**Advanced Course–Asia & Africa**

# CONSERVATION AGRICULTURE:
## Gateway for Sustainable Intensification of Smallholder Systems

### TRAINING REPORT



**October 23-November 06, 2017,**
**October 22-November 03, 2018,**
**November 07-22, 2019 and**
**December 06-18, 2021** (to be held)
**at**
**CIMMYT-BISA, Ludhiana & Karnal, India**

## Acknowledgement

### Citation

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## Executive Summary

The Advanced Course (Asia & Africa) on Conservation Agriculture: Gateway for Sustainable Intensification of Smallholder Systems organized by the International Maize and Wheat Improvement Center (CIMMYT) and Borlaug Institute for South Asia (BISA)., were conducted during October 23-November 06, 2017, October 22-November 03, 2018 and November 07-22, 2019 and to be held on December 06-18, 2021 at the research platforms of CIMMYT-BISA, Ludhiana & Karnal, India.

The training objectives were centered on understanding Conservation Agriculture (CA) and its applications in Asia and Africa. First, invited eminent experts from the different institutes during the course, followed by Microsoft Power Point presentations and field activities along with consultants, and stakeholders, to engage in discussions focused on the CA practices. A number of issues were raised during the presentations and field visits. Participants queried, critiqued, and exchanged insights on CA practices and technologies. There were 69 participants amongst males, females and youth attended the trainings from Asian and African countries during years 2017, 2018, 2019 and 2021.

The key findings from the training were that participants need more collaboration with educational institutions and stakeholders when it comes to new knowledge and information, that they would need to re-visit the research, education, and extension linkages vis-à-vis the CA practices, and that the information gained during the course had to cascade to students and the farming community. The participants were pleased that the CA practices was out and that they could begin to explore different areas they could implement on-site in their contexts.

Furthermore, participants noted that the CA practices was a useful technology to their work situations. Finally, the participants stated that the partnerships they had with the different experts represented by the different institutions was paramount to the subsequent programs and activities, that would follow the CA practices.

## Background

The Conservation Agriculture (CA) practices with increased acceptance across the globe are being considered as harbinger for sustainable intensification of smallholder production systems. Its positive impact on natural resources, and adaptation to and mitigation of climate change effects are widely acknowledged. In developing world specially Asia and Africa, CA is a relatively new introduction and hence capacity development is vital for development, adaptation and scaling CA based technologies for impact at scale on smallholder farmers in these regions. Therefore, an advanced and practical course on conservation agriculture shall offer unique capacity development opportunity to the scientific community associated with natural resource management research for development. The advanced course on CA in Asia, was initiated during 2010 and the eighth in series is being organized by CIMMYT and BISA under the aegis of CGIAR Research Programs on WHEAT, CCAFS, MAIZE and in close collaboration with Indian NARS (ICAR, PAU etc).

This course links the advances and multidisciplinary approach for sustainable intensification of maize and wheat-based system, restoration of natural resource degradation and climate resilient production systems with vast expertise of CIMMYT researcher and partners across Asia, Africa and Americas. Keeping in view the high response, the course has become a regular flagship activity wherein selected young men and women researchers from NARS as well as international organizations and NGOs across Asia involved in CA based sustainable intensification can be benefited.

## Learning Objectives

Active participation in the course will allow the participants to:

➢ Develop enhanced understanding on the principles of Sciences/Agricultural conservation agriculture, application of new tools and techniques and scale appropriate CA machinery for diverse production systems, agro-ecologies and farm typologies



➢ Synthesize and apply the information and knowledge related to CA based sustainable intensification (SI) such as:

- Basic understanding on CA research
- Basic elements of CA adapted of range of situation
- Scale appropriate CA machinery for different production environments

- Component technologies for CA based SI viz. genotype adapted to CA, crop enhancement, precision water & nutrient management, weed management strategies, crop residue management using advanced tools and techniques including remote sensing, crop modelling

➢ Acquire skills to plan and manage long-term basic and strategic research trials on CA and monitor soil, plant and GHG emissions under contrasting scenarios
➢ Generate scientifically-sound hypotheses, data management strategies, and interpret data and summarize them into scientifically sound conclusions and recommendations and linking to knowledge networks
➢ Understanding on farming systems analysis, typologies, innovation system, business models for targeting and scaling with impact at scale

