Proceedings of the Three-Day Visit to ICRISAT by UPCAR Delegation

Uttar Pradesh Council of Agricultural Research (UPCAR), Lucknow, Uttar Pradesh

International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, Telangana State

Date of Visit: 5th -7th September, 2025

Delegation Members:

- Dr. Sanjay Singh, Director General, UPCAR
- Dr. Permendra Singh, Deputy Director General, UPCAR
- Dr. Rajarshi Gaur, Deputy Director General, UPCAR
- Dr. Rinni Singh, Scientific Officer, UPCAR

Background

A Memorandum of Understanding (MOU) was signed between **Uttar Pradesh Council of Agricultural Research (UPCAR), Lucknow, Uttar Pradesh** and the **International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, Telangana State** in August 2025. The objective of this MOU is to foster collaboration for sustainable agriculture in Uttar Pradesh through:

- Collaborative research programs
- Exchange of scientific knowledge and material
- Joint training and capacity-building initiatives
- Field-level implementation of sustainable agricultural practices
- Leveraging cutting-edge research for benefit of farmers

In continuation of this collaboration, a four-member delegation from UPCAR undertook a three-day official visit to ICRISAT.

The visit was co-ordinated by Dr. Ramesh Singh, Principal Scientist & Cluster Lead – Resilient Farming & Food Systems, ICRISAT, and his team.

INSTITUTIONAL OVERVIEW, LABORATORY VISITS & TECHNICAL DISCUSSIONS

1. Visit to ICRISAT Museum

The day commenced with a guided tour of the ICRISAT Museum, offering a historical overview of the institute's establishment, its vision and mission, and its global contributions in advancing semi-arid tropical agriculture. The delegation gained valuable insights into the genesis and evolution of ICRISAT's research and development initiatives.

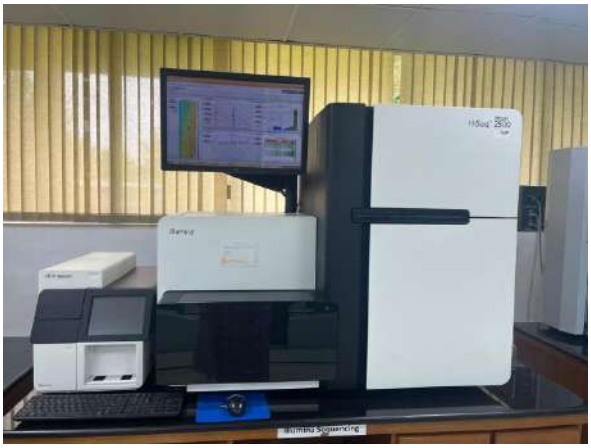
2. Laboratory Visits

- **Charles Renard Analytical Laboratory**:
  - ✓ Accredited by FAO Global Soil Laboratory Network (GLOSOLAN).
  - ✓ Demonstrated techniques such as spectroscopy for assessment of 17 nutrients of soil.

- ✓ Discussed how these methodologies contribute to soil health mapping and restoration planning.

- **Molecular Biology and Genetic Engineering Lab**:

- ✓ A demonstration of equipment and techniques used in genotypic analysis, molecular breeding, and trait enhancement of landraces for key crops like groundnut, chickpea, and sorghum.
- ✓ Emphasis on breeding for climate-resilient traits, yield enhancement, and stress tolerance.
- ✓ List of high-end equipment in the Molecular Biology and Genetic Engineering Lab at ICRISAT:
    - Illumina Sequencer for high-throughput DNA sequencing and genomics studies
    - Sanger Sequencer for DNA sequencing and validation of genetic variants
    - High-Throughput Genotyping Platforms , SNP genotyping arrays for large-scale genetic analysis and testing the seed quality
    - Automated Liquid Handling Systems for precise, high-throughput sample and reagent dispensing
    - Real-Time PCR (qPCR) System for quantitative gene expression analysis
    - Gel Documentation System for imaging nucleic acid gels
    - Automated DNA/RNA Extractors for efficient nucleic acid isolation
    - Thermocyclers (PCR machines) for DNA amplification
    - Electrophoresis Units for nucleic acid separation
    - Microplate Readers for biochemical assays



3. Round Table Discussion with ICRISAT Scientists

Experts from ICRISAT in breeding (groundnut, chickpea, and pigeon pea), agronomy, soil science, agri-business, and water technology participated in the discussion. Key points discussed included:

- A comprehensive plan for the rehabilitation of the Bundelkhand region through Dry land agriculture and climate-resilient practices
- Strategies to address water scarcity through water-saving technologies and the need for region-specific agronomic packages.
- Exchange of breeding material ranging from early generations (F2 to F5) to fixed material (F7), emphasizing the importance of sharing genetic resources to accelerate crop improvement and validate adaptability across diverse environments in the state of Uttar Pradesh.
- Cropping and Mixed cropping systems as a strategy to enhance farmer income and increase overall crop yield by optimizing land use and reducing risk.
- The establishment of mechanization centers for small-scale farmers was highlighted as a crucial step to improve farm efficiency and reduce labor bottlenecks. Additionally, the Direct Seeded Rice (DRS) system at Jhansi was discussed as an innovative approach to improve water-use efficiency and reduce cultivation costs.
- Water management was a major focus, including the gravity irrigation system and the development of man-made water bodies at ICRISAT, which support sustainable water conservation practices. The benefits of effective water management discussed included enhanced soil moisture retention, increased crop resilience to drought, improved groundwater recharge, and overall socioeconomic upliftment of farming communities through sustainable resource use.

