



Indian Phytopath News

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From President's Desk

Artificial Intelligence (AI) in Phytopathology: Future Perspective

Plant diseases are one of the major constraints to reduce crop productivity, and farm profitability. The increasing transboundary movement of planting material, changing climatic conditions and the emergence of new pathotypes have made disease management more complex than ever before. Traditionally, the plant disease diagnosis and monitoring have relied only on field observations, scouting, laboratory examination, and expert opinion. However, these approaches remain indispensable. The volume of information generated in modern agriculture has created a requirement for tools which can process the large datasets rapidly and support timely decision-making. Artificial Intelligence has emerged as one of the most promising technologies in this regard. AI refers to computational systems capable of recognizing patterns, learning from data, and assisting in decision-making. In plant pathology, AI is increasingly being used to analyze images, weather records, sensor outputs, genomic information and disease surveillance datasets. Rather than replacing plant pathologists, AI acts as a powerful analytical partner that enhances diagnostic efficiency, improves disease forecasting, and supports precision crop disease management strategies.



One of the most visible applications of AI in plant pathology is image-based disease diagnosis. Advances in computer vision and deep learning have enabled computers to identify disease symptoms from photographs of leaves, stems, fruits and entire crop canopies. Convolutional Neural Networks (LeNet-5, AlexNet, VGGNet, ResNet and MobileNet) and related deep-learning architectures such as object detection models (e.g., YOLO, R-CNN), image segmentation (e.g., U-Net) and generative models (e.g., GANs, Diffusion

IN THIS ISSUE

From President's Desk	01
Awards/Honours/Promotion	02
IPS Symposia 2025-26	03
Book Published	05
Obituary	05
Editorial Board - Newsletter	05

Models) can learn complex visual features associated with pathogen infection. Once trained using thousands of labelled images, these systems can classify diseases with remarkable accuracy under controlled conditions. Smartphone-based diagnostic applications are now being explored for several crops, allowing farmers and extension workers to obtain preliminary disease assessments directly in the field. The usefulness of AI extends beyond symptom recognition. Plant disease development is strongly influenced by environmental factors such as temperature, humidity, rainfall, and leaf wetness duration. Machine-learning algorithms can integrate these variables to generate disease risk predictions. Such predictive models can serve as early-warning systems by identifying periods favourable for pathogen infection and epidemic development. Researchers are increasingly combining weather datasets, historical disease records and real-time sensor information to improve forecasting accuracy. These developments support more efficient fungicide application schedules and help reduce unnecessary chemical inputs.

Remote sensing technologies have further expanded the role of AI in disease surveillance. Drones, satellites and proximal sensors can collect high-resolution information from large agricultural landscapes. Disease-affected plants often exhibit subtle physiological changes before visible symptoms become apparent. Variations in canopy temperature, chlorophyll content, spectral reflectance and plant

vigor can be detected through advanced imaging systems. AI algorithms analyze these datasets to identify abnormal patterns associated with disease outbreaks. Such approaches are particularly valuable for large-scale crops where field scouting alone may not provide adequate coverage.

Recent research has also demonstrated the potential of AI-assisted decision support systems. These platforms integrate multiple streams of information including pathogen biology, host susceptibility, weather conditions and management history. By processing diverse datasets simultaneously, AI can generate recommendations tailored to specific production environments. This capability is especially relevant in precision agriculture, where interventions can be targeted spatially and temporally according to disease risk. Another emerging area involves the integration of AI with molecular plant pathology. Modern diagnostic laboratories generate large volumes of genomic and transcriptomic data. AI-based analytical tools can assist in identifying pathogen signatures, predicting virulence-related traits, and exploring host-pathogen interactions. These applications have the potential to accelerate resistance breeding programs and improve understanding of disease epidemiology.

Despite its considerable promise, AI is not without limitations. The quality of predictions depends heavily on the quality and diversity of training data. Models developed under controlled conditions may perform differently when exposed to varying field environments, lighting conditions, crop stages and pathogen populations. Data scarcity remains a challenge for several crops and diseases, particularly in regions where digital datasets are limited. Furthermore, AI outputs require validation by trained professionals to avoid misdiagnosis and inappropriate management recommendations. Ethical and practical considerations must also be addressed. Data ownership, accessibility, computational infrastructure and user training influence successful implementation of this technique. Smallholder farming systems may face barriers related to connectivity, equipment availability and technical support.

