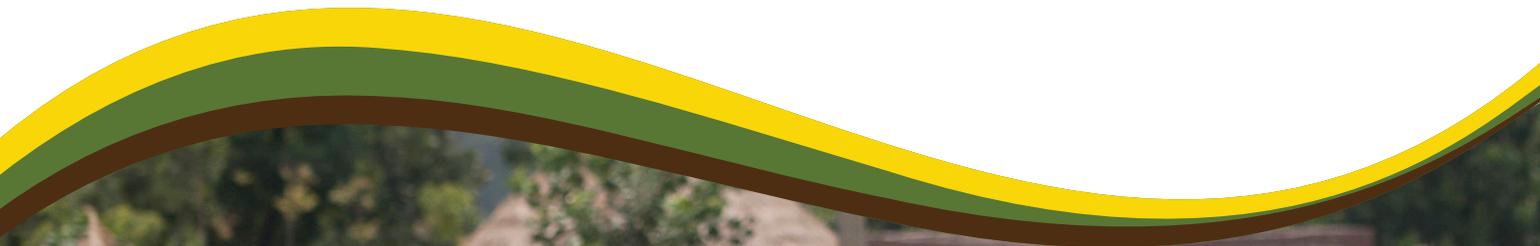




RESEARCH PROGRAM ON
**Climate Change,
Agriculture and
Food Security**



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A decorative graphic element consisting of three overlapping, wavy bands in yellow, green, and brown, arching across the top of the page.A photograph of a lush green rice paddy field. Several people are bent over, engaged in planting rice seedlings in the water. In the background, there are traditional houses with thatched roofs and a brick wall.

CCAFS Climate-Smart Agriculture Learning Platform, *South Asia*



Towards climate-smart agricultural policies and investments in Telangana

In the Southern Indian state of Telangana, a unified approach developed by ICRISAT is guiding policy and investment decisions for scaling climate-smart agriculture

Shalander Kumar (ICRISAT)

Research undertaken for the Southern Indian state of Telangana has revealed increasing vulnerability of the state to climatic changes and associated risks to multiple sectors including agriculture. The drastic effects of heat waves and droughts are particularly problematic which are projected to wreak havoc on the rainfed systems in Telangana. In fact, in the year 2014-2015, the Gross State Domestic Product in the agriculture sector declined by 10.3% which can be attributed to adverse seasonal conditions. With nearly 55% of the state's population dependent on farm activity, an unmitigated sector casts a grim shadow over livelihood opportunities of these communities.

Existing efforts to offset such adversities have been inadequate owing to a lack of information on climatic risks at the sub-district or mandal level, scanty information on impacts of interventions at the district/sub-district levels, inhibited capacities and costs pertaining to adaptation options. Moreover the efforts are still left wanting in coherence for impacts to be truly felt.

To help the state in transitioning its agriculture system to a climate-smart one, the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) with support from the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) and the Ministry of Environment, Forests and Climate Change of the government of India, has developed and piloted an evidence based scientific framework for guiding investments and policies towards attaining the said goal. The unified approach includes four components: *climate risk analysis, participatory prioritization, ex-ante impact evaluation and CSA actions integrated into district level plans and development of State Action Plan on Climate Change.*

Climate proofing agriculture in Telangana

In Telangana, climate risk mapping had been done at the Mandal level (An administrative unit in India at the sub-district level) which makes it the first such state in the country where analysis at the said administrative level had been carried out. Indicators such as temperature changes, heat and cold waves, rainfall variability and changes in frequency or intensity of

consecutive dry and wet days were analysed to arrive at a climate exposure index and through that, identify the 'hotspots' facing high climatic risks. Such analyses helped in determining locally contextualized CSA interventions in the given setting.

A multi-stakeholder participatory prioritization was subsequently carried out to identify and rank CSA practices using the criteria of *climate-smartness and ease of adoption*. Based on these criteria a number of promising solutions were selected such as in-situ moisture conservation, micro-irrigation, rainwater harvesting, integrated nutrient management among others. Incentives relating to financing, capacity building, improved infrastructure etc. were also analysed to identify ways to facilitate the adoption of such practices. It was divulged that capacity building of stakeholders was regarded as the most important incentive for facilitating the adoption of almost all CSA practices.