4. Walk through by Global Research Program Director – Accelerated Crop Improvement & Head of Gene bank

Dr. Kuldeep Singh, Acting Global Research Program Director – Accelerated Crop Improvement & Head of Gene bank, shared a roadmap for crop improvement using gene bank resources. The ICRISAT Gene bank established in 1979 at Patancheru, India serves as a world repository for the collection of germplasm of the 11 crops. Several landraces now conserved in the ICRISAT gene banks have disappeared from their natural habitats in Africa and Asia. The collection serves both as insurance against genetic erosion and a source of tolerance to diseases and pests, environmental stresses, higher nutritional quality and traits related to yield for crop improvement.

Key highlights:

- Two types of **Gene Banks** are maintained at ICRISAT: **Short-term** that stores seeds at 5°C for up to 5 years, mainly for active use in breeding and research and **Long-term** that stores seeds at -20°C for more than 50 years, primarily for conservation and future regeneration. Maintain seed viability by controlling temperature and humidity, slowing down metabolic activity to extend the lifespan of genetic material while ensuring accessibility for current and future needs.
- ICRISAT Gene bank houses 132,087 germplasm accessions from 144 countries through donations and collection missions
- Focused on 11 crops: sorghum, pearl millet, chickpea, pigeonpea, groundnut, finger millet, foxtail millet, little millet, kodo millet, proso millet and barnyard millet

- Landraces preserved have traits for drought tolerance, disease resistance, and nutritional quality

- Gene Banks maintain seed viability by controlling temperature and humidity, slowing down metabolic activity to extend the lifespan of genetic material while ensuring accessibility for current and future needs.

5. Visit to William D. Dar Agri Business Incubation Centre

- Explored incubation activities supporting agripreneurs and start-ups in the semi-arid tropics

- Emphasis on scaling innovative solutions for farmers and also extension of collaborative efforts to establish similar activities in the state of Uttar Pradesh.


William D Dar
Agribusiness Centre
In recognition of the contributions of
Dr William D Dar, ICRISAT Director General (2000-2014)
for promoting international agricultural research and
inclusive development in the semi-arid tropics
17 February 2017
ICRISAT
INTERNATIONAL CROPS RESEARCH
INSTITUTE FOR THE SEMI-ARID TROPICS

MEETING WITH *ICRISAT* LEADERSHIP & FIELD VISITS

1. Meeting with Dr. Himanshu Pathak, Director General, ICRISAT

A strategic meeting was held to further explore joint initiatives and collaborative research areas with emphasis on:

- Dry land agriculture in Uttar Pradesh
- Climate-resilient farming systems
- Leveraging ICRISAT's technological expertise for field implementation
- Symposium to be organized this year (2025-2026) on "Regenerative Farming" and 3-4 field trials to be conducted at different locations of Uttar Pradesh.
- A joint meeting of ICRISAT and UPCAR to be organized on 15th September, 2025 to visit the Bundelkhand region to review the water technology project at field level along with African delegation also in attendance.

2. Visit to ICRISAT Agricultural Fields

- Visited multiple cropping systems under Dry land and Regenerative farming
- Discussions on:
  - ✓ Intercropping, soil health management, and bio-input usage
  - ✓ Field-based evidence generation and data analytics for crop performance
  - ✓ Regenerative agriculture strategies

TECHNOLOGICAL DEMONSTRATIONS & FUTURE COLLABORATION

1. Visit to Dry land Living Lab

- Observed experimental treatments including mixed cropping (e.g., Pigeon pea + Sorghum)
- Demonstrations of:
  - ✓ Zero tillage
  - ✓ Soil-based fertilization (STBF)
  - ✓ Mulching and microbial consortia
  - ✓ Comparative results of 7 cropping system combinations

Key Cropping Systems Identified:

- (Pigeon pea + Maize) – Chickpea
- (Pigeon pea – medium to long duration + Sorghum) – Relay Green gram

2. Regenerative Agriculture Discussion

Generating science based evidence on regenerative agriculture packages with continued feedback loop through component technologies for major production systems.