## Contents and Methodology

Conservation Agriculture (CA) based sustainable intensification (SI): principles and practices:

- ✦ Calibration, operation and maintenance of conservation agriculture machinery
- ✦ Component technologies for CA based SI systems
- ✦ Small holder precision agriculture: concepts and applications G x E x M interactions in maize and wheat systems
- ✦ Innovation systems and pathways: CA hubs and modules
- ✦ Climate Smart Agriculture (CSA) and Climate Smart Villages (CSVs)
- ✦ Crop-livestock interactions in relation to CA/SI
- ✦ Impact assessment of CA/SI technologies
- ✦ In-field hands-on for CA based crop management technologies for planting to harvest including decision support tools/sensors/crop modelling
- ✦ Farming Systems Analysis, targeting and typologies
- ✦ Remote sensing/GIS/UAVs/modelling approaches
- ✦ Interaction with farmers, stakeholders of public and private sector and CA machinery manufacturers.
- ✦ Exposure visit to experiment station/research platforms/ innovations platforms.
- ✦ Slide presentations, video films, small group discussions, brainstorming, and exercises
- ✦ Individual mentoring and problem-solving approaches

## Desired Behavioural Outcomes

- ❖ At their respective organizations/countries/regions, the participants are expected to appreciate the imperative need of nurturing a new attitudinal approach in the working environment towards implementing farmer and environment friendly technologies including CA based SI and CSA
- ❖ Initiate activities, and extend to farmers the location-specific CA based SI and CSA management solutions/technologies
- ❖ Deliver short-term TOT courses on CA based SI and CSA

## Programmes Agenda

| Time | Topic | Resource Person |
|------|-------|-----------------|
| **Day-1: Opening session, introduction to course, overview of CA** | | |
| *0830-0900* | *Registration* | Prachi (BISA) |
| *0900-0930* | *Overview logistic arrangements for the participants: Do's and Don'ts* | Tripti Agarwal (CIMMYT) |
| *0930-1030* | ***Opening session*** | |
| *0930-0940* | *Welcome & Introduction to the Course* | ML Jat, CIMMYT |
| *0940-0950* | *Remarks of Guest of Honour* | Rajbir Singh, Director ICAR-ATARI |
| *0950-1000* | *Remarks of Guest of Honour* | JK Ladha (UC Davis, USA) |
| *1000-1010* | *Remarks of Chair* | Raj Gupta (INSA/PACA) |
| *1010-1025* | *Remarks of the Chief Guest* | BS Sidhu, Comissioner Agriculture, Punjab |
| *1025-1030* | *Vote of thanks* | HS Sidhu, BISA |
| *1030-1100* | ***Group Photo & Coffee Break*** | |
| *1100-1130* | Overview of CIMMYT-BISA | ML Jat & HS Sidhu (CIMMYT-BISA) |
| *1130-1215* | CIMMYT Academy's Learning Management System & CA module | Tripti Agarwal (CIMMYT) |
| *1215-1315* | Global Overview of Conservation Agriculture | ML Jat (CIMMYT) |
| *1315-1400* | Lunch | Prachi |
| *1400-1515* | Overview of Recent Advances in Scale Appropriate CA Machinery | HS Sidhu (BISA) |
| *1515-1530* | Coffee Break | |
| *1530-1630* | Global experiences on CA based Rice Systems | JK Ladha (UC Davis, USA) |
| *1630-1730* | CA in rainfed systems | Yash Saharawat (ICARDA) |
| **Day-2: (Hands on training on CA machinery)- BISA Farm** | | |
| *0900-1100* | Laser leveling-Concepts & field techniques | ML Jat & HS Sidhu (CIMMYT-BISA) |
| *1100-1300* | Field training on laser leveling | Manpreet (PAU) |
| *1300-1400* | Lunch Break | |
| *1400-1700* | Hands-on trainign on calibration, operation of CA machinery (Turbo seeder & SMS) while planting | HS Sidhu, ML Jat, Varinder (CIMMYT-BISA) |
| **Day-3: (Hands-on training on CA machinery)- BISA Farm** | | |
| *0900-1100* | Hands-on training on calibration, operation of Multi-crop zero till planter while planting experiment | HS Sidhu, HS Jat, et al |
| *1100-1300* | High clearance CA machinery for sustainable intensification | Manpreet Singh, Naveen, HS Sidhu, Varinder |
| *1300-1400* | Lunch Break | |
| *1400-1700* | Hands-on training on 2WT CA machinery and CA in smallholder systems | HS Sidhu et al |
| **Day-4: (Soil and water management -local manufacturer visit) BISA Farm** | | |
| *0900-1030* | Water management in CA based systems: Concpet, Approaches and Lessons | HS Jat, HS Sidhu, Naveen, ML Jat |
| *1100-1200* | Precison water management approaches in CA-In-field learning | HS Sidhu, HS Jat, Naveen, Lalit, Kajod, Love |
| *1200-1300* | CA and Soil Quality (Chemical) | Yadvinder Singh (CIMMYT-BISA) |
| *1300-1400* | Lunch Break | |