This was followed by an ex-ante impact assessment (additional returns due to adoption of CSA practices) to determine the investments needed for adoption and the benefits incurred. For instance, it was revealed that adopting farm ponds for major crops would give an annual total additional net return of approximately INR 987 million in the study area, given an internal rate of return of 14% on investments in infrastructure and capacity development.

Deliberations led by ICRISAT with key stakeholders such as the Environment Protection Training and Research Institute (EPTRI), nodal agency for climate change adaptation, National Bank for Agriculture and Rural Development, the apex financial institution catering to the agriculture sector in India, among others have incorporated this approach for making policy and investment decisions in relation to scaling CSA in Telangana. Kalyan Chakravarthy, DG, EPTRI emphasized that *"this analysis/framework will be a guide for planning and investments/resource allocation for scaling up climate-smart agriculture in the state"*. The findings from ICRISAT's interventions is going to be utilized for developing the State Action Plan on Climate Change for agriculture and can be a point of reference for scaling in other states as well.



National legislation to support crop residue management and strengthen pollution control in North India

Science based evidence generated by CCAFS-CIMMYT & partners contributed to a national policy mobilizing a multi-million dollar investment to promote climate-smart technologies

M.L.Jat and Tripti Agarwal
(CIMMYT)

Each year the National Capital Region in the Indo-Gangetic belt of India is swamped by severe air pollution compounded largely among other things, by crop residue burning in the nearby states. Research informs that in the state of Punjab alone, around 20 million tonnes of rice and wheat residues out of a total of 37 million tonnes are being burned in-situ annually, leading to a loss of around 8 million tonnes of carbon equivalent to a CO₂ load of about 29 million tonnes per year and a loss of about 100,000 tonnes of nitrogen. There is further destruction of beneficial microflora of the soil with major implications on soil health and nutrient use efficiency. Other North Western states follow this lead with around 23 million tonnes of rice residue being burned annually.

Pinning the problem

It is estimated that one tonne rice residue on burning releases 13 kg particulate matter, 60 kg CO, 1460 kg CO₂, 3.5 kg NO_x, 0.2 kg SO₂ (Bakker et al., 2013). Black carbon emitted during residue burning warms the lower atmosphere and it is the second most important contributor to global warming after CO₂. Increase in the concentration of PM 2.5 and PM 10 during large scale burning of rice residues is a major health hazard. With such serious and hazardous consequences for human, environmental and soil health, crop residue burning is an issue that merits not just immediate but sustainable rectification. Any approach has to keep in mind that solutions need to be laced with food security concerns especially for a nation with a bludgeoning population and a food production scenario made more complex due to climate change impacts.

Technology to the rescue

One of the core areas of research for the International Maize and Wheat Improvement Center (CIMMYT) and the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) in the region has been on in-situ management of crop residues based on the principles of Conservation Agriculture. In relation to this, the Happy Seeder technology has been deployed for crop residue management in the Climate-Smart Villages of Haryana and Punjab states. Happy Seeder not only helps sow

wheat in standing rice stubbles, but helps improve soil health by incorporating organic matter and soil moisture index. The innovative planter takes advantage of the residual moisture in the fields and thereby helps in saving pre-sowing irrigation equivalent to 1 million litres of water per hectare through surface retention of residues as mulch. As a result, the onus provided to Conservation Agriculture through zero tillage stemming out of the application of such a technology is bringing about more benefits than one.

Science led evidence for rectification

Over a course of five years, the science led evidence so generated on the multiple benefits of the Happy Seeder technology, led to the development of a range of information and communication materials which fed the policy arena with corroborations required for crafting policies towards banning crop residue burning while providing sustainable and scalable solutions to farmers. A number of stakeholder engagement mediated through policy dialogue, round table discussions, along with policy papers, briefs and media collaboration finally culminated into a national legislation for promoting in-situ crop residue management using the Happy Seeder technology. An investment of INR 1150 crores has been directed towards this scheme by the government of India, to be launched in the North Indian states of Punjab, Haryana, Uttar Pradesh and the National Capital Region of Delhi. This fund has been approved by the Cabinet Committee on Economic Affairs of the government for the years 2018-20. Central to this scheme will also be the establishment of 'Farm Machinery Banks' to promote the custom hiring of the machinery. There are other investment convergence made by Indian Council of Agriculture Research (ICAR) institutes, Punjab Agricultural University, CGIAR Research Program on Wheat Agri-Food Systems, Department of Agriculture of Punjab and Haryana, Borlaug Institute for South Asia (BISA), private partners and international research organizations mobilizing Farmer Cooperatives, as well as the private sector for inclusive implementation of the approach. Such promising initiative needs to be complemented by strategic interventions for targeted impacts on soil welfare.



