

Policy Brief

The Conservation Agriculture Roadmap for India



Indian Council of Agricultural Research (ICAR)
International Maize and Wheat Improvement Center (CIMMYT)



The Context:

Agriculture remains central to the Indian economy, providing livelihood to the majority of its population. Though Indian agriculture have made spectacular progress for food self-sufficiency, yet growing challenges of large management yield gaps, low water and nutrient efficiency, imbalance and inadequate use of external production inputs, diminishing farm profits, deterioration of soil health and environmental quality coupled with climate risks are major concerns. Feeding a growing population with increasing dietary preferences for resource-intensive food products is a major challenge. Moreover, with no scope for horizontal expansion of farming to produce needed food; improving agronomic productivity and achieving high and stable yields under changing and uncertain climate are important for feeding the growing population. Increasing climatic variability affects most of the biological, physical and chemical processes that drive productivity of agricultural systems. The productivity and stability of agricultural systems depends upon measurable factors and processes controlled by climate and non-climate drivers of production paradigm. It is therefore vitally important to develop strategies and practices to sustainably increase food production while increasing farm income, protecting natural resources and minimizing environmental footprints.


In most part of India, the agronomic yield of food staples can still be increased substantially through bridging management yield gaps. The widespread adoption of conservation agriculture (CA) based sustainable intensification (SI) can contribute to this significantly specially in rainfed and fragile ecologies, yet conserving and protecting natural resources. Conservation agriculture based management technologies has proved to produce more with less (costs, water, energy, labour etc), reduce environmental pollution, promote conjunctive use of organics (avoid residue burning), improve soil health and help adapting to climatic risks. Like any other tillage and crop establishment technology, it may not be a panacea for all present day ills, but has proven to bring out South American Agriculture out of its stagnant state almost 35 years ago, skyrocketing the cereals and oilseed production system. Thus, for addressing the issues of resource fatigue and bridging 'management yield gaps', Conservation Agriculture based sustainable intensification is cornerstone.

Over past two decades, efforts have been made on research for developing, adapting and scaling conservation agriculture based sustainable intensification under various programs, schemes and initiatives by ICAR, State Agriculture Universities (SAUs), CIMMYT and other CGIAR centers, developmental departments, NGOs, private sector and farmer organizations. There are some good success stories around CA based technologies. However, the potential impact has yet to be achieved. CA being knowledge intensive with site/location/situation specificity in application of component technologies (variety, machine, water, nutrient, weed, pest etc) on basic elements of CA (minimum mechanical disturbance of soil, rational organic soil cover and efficient crop rotation), needs precise understanding on recommendation domain for its large scale adoption. The CA research has evolved over time and still evolving in view of benefits that CA can provide to address the growing challenges. Also, CA need a holistic system based approach and multi-disciplinary team efforts and continuum of "Basic-Strategic-Applied Research-Participatory Adaptation & co-learning-Capacity Development-Last Mile Delivery".



The Workshop on CA

Significant efforts have been made to advance CA research over a period of couple of decades through eco-regional programs like Rice-Wheat Consortium (RWC), national initiatives like National Agricultural Technology Project (NATP), National Agricultural Innovation Project (NAIP), ICAR platform on CA, National Innovations on Climate Resilient Agriculture (NICRA), regional bilateral collaborative programs like Cereal Systems Initiative for South Asia (CSISA), Sustainable and Resilient Farming Systems Initiative for Eastern Gangetic Plains (SRFSI), CGIAR Research Programs (CRPs) on Climate Change, Agriculture and Food Security (CCAFS), Wheat-Agri-Food System (WHEAT), Maize Agri-Food System (MAIZE), regional platforms like Borlaug Institute for South Asia (BISA) etc and involving large number of ICAR institutions, SAUs and developmental department. Though despite all these, the uptake of CA in India has been slow, but with science based evidence on multiple benefits in addressing growing complexity of challenges and to deliver to several Sustainable Development Goals, CA has emerged as one of the major frontiers of future farming. However, scaling CA based management practices in diversity of farm typologies and production



ecologies for impact at scale need a collaborative approach of consortium of projects/programs/institutions involved in CA research for development (CAR4D) in India.