Looking ahead, the convergence of AI with the Internet of Things (IoT), robotics, remote sensing, and advanced molecular diagnostics is likely to reshape

plant disease management. Smart sensors deployed in fields may continuously monitor environmental conditions, while AI systems analyze incoming data in real time to generate actionable alerts. Autonomous scouting platforms and intelligent imaging systems could further strengthen disease surveillance capabilities. In crops such as sugarcane, where large production areas often complicate disease monitoring, these innovations may significantly enhance the speed and precision of management decisions. Consequently, future efforts should emphasize user-friendly technologies that complement existing extension networks and local expertise.

Artificial intelligence is emerging as a transformative tool in plant pathology. AI can apply in area of plant pathology such as disease diagnosis, forecasting to surveillance, precision management and research analytics. The technology offers substantial opportunities for improving crop health management, reducing crop losses and strengthening agricultural sustainability.

Dinesh Singh

President

Indian Phytopathological Society

Awards/Honours/Promotions

- **Dr. R. Thangavelu**, Principal Scientist (Plant Pathology), ICAR-NRC for Banana, Tiruchirapalli, Tamil Nadu has joined as the Director of the ICAR-National Research Institute for Integrated Pest Management (ICAR-NRIIPM) in New Delhi, with effect from April 2025.
- **Dr. C.D. Mayee**, past president of IPS and life member of the society has been honoured by International Cotton Advisory Committee (ICAC), the apex body of International cotton at Washington, USA with ICAC COTTON RESEARCHER OF THE YEAR-2025 AWARD in a glittering function held in Townhall of BREMEN, Germany. Dr Mayee not just a cotton scientists, but a visionary whose work has safeguarded cotton production, educated farmers about new technologies and practices to manage pests and diseases, strengthened the farmers income in rainfed areas and positioned India as a cotton innovation hub, truly a crop savior in every sense. This honours

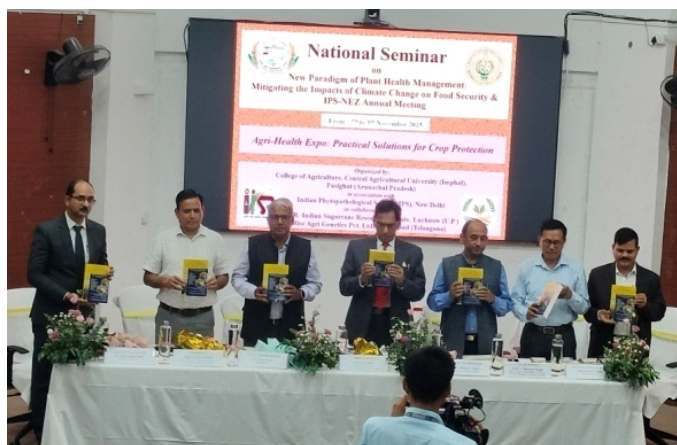
at the age 80 makes it more significant for him as the recognition came after real dedication of science and technology of cotton. He has been President of Indian Society for Cotton Improvement, Mumbai for the last 12 years and is the founder President of South Asia Biotechnology Center, Jodhpur. He desires to share this honour with his plant pathology colleagues who have stood with him at all the times since his student days at IARI in 1968-1972.



IPS Symposia 2025-26

IPS North-Eastern Zone Symposium

The IPS North-Eastern Zonal Meet and National Conference on “*New Paradigm of Plant Health Management: Mitigating the Impacts of Climate Change on Food Security*” was organized during 7–9 November 2025 at the Seminar Hall, Central Agricultural University (Imphal)–College of Agriculture, Pasighat, Arunachal Pradesh. The event was jointly



organized by the College of Agriculture and College of Horticulture & Forestry, Pasighat, in collaboration with the Indian Phytopathological Society (IPS), New Delhi. The conference served as a platform for deliberations on emerging challenges and innovative strategies in plant health management under changing climatic conditions and their implications for food security. The programme was organized under the leadership of Dr. Gireesh Chand, Zonal President, IPS North-Eastern Zone, along with Dr. Amit Kumar Singh.

IPS Northern Zone Symposium

The IPS North Zone Meet and National Symposium on “*Frontiers in Plant Health Management: Integrating Research, Technology and Sustainability*” was successfully held from 18–20 November 2025, jointly organized by the Indian Society of Plant Pathologists (INSOPP), the Indian Phytopathological Society (IPS), and ICAR–Indian Agricultural Research Institute (IARI), New Delhi. The symposium brought together leading experts and researchers in plant protection from across the country and served as a platform for scientific deliberations on emerging challenges and future directions in plant health management. The event concluded with a collective resolution to strengthen national networking, promote multi-institutional research collaborations, and enhance translational outreach for the benefit of farmers and environmental sustainability. Participants expressed confidence that the discussions and outcomes of the symposium would significantly contribute to shaping India's future roadmap for plant health research, capacity building, and ecosystem sustainability. The conference was organized under the leadership of Dr. Ritu Bala, Zonal President, IPS North Zone, along with Dr. Yogita Bohra.