Strengthening partnerships for addressing agrarian distress in India

A Conclave with members from the private sector, academia and government provides insights into scaling climate-finance for the agriculture sector in India

Shehnab Sahin (CAFS South Asia)

The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), together with the International Maize and Wheat Improvement Center (CIMMYT), Borlaug Institute for South Asia (BISA) and the Federation of Indian Chambers of Commerce and Industry (FICCI), organized a Conclave to engage the private sector and other development partners in discussions about scaling investments towards Climate-Smart Agriculture (CSA). The conclave titled 'Climate-Smart Agriculture as an Investment Destination for Corporate Social Responsibility (CSR)' was held in New Delhi which saw a vibrant participation from the private sector, international development agencies, academia and embassies. Through 2 panel discussions and group sessions, the main ideas explored were: the merits of scaling private sector support towards CSA and whether resilient agriculture is a good investment destination for CSR.

Assessing CSA in India as a destination for climate-finance

Discussions were heralded with remarks from the Australian High Commissioner to India, Ms. Harinder Sidhu who highlighted similarities between India and Australia in terms of agro-economy, risks from climate change as well as common goals and objectives in the agriculture sector. The strong involvement of the Australian private sector in agriculture was underscored, wherein the former works in tandem with the farming communities and the government to optimize benefits. Enhanced involvement of the Indian private sector in agriculture especially in the space of technology and manufacturing development was suggested.

Some of the central propositions from the academic/scientific community on the merits of private sector involvement in CSA were that, it would lead to multiple returns for the latter in terms of having access to a vast body of data along with interpretation, expert knowledge, witnessing impacts on the targets measured by indicators, global recognition as well as opportunities for innovative partnerships. The case for CSA as a good investment destination for CSR was emphasized by sharing some very successful case studies from the region. From the policy perspective, it was proposed to devise pathways for constituting a Green Climate Fund with CSR resources and mainstreaming a CSR Consortia for CSA through public-private partnership mode. A CSR Green Fund can be mobilized with as minimal as 5% of financial contribution. The Consortia on the other hand, can

make regional allocations among themselves to make concerted efforts in the most backward and climate affected regions of the country. These points were put forward by Martin Kropff, Director General of CIMMYT, Pramod Aggarwal, Regional Program Leader of CCAFS South Asia and Pramod Joshi, Director for South Asia at IFPRI.

Industry perspectives on the prospects of CSA in India

Industry perspectives were led by Baskar Reddy, Executive Head of Syngenta Foundation, Rajiv Kumar, Head of Sustainability at Olam International, Lopamudra Priyadarshini, Head of CSR initiatives of Sonalika group and Ahkilesh Yadav, Regional Program Manager of North India, ITC Limited. Sustainability initiatives in the agriculture field is already being pursued by them with Sonalika group and ITC invested in CSA through collaborations with CGIAR centers like CIMMYT- CCAFS in India. It was amply posited that resilient agriculture is imperative for business sustainability and is not simply a way for risk mitigation. Private sector participation should focus on crafting innovative and inclusive business models supported by CSR. Further, group sessions explored different pathways to reduce agrarian distress through scaling CSA, improving products like insurance and Information and Communication (ICT) technologies as well as through enhanced gender/youth inclusion. Some of the recommendations made were; constituting a Consortium in public-private partnership mode; integrating 'sustainability' in the value chains; aligning manufacturing priorities towards creating a resilient farming sector with higher investments on farm equipment that promote CSA; moving beyond pilots towards upscaling; gaining service efficiency like in insurance through heightened ICT involvement and enhancing social inclusion in agri-based micro-enterprises.

Professor Ramesh Chand, Member of Niti Aayog (principal think tank of the government of India) concluded the Conclave by re-iterating the still low private sector investments towards agriculture in India. He alluded to the crucial importance of resource mobilization for devising better institutional mechanism to fight climatic risks in agriculture, where the private sector can play an important role. 'It is a very good idea for the private sector to combine business interests with social goals which ends up giving good results'- he said. This is a thought that needs to permeate.



