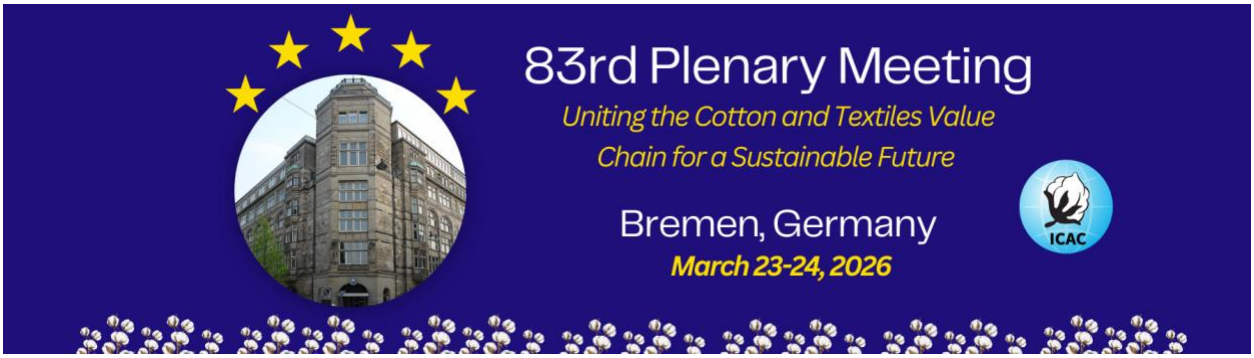
# International Cotton Advisory Committee

## Provisional Minutes

## 83rd ICAC Plenary Meeting

**March 23-24, 2026**
**Bremen Parliament Building**
**Bremen, Germany**




# 83rd ICAC Plenary Meeting

# MINUTES

## 3rd Open Session: Technical Seminar: Deep Learning and Sensor Technologies for Automated Detection and Monitoring of Cotton Diseases and Insect Pests

9:00 am to 10:0 am, Tuesday, March 24, 2026

The Chair opened the session at 9:00 am and welcomed the speakers:

- Dr. C.D. Mayee
- Dr. Keshav Kranthi

The session aimed to explore how emerging technologies can address persistent challenges in pest detection and crop protection.

## Presentation: Sensor Technologies for Automated Detection and Monitoring of Cotton Pests & Diseases: Indian Work

## Speaker: Dr. C.D. Mayee

Dr. C.D. Mayee's presentation provided a detailed account of the transition from conventional, labor-intensive pest monitoring to AI-enabled, sensor-based automated systems highlighting the recent advances made in India, with special reference to cotton crop protection. He highlighted the limitations of current practices such as manual counting using sticky and pheromone traps, which are time-consuming, inconsistent, and unable to provide real-time information for timely interventions. The presentation emphasized the integration of computer vision, deep learning, and IoT technologies for pest detection and monitoring. A key innovation discussed was the Cotton Microclimate and Insect Monitoring System (C-MIMS), a 5G-enabled platform combining AI-powered imaging, wireless sensors, and microclimate monitoring (temperature, humidity, light, wind, soil moisture and temperature). The system employs advanced hardware such as high-resolution cameras (Sony IMX sensors), Raspberry Pi-based image processors, and

machine learning algorithms (including YOLO-based models and SVM classifiers) to detect, classify, and count pests like pink bollworm, jassids, whiteflies, and thrips under diverse field conditions. Data are transmitted to cloud servers using standard communication protocols, where predictive models, including ARIMA and phenology-based approaches, analyze pest dynamics in relation to weather, enabling continuous monitoring and large-scale applicability.

The presentation further demonstrated how these technologies are operationalized through real-time decision support systems, delivering pest alerts and advisories to farmers via mobile apps, emails, and web portals based on economic threshold levels and predictive indicators such as moth emergence and generational cycles. Notably, ICAR-CICR's AI-based smart pheromone traps with ~96% detection accuracy and wireless multi-pest monitoring systems were shown to significantly reduce pesticide use (by ~38%) while maintaining pest populations below economic thresholds through timely interventions. The integration of multi-location data enables area-wide pest surveillance and forecasting, forming the basis for digital IPM systems. Additional applications such as sensor-based smart irrigation and fertigation further illustrate the broader role of AI in precision agriculture. However, Dr. Mayee also highlighted challenges including high initial investment, data requirements, connectivity limitations, and the need for skilled manpower and farmer training. Overall, the presentation underscored a technology-driven paradigm shift in Indian agriculture, where AI, IoT, cloud computing, and digital platforms are converging to enable real-time pest monitoring, predictive analytics, and climate-resilient, sustainable cotton production.