IPS Western Zone Symposium

The IPS West Zone Meet and National Symposium on *“Integrating Crop Care for Sustainable Plant Health under Changing Climatic Scenario”* was organized during 16–17 December 2025 through the joint efforts of the Department of Plant Pathology, College of Agriculture, Vasantao Naik Marathwada Krishi Vidyapeeth (VNMKV), Parbhani, Maharashtra, the Indian Phytopathological Society (IPS), New Delhi, and the Association of Plant Pathologists, PDKV, Akola, Maharashtra. The symposium provided a platform for discussions on sustainable crop care approaches and plant health management strategies under changing climatic conditions. The conference was organized under the leadership of Dr. Vikram Gholve, Zonal President, IPS West Zone, along with Dr. Gajendra Jagtap, Zonal Councillor, IPS-West Zone.



IPS Southern Zone Symposium

The IPS South Zone Meet and National Conference on *“Transforming Plant Health Management: Integrating Traditional Practices with Modern Innovations for Global Food Security”* was organized during 18–19 December 2025 by the Indian Phytopathological Society (Southern Zone Chapter) in collaboration with Pandit Jawaharlal Nehru College of Agriculture and Research Institute (PAJANCOA & RI), Karaikal, Union Territory of Puducherry. The conference served as an important platform for discussing the integration of traditional agricultural practices with modern innovations to address global food



security challenges and advance plant health management. More than 200 delegates, including scientists, academicians, researchers, and students, participated in the event. The conference was organized under the leadership of Dr. C. Jeyalakshmi, Zonal President, IPS South Zone, along with Dr. P. Balabaskar, Zonal Councillor, IPS South Zone.

National Conference on “Novel Strategies for Biotic Stress Management in Crop Plants” Commences at ICAR-NIBSM, Raipur

The two-day National Conference on *“Novel Strategies for Biotic Stress Management in Crop Plants”* was organized on 11-12 December 2025 at ICAR–National Institute of Biotic Stresses Management (ICAR-NIBSM), Raipur, jointly organized by the Indian Phytopathological Society (IPS) and the Biotic Stress Management Society (BSMS). The conference aims to promote innovative and sustainable strategies for managing biotic stresses and enhancing crop resilience across diverse agro-ecological regions. Chief Guest Dr. Girish Chandel, Vice Chancellor, IGKV, emphasized strengthening research-extension linkages for sustainable farmer-centric solutions, while Guest of Honour Dr. N. Krishna Kumar, Former Deputy Director General (Horticulture), ICAR, highlighted the role of advanced biotechnological tools in addressing emerging biotic challenges. Dr. Malkhan Singh Gurjar from IPS stressed the importance of collaborative scientific platforms in developing resilient and climate-ready crop production systems. Chairing the inaugural session, Dr. P.K. Rai, Director, ICAR-NIBSM and President, BSMS, underlined the need for innovative and eco-friendly approaches to mitigate emerging biotic stresses and



described the collaboration between IPS and BSMS as an important step toward strengthening national research initiatives. During the event, a technical bulletin titled “*Emergence of Antibiotic Resistance in Bacterial Blight Pathogen, Xanthomonas oryzae pv. oryzae and Rice phyllosphere-associated Sphingomonas spp. in Chhattisgarh*” by Sushil K. Sharma and colleagues was also released. The conference witnessed participation of around 200 scientists, researchers, academicians, and students from various institutions across the country.

Book Published

Asian Citrus Industry: Growth and Sustainability

Editors: Dilip Kumar Ghosh, Kwan

Jeong Song, Sangeeta

Bhattacharyya, Subhra Saikat Roy,

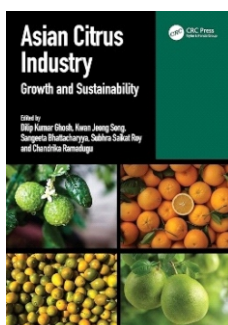
Chandrika Ramadugu

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Obituary

Dr. R.S. Mehrotra, an eminent Indian mycologist, plant pathologist, and distinguished academican, passed away on October 25, 2025. He was widely recognized for his pioneering contributions to fungal biodiversity, mycology, plant pathology, and higher education. Renowned for his dedication to teaching, research, and academic excellence, Dr. Mehrotra made significant contributions to the understanding of fungal taxonomy, ecology, and plant diseases. Through his scholarly work and mentorship, he inspired and guided generations of students, researchers, and scientists, leaving a lasting impact on the field of plant sciences and the scientific community.



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