| Time | Session | Facilitator |
|---|---|---|
| 1400-1830 | Visit to Machinery manufacturers (National and Amar) | Manish, Lalit (CIMMYT-BISA) |
| **Day-5: (Gender, social incusivity, business models for CA)-BISA Farm** | | |
| 0900-1000 | Gender, youth and social inclusivity in CA- experiences from South Asia | Tripti Agarwal (CIMMYT) |
| 1030-1130 | Gender, youth and social inclusivity in CA mechnization- experiences from Africa | Mulunesh Tsegaye CIMMYT Ethiopia |
| 1130-1300 | GENNOVATE exercise for CA mecanization | Tripti and Mulunesh |
| 1300-1400 | Lunch Break | |
| 1400-1500 | Business models for scaling CSA technologies | Tripti Agarwal (CIMMYT) |
| 1500-1730 | Visit and interactios at PACS as a business model for scaling CA | Manish and Naveen (CIMMYT-BISA) |
| **Day-6: (Exposure visit and interaction to CA Machinery Business Cases & excurson to Amritsar)** | | |
| 0800-1200 | Visit and interaction with Kamboj Mechancal works and ASS Founday, Amritsar | Manish, Naveen, Prachi (CIMMYT-BISA) |
| 1200-1300 | Lunch | |
| 1300-1900 | Visit Golden Temple and Wagha Border | Manish, Naveen, Prachi (CIMMYT-BISA) |
| **Day-7: (Free Day)** | | |
| | | |
| **Day-8: (Precision agriculture, climate smart agriculture)** | | |
| 0900-1000 | Precision Agriculture: Learnings across globe | Steve Phillip, IPNI, USA |
| 1000-1130 | Precsion Nutrient Management in CA including hands-on training on Nutrient Expert, GreenSeeker | T Satyanarayana (IPNI) & ML Jat (CIMMYT) |
| 1200-1300 | G x E x M research (including GxExM in CA) | ML Jat (CIMMYT) |
| 1300-1400 | Lunch | |
| 1400-1530 | How doeas CA delives of Climate Smart Agriculture? | ML Jat (CIMMYT) |
| 1600-1700 | Climate change mitigation: learnings from smallholder systems of South Asia | Tek Sapkota (CIMMYT) |
| **Day-9: (Modelling, decsion tools and pest management in CA)** | | |
| 0900-1000 | Principles of weed management with special reference to CA | Ravi G Singh, CIMMYT-Mexico |
| 1000-1100 | Weed management in CA based wheat and maize systems | Ravi G Singh, CIMMYT-Mexico |
| 1100-1200 | Mode of action of herbicides and application methods/spray techniques | Ravi G Singh, CIMMYT-Mexico |
| 1200-1300 | APSIM modelling | Alison (CSIRO, Australia) |
| 1300-1400 | Lunch break | |
| 1400-1530 | Cropping systems modelling & Remote Sensing in CA research | Balwinder Singh (CIMMYT) |
| 1600-1730 | Integrated Pest management with special reference to CA | Neelam Choudhary, MoAFW, GoI |
| **Day-10:  (Breeding for CA, GxExM)** | | |
| 0900-1000 | Wheat Breeding @ CIMMYT- special reference to breeding for CA | Uttam Kumar (BISA) |
| 1030-1130 | Hands-on training in CA plot planter | HS Sidhu, Naveen, Kajod, Love et al (BISA) |
| 1130-1300 | Quality seed production in wheat and its integration with CA | S Atwal (BISA), Raju Singh |
| 1300-1400 | Lunch | |
| 1400-1530 | Hands-on training on raised bed planter | Mahesh Gathala, Raju Singh, HS Sidhu |
| 1600-1700 | CA and mechanization: opportunities and challenges in West Asia | Mahesh Gathala (CIMMYT) |
| **Day-11:  (Manufacturer visit, Travel, Karnal, Haryana)** | | |