Five pillars discussed:

1. Conservation agriculture (Zero tillage, weed management)
2. Mixed cropping
3. Residue management
4. Permanent root and bed systems
5. Soil health improvement

3. Visit to Agro meteorology Observatory Facility (Class B)

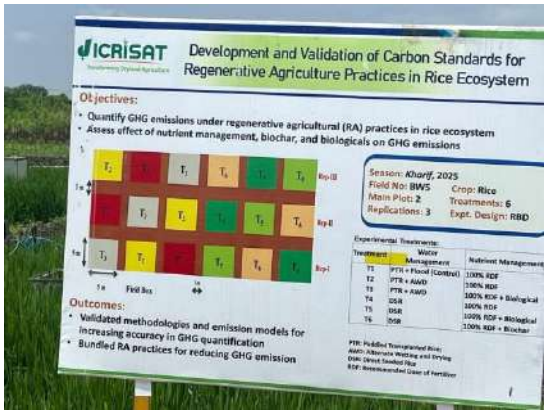
- Infrastructure: Laser precipitation monitors, Stevenson screens, sensors, data loggers
- Focused on developing production systems for the semi-arid tropics by matching crops to their environments, conducting field studies on weather and soil parameters, utilizes various sensors and data loggers, and generates agro-meteorological advisories tailored to semi-arid cropping systems, indicating a functional network of monitoring and research facilities

4. Visit to Agricultural Engineering Division

- Display of latest machinery for ploughing, sowing, and harvesting
- Discussion on potential procurement and deployment in the state of Uttar Pradesh
- Joint projects will be submitted to DST for agricultural mechanization in UP

5. Visit to GHG Emissions Monitoring Station

- Focus on GHG emissions reduction and soil carbon monitoring
- Current project: “Development and Validation of Carbon Standards for Regenerative Practices in Rice Ecosystems”, examines GHG emissions under various nutrient management and biochar applications



6. Visit to transplanted Pigeon pea

- Focus on improving crop establishment and early vigor by raising seedlings in a controlled environment and transplanting them into the field, thereby overcoming issues related to poor germination, moisture stress, and delayed sowing in rainfed conditions, productivity increased by 20-30% by such practice.
- ICRISAT and UPCAR jointly agree to submit project to increase productivity of pulses in UP

7. Visit to Composting and Waste Recycling Units

Observed three major compost types for enhancing the fertility of soil:

1. Agricultural farm residue compost
2. Vermicomposting
3. Bio char production

8. Visit to the "Soil Testing on Wheels" facility at ICRISAT

- The basic objective is to provide rapid, on-site soil analysis to farmers and researchers, enabling timely and precise fertilizer recommendations to improve soil health and crop productivity.
- The modus operandi involves a mobile laboratory equipped with modern soil testing instruments that collects soil samples directly from the field, quickly analyzes key nutrient levels, pH, and other soil properties, and delivers immediate, tailored fertilizer and management advice to optimize crop growth.
- The capacity of the facility is analyzing 18 elements at the cost of INR 1700. The output is 200 samples / day.
- The "Soil Testing on Wheels" facility at ICRISAT uses a range of portable and rapid-analysis equipment, including:

  - Portable pH meter for soil acidity/alkalinity measurement
  - Electrical Conductivity (EC) meter for soil salinity assessment
  - Portable spectrophotometer for nutrient analysis (e.g., nitrogen, phosphorus, potassium)
  - Soil moisture meter to determine soil water content
  - Colorimeter for micronutrient estimation
  - Portable flame photometer for potassium and sodium measurement


TESTING ON WHEELS

MAJOR FOCUS AREAS FOR FUTURE COLLABORATION

Discussions during the visit identified the following areas of strategic collaboration:

- Seed availability for chickpea and millets for on-field demonstrations in Uttar Pradesh
- Promotion of Regenerative Agriculture practices tailored to Uttar Pradesh's agro-climatic zones
- Bundelkhand region rehabilitation plan through Dry land farming techniques
- Research scholar exchange, training programs, and joint capacity-building workshops
- Symposium to be organized this year on "Regenerative Farming" and 3-4 field trials to be conducted.
- Climate-smart agriculture: carbon footprint reduction, Bio char production, and on-farm waste composting along with FPOs (Farmer Producer Organizations) of Uttar Pradesh.
- Promoting carbon credit reduction through climate-smart agricultural practices, with a strategic focus on integrating state policy interventions that reward and incentivize farmers ensuring long-term adoption and sustainability of low-emission, regenerative farming systems
- Technology transfer: Deployment of ICRISAT-developed agricultural tools and equipment in UP

CONCLUSION

The three-day visit to ICRISAT provided an invaluable opportunity for the UPCAR delegation to explore areas of mutual interest and potential collaboration. The discussions and field visits underscored ICRISAT's extensive research capabilities, advanced infrastructure, and relevance to the sustainable agricultural transformation in Uttar Pradesh. Both institutions reaffirmed their commitment to working jointly to address challenges such as water scarcity, climate change, land degradation, and improving farmer livelihoods in Uttar Pradesh.