## Presentation: Sensors for Pest and Disease Monitoring -Early Detection for Precision Management

**Speaker: Dr. Keshav Kranthi**

Dr. Kranthi provided a global perspective on how emerging sensor technologies and digital pest monitoring systems are transforming crop protection across both large farms and smallholder systems worldwide. The presentation began by highlighting that pests and diseases cause 20–40% global crop losses, and that traditional monitoring methods, such as manual scouting, sweep nets, and conventional traps are labor-intensive, subjective, and often detect infestations too late. The presentation defined agricultural sensors as devices that capture biological, chemical, and physical signals, including insect presence, plant stress, volatile compounds, spectral signatures, and insect movement, and convert them into actionable digital information. It then reviewed key sensor technologies, including AI-enabled smart pheromone traps (e.g., Trap-view, Semios, iSCOUT), optical sensors that identify insects by wingbeat frequency, acoustic sensors detecting larval feeding, hyperspectral and multispectral sensors on drones and satellites for early stress detection, electronic nose sensors that detect plant-emitted VOCs, radar systems for tracking migratory pests, and AI-powered smartphone applications for field-level diagnosis.

The talk emphasized that integrating these diverse data streams with weather data, pest biology models, and AI-driven analytics platforms enables real-time monitoring, hotspot mapping, and predictive pest forecasting, thereby shifting pest management from reactive spraying to proactive, precision-based interventions. It also highlighted the concept of digital pest surveillance networks, where sensor data, satellite inputs, and farmer observations converge to

generate early warning systems at regional and global scales. Special relevance was outlined for cotton, where such systems can improve monitoring of key pests such as bollworms, jassids, whiteflies, thrips, and pink bollworm, leading to better timing of control measures, reduced pesticide use, and improved productivity. The presentation concluded by underscoring that sensors do not replace Integrated Pest Management (IPM), but rather strengthen decision-making, while also noting challenges related to cost, scalability, and accessibility for smallholders. Overall, the central message was that early detection enabled by sensor technologies is fundamental to sustainable, climate-resilient agriculture and will play a pivotal role in the future of precision crop protection.

## Discussion and Q&A

The discussion and Q&A session focused on the practical applicability, accuracy, and broader implications of AI-based pest monitoring systems. Panelists highlighted that the accuracy of AI models, typically ranging from 90–99%, is validated through ground-truthing by comparing automated counts with manual observations. It was emphasized that pest dynamics are not driven by sensors alone but are strongly influenced by climatic and agronomic factors, including weather conditions, soil nutrients, and crop management practices. Integrating these variables into predictive models significantly enhances the reliability of pest forecasting. A key point of consensus was the distinction between monitoring and prevention: while digital monitoring systems provide timely and precise decision support, preventive agronomic practices, such as balanced fertilizer use and avoiding practices that exacerbate pest outbreaks remain fundamental. The importance of farmer training was underscored as a major constraint, although increasing smartphone penetration offers new opportunities for digital extension services and dissemination of best practices. However, cost and accessibility continue to be major barriers, with suggested solutions including shared infrastructure, government support, and the development of scalable, low-cost sensor technologies.

An important intervention was made by the delegate from Egypt, who raised concerns about recent jassid infestations in Egyptian cotton (*Gossypium barbadense*) and inquired about the role of early detection systems in preventing such outbreaks. Panelists responded that jassids are particularly damaging at the seedling stage and emphasized the need for early monitoring and rapid detection, along with improved agronomic management. Key recommendations included careful nitrogen management, maintaining adequate potassium levels, developing and adopting tolerant varieties, and strengthening research and international collaboration. It was also noted that ICAC has developed resources that could support national efforts in jassid management. Additional discussions highlighted the importance of best agronomic practices, cluster-based farmer training programs, and public–private partnerships for scaling digital technologies, as well as the integration of pest monitoring into climate-smart agriculture systems. In closing, the Chair emphasized the growing role of digital and AI-driven tools in agriculture, while stressing the need to balance innovation with accessibility and to maintain the central role of integrated pest management (IPM). The session concluded with appreciation to all speakers and participants.