Keeping this in view, during the DARE/ICAR-CGIAR annual meeting (2018), Dr T Mohapatra, Secretary DARE and Director General, ICAR emphasized to have a relook on CA as why the adoption is slow, what are new research aspects as well as to make synergies and complementarities of the on-going CA research in India by ICAR, CIMMYT, BISA and other centers. Accordingly, a 2-day workshop on “**Conservation Agriculture in India: Key Learnings, Research Gaps and Way Forward for Impact at Scale**” was organized jointly by ICAR and CIMMYT during July 9-10, 2018 at NASC Complex Pusa New Delhi. A total of 60 lead researchers, research & extension managers, policy planners from ICAR, State Agriculture Universities, CGIAR Centers (CIMMYT, IRRI, CARDIA, IWMI), State Governments, Private sector participated in the workshop and deliberated on the following objectives-

- Stock taking of the CA research for development (CAR4D) in India, synthesize scalable options and identify research gaps
- Develop an action plan/strategy for scaling CA for impact at scale
- Develop a virtual platform for joint learning, knowledge sharing & capacity development,
- Discuss south-south collaboration plan on CA, and
- Discuss CA adoption bottlenecks and their solutions for diversity of farming typologies

The CA Road Map

1. **Conservation Agriculture (CA) addresses several major challenges** confronting agriculture in India including climate change, water scarcity, soil health deterioration, low farm profitability, environmental pollution and its adverse impacts on ecosystem and human health. As such, CA contributes to at least 8 of the UN's Sustainable Development Goals (SDGs) and should be valued by policy makers accordingly.
2. Several well-executed research programs have generated significant knowledge of CA

performance over past 2 decades. However, due to temporal, management, and geographic factors, response cannot be generalized. There is a need to **better aggregate and map knowledge of CA across sites in order to define recommendation domains** that consider soil, climate, cropping systems and socio-economic conditions of different regions of the country.

3. While **there is a strong need for strengthening the long-term CA research platforms** as sites of learning as well as new scientific insights and evidence generations and developing adapted component technologies (water, nutrient, genotypes x environment x management interactions) for CA, the **on-farm research-cum-demonstration with farmers' participation** involving Krishi Vigyan Kendras (KVKs) is essential for validating CA performance on a broader spatial scale, including identification of adoption bottlenecks.
4. **Commercial availability of scale appropriate machinery** is one of the critical factors for success of CA. Hence, CA mechanization priorities need to be defined and strengthened in the regions having weak manufacturing capacity and distribution channels. Special emphasis should be made on establishing CA mechanization hubs in rainfed ecologies and eastern India.
5. **Soil biology and pest (including insects, pathogens) dynamics under CA** needs a thorough investigation due to change in hydro-thermal, carbon and nutrient regimes of the soil in presence of crop residue cover and non-disturbance of soil. Changes in community structure and dynamics of microbial mediated processes under CA need to be evaluated to harness the benefit.
6. By synthesizing all the evidence generated on CA across the diversity of production system and ecologies over past 2 decades, a strong case need to be made for a new '**National Initiative on Conservation Agriculture (NICA)**' to be sponsored by Ministry of Agriculture & Farmers Welfare for evidence based promotion of CA in India. Emphasis is to be laid on CA for rainfed agriculture. Under proposed '**National Initiative on Conservation Agriculture**' some strategic sites should be identified and established with



ICAR-CIMMYT collaboration as permanent demonstrative units on CA under **deficit, limited** and **adequate** water availability situations for irrigation with a provision of both **in-situ** and **ex-situ** water conservation/harvesting. These sites should represent diverse soil types and climatic conditions for a major production system of the region.

7. **Scalable and sustainable business models** should be developed for promoting adoption of CA in large scales through Motivating and Attracting Youth in Agriculture (MAYA) and empowering women for creating effective custom hiring centers as well as manufacturing hubs. Enhanced capacity development of all stakeholders involving farmers-service providers-scientists-to policy makers should be an integral part of such models.
8. **The CA should be the part of course curriculum** of undergraduate and post-graduate courses in all the Agricultural Universities. The Education Division of ICAR may take appropriate action to initiate such courses. In all the agricultural universities as well as ICAR research institutions and KVK farms, there should be large-scale demonstrations of CA-based systems for training of young researchers. The practical crop production program at undergraduate level by the students

should be mandated for CA-based production system.

9. There is a need to **establish a learning platform/ CA-Community of Practitioners (CA-CoP)** with a mechanism for regular interactions, knowledge sharing and capacity development.
10. A **‘Technical Working Group on Conservation Agriculture (TWGCA)’** involving key researchers from ICAR, SAUs, CIMMYT, other CG Centers and other organizations (like BISA, IPNI) should be established as **“The India CA Center”** with defined roles and responsibilities to promote CA in India. The Center should be mandated to work on (i) mapping CA research and development initiatives, (ii) defining recommendation domains of CA-based management systems, (iii) identifying research gaps and address pertinent questions and concerns related to CA, (iv) acting as knowledge repository and sharing center, (v) serving as catalyst for capacity development of stakeholders, (vi) developing science-driven policy guidelines and advisories for outscaling CA, (vii) developing proposals and raising funding for CA research and development, (viii) acting as facilitator for south-south collaboration, (ix) developing framework for tracking adoption and social impact of CA and (x) monitoring and evaluating CA adoption and its impacts.



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Reference websites: www.icar.org.in; www.cimmyt.org