainfed and irrigated crops, carbon sequestration, water harvesting potential and ground water recharge in relation to rainfall variability **NRCAF & CRIDA** (quantification of carbon sequestration potential in selected agroforestry systems) **PDFSR** (assessment of mitigation potential through farming system approach) **CRRI** (mitigation potential of improved management practices and products in rice cultivation) **ICAR-NEH** (SWM practices for enhancing climatic resilience)	Improved water and nutrient use efficiency parameters identified. Scope of CA practices reviewed and documented. Review & documentation of agroforestry systems for enhanced carbon sequestration suitable for different agro-climatic regions. Identification of	Erosivity, water harvesting potential and ground water recharge under high intense rains quantified. Agro-techniques for improved integration of trees in production system to enhance carbon sequestration Efficient strategies identified to reduce GHGs emissions and enhanced

	CIAE (engineering interventions for conservation agriculture, precision farming and energy use efficiency)	potential strategies to reduce GHGs emissions and enhance carbon sequestration from aquaculture. Review and documentation of precision tools for irrigation scheduling, nutrient application and design parameters identified.	carbon sequestration. Work on better designs of SWC structures initiated.
Pest and disease dynamics, changes in crop-pest/pathogen relationships, changed profile of insect pests and emergence of new bio types due to climate change	**DRR & NCIPM** (initial model on pest dynamics of rice - BPH) **CRIDA & NCIPM** (pest and disease dynamics of pigeonpea, groundnut and forewarning system) **IIHR & NCIPM** (relationships between high temperature and pest and disease on tomato and mango)	Components for improved pest forewarning models identified Climate and pest data collection protocols standardized	The forewarning modules formulated and evaluation initiated
Understanding the unique traits in indigenous livestock which make them resilient to climate change and development of database	**NDRI** (cattle and buffalo) **IVRI** (livestock diseases resistance traits) **ICAR-NEH** (pig and poultry)	Information and data base on genetic adaptation in cattle and buffalo developed. Improved survival parameters of indigenous livestock under climatic stresses identified.	Useful traits in indigenous breeds of cattle, buffalo, pig and poultry in relation to climate change documented and characterized Changes in incidence pattern of livestock diseases documented
Adaptation strategies in livestock to thermal stress through nutritional and environmental manipulations	**NDRI** (cattle and buffalo)	Review and documentation of existing knowledge and gaps identified Environmental and nutritional parameters identified and methodology for adaptation studies standardized	Preliminary evaluation of location specific and cost effective interventions initiated.
Assessment of spawning behaviour of major fish species in marine and inland environments with a view to harness the beneficial effects of temperature	**CMFRI** (marine fish) **CIFRI** (inland fish)	Studies on spawning behavior of marine and inland fishes initiated	Potential fishing zones in seas identified and breeding strategy for inland fishes in the context of climate change evolved.
Impacts on aquaculture and mitigation options	**CIBA,** Chennai	Impact of climate variables documented and source of GHG emissions identified	Mitigation potential through carbon sequestration quantified

Technology Demonstration

Under this component, an integrated package of proven technologies will be demonstrated in one village in each district for adaptation and mitigation of the crop and livestock production systems to climate variability based on the available technologies. The districts to be covered for these demonstrations and list of KVKs are given in Fig.1.



The process of finalizing the demonstration package will have the following steps:

1. Analysis of climatic constraints of village based on long term data
2. Assessment of the natural resources status of the village
3. Identification of major production systems
4. Studying of existing institutional structures and identify the gaps
5. Focus group discussion with the community to finalize the interventions

The interventions will cover the following four modules:

Module I: Natural resources

This module consists of interventions related to in-situ moisture conservation, water harvesting and recycling for supplemental irrigation, improved drainage in flood prone areas, conservation tillage where ever appropriate, artificial ground water recharge and water saving irrigation methods.

Module II : Crop Production

This module consists of introducing drought/temperature tolerant varieties, advancement of planting dates of rabi crops in areas with terminal heat stress, water saving paddy cultivation methods (SRI, aerobic, direct seeding), frost management in horticulture through fumigation, community nurseries for delayed monsoon, custom hiring centres for timely planting, location specific intercropping systems with high sustainable yield index.

Module III : Livestock and Fisheries

Use of community lands for fodder production during droughts/floods, improved fodder/feed storage methods, preventive vaccination, improved shelters for reducing heat stress in livestock , management of fish ponds/tanks during water scarcity and excess water, etc.

Module IV : Institutional Interventions

This module consists of institutional interventions either by strengthening the existing ones or initiating new ones relating to seed bank, fodder bank, commodity groups, custom hiring centre, collective marketing, introduction of weather index based insurance and climate literacy through a village level weather station.

The KVK team for each distrit will carry out a detailed exercise on the needs of the village, the climatic vulnerability (drought/floods/heat wave/frost/cyclone) and the available technology options from the concerned Zonal Agricultural Research Stations of the SAU. After a careful study of the gaps, specific interventions from each of the module will be selected and an integrated package from all modules will be formulated. The whole village will be saturated with the above interventions in order to demonstrate a discernable effect. As an outcome of this exercise location specific climate resilient practices and constraints in its adoption will be documented.

Capacity building

Under this component, need based training will be provided to scientists on the latest tools and methodologies of climate change research at the best of the institutions in the world. Simultaneously, capacity building of senior faculty will be done through short term exposure visits, participation in international symposia, training programs for extension functionaries of the states, policy makers, NGOs and farmers will be organized to generate awareness on climate change.

Sponsored Research

Under this component, research proposals will be invited from identified institutions/ scientists to fill up critical research gaps.

Outputs

- Selection of promising crop genotypes and livestock breeds with greater tolerance to climatic stress.
- Existing best bet practices for climate resilience demonstrated in 100 vulnerable districts.
- Infrastructure at key research institutes for climatic change research strengthened.
- Adequately trained scientific man power to take up climate change research in the country.
- Empowered farmers to cope with climate variability.

Outcome

- Enhanced resilience of agricultural production in vulnerable regions of the country.

Coordination and Monitoring

The Scheme will be implemented with CRIDA, Hyderabad as Lead Institute under over all supervision of NRM Division of ICAR.

Budget

The Scheme has out lay of ₹ 350 Crores for XI Plan out of which ₹ 200 crores is allocated for 2010-2011 and ₹ 150 crores for 2011-2012.

Contact Information

For more information on the scheme, suggestions and new linkages contact:

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