| | | |
|---|---|---|
| 0830-1000 | Travel fron Ludhiana to LandForce Amargarh | ML Jat (CIMMYT) & team |
| 1000-1200 | Interactions with Landforce/Dashmesh on CA machinery | Sarabjit (LandForce) HS Sidhu, ML Jat, Mahesh Gathala |
| 1200-1600 | Travel to Karnal (lunch on the way) | |
| **Day-12:  (ICAR-CSSRI, Karnal Haryana)** | | |
| 0900-1000 | Sustainable intensification vis-à-vis climate smart agriculture: Learnings from long-term Research platform | PC Sharma, HS Jat (ICAR-CSSRI) |
| 1030-1130 | Soil Biology under CA | Madhu Choudhary (ICAR-CSSRI) |
| 1130-1230 | CA and Soil physical properties | CM Parihar (ICAR-IARI) |
| 1230-1330 | Lunch | |
| 1330-1500 | Hands-on-training on Soil sampling and soil properties (BD, PR, IR and Moisture%) & GHGs under CA | Ashim, Madhu, Suresh (ICAR-CSSRI) |
| 1530-1800 | Visit to climate smart villages and participatory research platforms & young farmers and coperative | Deepak, Suresh, Lalit (CIMMYT) |
| **Day-13:  (Participatory learning platforms and ICAR-CSSRI Karnal, Haryana)** | | |
| 0930-1100 | Systems analysis: Global experiences on farming systems typology & targeting for food security & resilience | Santiago Lopez Ridaura (CIMMYT Mexico) |
| 1100-1200 | Feedback and follow-up discussions | ML Jat, HS Sidhu, HS Jat (CIMMYT-BISA) |
| 1200-1330 | Plenary  & certificate distribution | PC Sharma, Director ICAR-CSSRI |
| 1330-1430 | Lunch | |
| 1000-1700 | Travel back to Delhi | Tripti Agarwal |

## Analysis of Participants

| Year | Asian | African | Males | Females | Total |
|---|---|---|---|---|---|
| 2017 | 22 | - | 21 | 1 | 22 |
| 2018 | 16 | 1 | 13 | 4 | 17 |
| 2019 | 11 | 4 | 13 | 2 | 15 |
| 2021* | 10 | 5 | 10 | 5 | 15 |
| **Total** | **59** | **10** | **57** | **13** | **69** |

*Expected

## Selected Expectations from Participants

| Expectations | CA Training of Trainers Course Emphasis |
|---|---|
| To gain practical knowledge on CA | Mastery of knowledge |
| To understand the content in the CA practices | Provided simple examples to illustrate ideas and issues in the CA practices |
| To have our minds broadened enough in CA issues | Open discussions with convergent and divergent opinions, views, and facts |
| To learn more about CA | Basic terminology defined in the presentations |

| To be a better researcher in CA | Research, education and extension linkages emphasized in the discussions |
|---|---|
| To make practical the concepts in the CA practices | Specific examples from within Asia and Africa shared during the presentation |
| To gain more knowledge on CA to impart to participants | Experiment with different practices and methodologies (e.g. handouts, quizzes, analytical questions, group work and field demonstrations) |