Boosting rice cultivation through climate-smart agricultural practices in Odisha, India

Aiming for livelihood and food security through improvements in rice cultivation in the climate affected areas of Odisha, India

DS Rana, Sheetal Sharma,
S. Biswal and Debjani
Samantaray (IRRI)

The eastern state of Odisha in India, has been grappling with the challenge of providing sustainable livelihoods for its population amidst a fragile ecosystem. The state is faced with absolute water scarcity, erratic rainfall, droughts, cyclones, floods and land degradation. Agriculture in the area is predominantly centred on intensive rice-based cropping systems with associated productivity and sustainability problems characterized by small farms, weak resource base, large yield gaps from poor crop management, and high input-use inefficiencies. Climate change is an additional risk multiplier with extreme weather events like droughts, flood, cyclones etc. adversely affecting crop performance. In such a scenario the International Rice Research Institute (IRRI) with support from the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) is trying out climate-smart agriculture practices (CSAPs) to sustainably increase agricultural productivity and incomes, adapting and building resilience to climate change, and, where possible, reducing and/or removing greenhouse gas (GHG) emissions.

Rice based CSAPs and early results

Some of the main issues identified across project sites were undulating topography, intensive tillage, labour intensive manual transplanting, increased and changing weed flora, flood irrigation amidst others. In all such locations, interventions were differentiated as farmer's practices managed by farmers (FPMF), climate-smart practices managed by farmers (CSPFM) and climate-smart practices managed by researchers (CSPRM). Farmer's practices include local varieties, conventional tillage, manual transplanting, flood irrigation, no residue retention and traditional nutrient and pest management. Climate-smart practices include, laser land leveling, high yielding and stress tolerant varieties, reduced tillage, residue retention, site specific nutrient management, mechanical transplanting and harvesting and integrated pest management.

It was seen that farmers obtained significantly higher crop yields with various CSAPs. In the project sites, average rice yield with CSAPs over farmer's practice was 16% higher in farmer managed plots which was further increased to 23% in researcher managed plots. Although the rice yields did not differ significantly in tillage and water regime treatments, farmers reported lower cost of cultivation as compared to practices of conventional tillage and continuous flooding. Reduced tillage decreased cost of cultivation ranging from USD 30-120 /ha. Likewise Alternate Wetting and Drying (AWD) practice reduced water use by 20-30%. Reduced tillage in combination with AWD has led to an over all reduction

of Global Warming Potential (GWP) and greenhouse gas emissions (GHG) in the project sites. The researchers managed plots had 26% lower GHG emissions than farmer's practices. Reduced tillage and AWD reduced GHG emissions by 17% and 43% over the farmer's practice respectively. When GHG emissions were converted to GWP, AWD had significantly lower GWP due to large reduction in methane emissions.

Policy dialogues paving the way forward

Increasing attention from decision-makers at the policy level in response to rising climatic challenges, is paving the way for ensuring that empirical evidence generated in the fields, translates into policy action. IRRI is working with Department of Agriculture (government of Odisha) and partners in the development and private sector, to identify research and development gaps in government intervention plans, and help formulate a roadmap for Odisha's State Action Plan; so state-level, national and international organizations can work together more effectively to find solutions.

"Climate-smart agriculture can address issues like crop diversification, nutrition management, post-harvest yield management, and improving market linkages. Our efforts need to be coordinated and focused on increasing farmer incomes and productivity and reducing input cost" said Dr.Saurabh Garg, Hon'ble Principal Secretary, Department of Agriculture and Farmers' Empowerment, government of Odisha, in a recently held workshop, 'Scaling Climate-Smart Agriculture in Odisha' in Bhubaneswar; organized by IRRI, in partnership with Department of Agriculture & Farmers' Empowerment, Indian Council of Agricultural Research, National Rice Research Institute, Odisha University of Agriculture and Technology, International Maize and Wheat Improvement Center, and supported by CCAFS.