## LIST OF PARTICIPANTS

**(2017)**

| S.No. | Name | Country | Continent | Gender |
|---|---|---|---|---|
| 1 | Seyyedsaeid POURDAD | Iran | Southern Asia | Male |
| 2 | Davoud AFYOUNI MOBARAKEH | Iran | Southern Asia | Male |
| 3 | Payman KESHAVARZ | Iran | Southern Asia | Male |
| 4 | Iraj ESKANDARI | Iran | Southern Asia | Male |
| 5 | Taher Mohammadiany | Iran | Southern Asia | Male |
| 6 | Shahriar FATEHI | Iran | Southern Asia | Male |
| 7 | Somayeh SALAVATI | Iran | Southern Asia | Female |
| 8 | Behzad SHAHSAVARI | Iran | Southern Asia | Male |
| 9 | Kamran TAZNABI | Iran | Southern Asia | Male |
| 10 | Maziar GHAZIHARSINI | Iran | Southern Asia | Male |
| 11 | Mohammadali ROUHANICHOROURI | Iran | Southern Asia | Male |
| 12 | Saeid Zarineshat | Iran | Southern Asia | Male |
| 13 | Md. Khoshnood Alizadeh Dizaj | Iran | Southern Asia | Male |
| 14 | Pankaj Gyawaly | Nepal | Southern Asia | Male |
| 15 | Samim Hossain Molla | Bangladesh | Southern Asia | Male |
| 16 | Mohammad Sadiquzzaman Sarker | Bangladesh | Southern Asia | Male |
| 17 | Md Akram H Chowdhary | Bangladesh | Southern Asia | Male |
| 18 | Tapamay Dhar | India | Southern Asia | Male |
| 19 | Probodh Mandal | India | Southern Asia | Male |
| 20 | PC Jat | India | Southern Asia | Male |
| 21 | K Rao | India | Southern Asia | Male |
| 22 | Arvind Kumar Yadav | India | Southern Asia | Male |

**(2018)**

| S.No. | Name | Country | Continent | Gender |
|---|---|---|---|---|
| 1 | Reza RAHIMZADEH | Iran | Southern Asia | Male |
| 2 | Masoud EZZATAHMADI | Iran | Southern Asia | Male |
| 3 | Jabraeil TAGHINEZHAD GIGLOU | Iran | Southern Asia | Male |
| 4 | Houshang KHOSRAVI | Iran | Southern Asia | Male |
| 5 | Alidad KARAMI | Iran | Southern Asia | Male |
| 6 | Baharam ZAREI | Iran | Southern Asia | Male |
| 7 | Khadijeh ALIJANI | Iran | Southern Asia | Female |
| 9 | Paramita Biswas | India | Southern Asia | Female |
| 10 | Debashis Ghosh | India | Southern Asia | Male |
| 11 | Sudeshna Das | India | Southern Asia | Female |
| 12 | Tara Bahadur Ghimire | Nepal | Southern Asia | Male |
| 13 | Mahesh Regmi | Nepal | Southern Asia | Male |
| 14 | Sagar Bista | Nepal | Southern Asia | Male |
| 15 | Birendra Raj Parajuli | Nepal | Southern Asia | Male |
| 16 | Nayeem Morshad | Bangladesh | Southern Asia | Male |
| 17 | Muluneshtsegaye Bezu | Ethiopia | Eastern Africa | Female |

**(2019)**

| S.No. | Name | Nationality | Continents | Gender |
|---|---|---|---|---|
| 1 | Houcine Angar | Tunisia | Northern Africa | Male |
| 2 | Mohamed Jadlaoui | Tunisia | Northern Africa | Male |
| 3 | Md Zakaria Hasan | Bangladesh | Southern Asia | Male |
| 4 | Mustafa Kamrul Hasan | Bangladesh | Southern Asia | Male |
| 5 | Hamza Iaaich | Morocco | Northern Africa | Male |
| 6 | Hanane Ouhemi | Morocco | Northern Africa | Female |
| 7 | Sagar Dhakal | Nepal | Southern Asia | Male |
| 8 | Siddha Upadhya | Nepal | Southern Asia | Male |
| 9 | Malay Kumar Mandal | India | Southern Asia | Male |
| 10 | Yogesh Kumar | India | Southern Asia | Male |
| 11 | Manish Kumar | India | Southern Asia | Male |
| 12 | Manoj Kumar | India | Southern Asia | Male |
| 13 | Deep Mohan Mahala | India | Southern Asia | Male |
| 14 | Harpreet Kaur | India | Southern Asia | Female |
| 15 | Kulbir Singh Saini | India | Southern Asia | Male |