The workshop supported informing policy, planning and science-based evidence to scale-up and prioritize investment on climate-smart agricultural approaches in Odisha, and saw experts in rice and rice-based agri-food systems, exchange knowledge on interventions in soil testing and mapping, enhancing crop nutrition, resource conservation technologies, water management, nutrient management, impact assessment for climate-smart agriculture and agroforestry that emphasised the need to adopt better, smarter agricultural practices, inclusive policies with more coordinated endeavours between partners, in the context of changing climatic conditions. It is hoped that such endeavours pave the way for developing a road map to scale-up context-specific CSAPs in Odisha.



Fine weaving climate-smart approaches in Nepal through policy support

State governments of Nepal scale out the Climate-Smart Village approach for climate change adaptation and agriculture development

Arun Khatri-Chhetri (CCAFS-South Asia) and Ishwari Prasad Kadariya (Agriculture and Forestry University Nepal)

What started out as a pilot 5 years ago in Nepal has left an indelible imprint on stakeholders with visible evidence to motivate widespread scaling. The Climate-Smart Village (CSV) approach of the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) was launched in Nepal on pilot mode, in the face of a threatened agriculture sector due to climate change impacts over the same. As a holistic approach, the CSVs provided the nation with multi-stakeholder learning platforms for participatory research and evidence generation on the plausible climate-smart agricultural (CSA) technologies and solutions for helping the sector adapt to and mitigate the effects of climatic variabilities upon the food production system. Further, they became the corner stones for drawing out lessons for policy makers from all levels of policy hierarchy.

Over the years, in collaboration with local partners, Local Initiatives for Biodiversity, Research and Development (LI-BIRD), National Agriculture Research System (NARC) and the Ministry of Agricultural Development (MoAD) the CSV approach was piloted in different districts of Nepal (Bardiya, Dang, Rupandehi, Nawalparasi, Mahottari).

Moving beyond pilots

Proactive policy engagement had resulted in the inclusion of CSVs in the 'policies and programs' document of the government of Nepal in 2017, which explicitly stated the commitment for gradually scaling the approach in more areas of Nepal. For this, CCAFS and partners assumed responsibility of providing technical support to the National Planning Commission as well as the MoAD.

The pilot program had taken into account several cross-sectoral issues such as water management, energy use, bio-diversity and rural development. The state governments in Nepal drew on the lessons and evidences of CSV pilots for scaling out the CSV approach across the country. Recently, the CSV approach has been included in the state government's Agriculture Development Policy and Programs documents which can be seen as a potential pathway to proliferate CSA practices, technologies and services to reach scale. Two out of seven states in Nepal (State 4 and State

5) have included the CSV approach in the state's agricultural development policies to establish Climate-Smart Agricultural Villages (CSAV) across the state. In the beginning (2018), at least one CSAV will be developed in each election block and CSAV will be extended to all rural municipalities and villages in 5 years period. This CSAV program will cover millions of farmers in the agricultural dependent and climatically vulnerable communities across the states



A women farmer in a CSV in Nepal assess the revitalized crops in the field.

In this refurbished scaling venture, CCAFS along with its partners, LI-BIRD, and the Agriculture and Forestry University of Nepal, have extended their commitment to provide technical support to the state governments and the state Ministry of Agriculture Development for implementing the Chief Minister's Climate-Smart Agriculture Village Program. It is to be seen how such a comprehensive plan for bringing about a transformative solution in this climate-vulnerable Himalayan state helps in bringing resilience and strengthen millions of its agriculture dependent population.



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About CCAFS

The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) is a research initiative seeking to overcome the threats to agriculture and food security in a changing climate. CCAFS invests in research to address the crucial tradeoffs between climate change, agriculture, and food security and works to promote more adaptable and resilient agriculture and food systems in five focus regions: South Asia, Southeast Asia, West Africa, East Africa and Latin America. CCAFS work is carried out with support from CGIAR Fund Donors and through bilateral funding agreements. For details please visit <https://ccafs.cgiar.org/donors>. The views expressed in this document cannot be taken to reflect the official opinions of these organizations.

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For more information, contact:

South Asia Regional Program Leader
Pramod K. Aggarwal
E: p.k.aggarwal@cgiar.org

South Asia Science Officer
Arun Khatri-Chhetri
E: A.Khatri-chhetri@cgiar.org

South Asia Communications Specialist
Shehnab Sahin
E: s.sahin@cgiar.org

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