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Meeting Report

Biosecurity risks and mitigation strategies in horticultural crops: Insights from the national seminar (NSBR 2026)

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Abstract

The National Seminar on "Biosecurity Risks and Mitigation Strategies in Horticultural Crops" (NSBR 2026) was organized by ICAR-Central Plantation Crops Research Institute (CPCRI), Regional Station, Kayamkulam, Kerala from 22 to 24 April 2026. The three-day national event addressed critical biosecurity threats posed by invasive alien species, transboundary phytopathogens, and climate-induced pest outbreaks impacting horticultural and plantation ecosystems. Emphasizing a holistic "One Health" paradigm, the seminar comprised keynote addresses, award lectures, thematic technical sessions, a cruise workshop on biosecurity outreach, and panel discussions. Over 120 delegates representing 35 institutes and organizations, including national research institutes, state agricultural universities, policy bodies, and progressive farming communities, deliberated on biosecurity governance, diagnostic innovations, and field-level mitigation strategies. Key outcomes included the launch of bio-suppression technologies, technical bulletins, and recommendations advocating for the revival of the Agricultural Biosecurity Bill and establishment of the Agricultural Biosecurity Authority of India (ABAI).

Keywords: Agricultural biosecurity, Bioinvasions, ICAR-CPCRI, One Health, Invasive alien pests, Quarantine policy, Plantation crops

Introduction

Horticultural crops, including plantation crops, spices, fruits, vegetables and ornamentals, are vital to India's agrarian economy and rural livelihood security. However, accelerated global trade, cross-border movements, and climate volatility have heightened the vulnerability of these agricultural systems to biological invasions and transboundary pest introductions. Exotic pests and pathogens, including the rugose spiralling whitefly (*Aleurodicus rugioperculatus* Martin) (Shanas *et al.,* 2016; Josephrajkumar *et al.,* 2023), coconut eriophyid mite (*Aceria guerreronis* Keifer) (Sathiamma *et al.,* 1998; Rajan *et al.,* 2007), emerging leaf spot pathogens of arecanut (Thava Prakasa Pandian *et al.,* 2024), and the invasive root-knot nematode, *Meloidogyne enterolobii* Yang & Eisenback (Poornima *et al.,* 2016; Anes *et al.,* 2023), have demonstrated significant socio-economic ramifications across India. To deliberate on biosecurity risks, diagnostic readiness, and sustainable mitigation frameworks, ICAR-CPCRI, Regional Station, Kayamkulam, convened the National Seminar on "Biosecurity Risks and Mitigation Strategies in Horticultural Crops" (NSBR 2026) during 22–24 April 2026. The seminar brought together plant health experts, regulatory officials, extension personnel, and farmers to foster an integrated, farmer-participatory approach under the One Health framework.

Inaugural session

The seminar was virtually inaugurated on 22 April 2026 by Dr. S. K. Singh, Deputy Director General (Horticultural Science), ICAR, New Delhi. In his inaugural address, Dr. Singh underscored the escalating frequency of bioinvasions threatening national food security and trade integrity. He emphasized that invasive species inflict billions of dollars in economic damage annually and urged the scientific community to formulate actionable roadmaps, including a white paper on sustainable biological solutions. While delivering the presidential address, Dr. K. B. Hebbar, Director, ICAR-CPCRI, Kasaragod, highlighted the complex interplay between abiotic stresses and pest outbreaks. Citing widespread bioinvasions in palm systems, Dr. Hebbar advocated for area-wide, farmer-participatory pest management strategies and community-level biosecurity literacy to protect smallholder plantation enterprises.

The keynote address was delivered by Dr. T. P. Rajendran, Former Assistant Director General (Plant Protection and Biosafety), ICAR. Dr. Rajendran provided a critical appraisal of India's biosecurity framework, noting that while quarantine regulations exist, enforcement mechanisms remain sluggish. He called for the establishment of a dynamic "National Biosecurity Risk Atlas" to monitor high-risk border corridors and entry ports. A major



Inaugural address by Dr. S.K. Singh (DDG – Horticultural Science)

highlight of the inaugural session was Dr. K. P. V. Menon Memorial Lecture, delivered by Dr. George V. Thomas, Former Director, ICAR-CPCRI. Dr. Thomas paid tribute to Dr. Menon's seminal research on coconut phytopathology and delineated strategic directions for managing coconut root (wilt) disease using microbiome engineering and host resistance breeding.

In the special plenary lecture, Dr. Gregory A. Evans highlighted the critical role of taxonomy in strengthening biosecurity amid increasing global trade and the associated risk of invasive pest introductions.

Biosecurity risks – awareness and preparedness

Technical Session-I entitled 'Biosecurity Risks – Awareness and Preparedness' was chaired by Dr. K. B. Hebbar, Director, ICAR-CPCRI, Kasaragod, with Dr. R. Selvarajan, Director, ICAR-NRCB, Tiruchirappalli, and Dr. Vinayaka Hegde, Head, Division of Crop Protection, ICAR-CPCRI, as Co-Chairs. Dr. Nihad K. and Dr. Prathibha P. S. Senior Scientists, ICAR-CPCRI coordinated the session. The speakers emphasized clean planting material, surveillance, early detection, quarantine, diagnostics, taxonomy, and eco-friendly pest management. Oral presentations highlighted recent advances in phytosanitary measures, molecular diagnostics, genomic surveillance, invasive pests, emerging diseases, safe germplasm movement, and integrated pest management in horticultural and plantation crops. The deliberations emphasized the growing biosecurity risks associated with globalization and climate change and the need for stronger surveillance, rapid diagnostics, effective quarantine, and stakeholder collaboration.

Recommendations

- Strengthen plant quarantine and phytosanitary regulations.
- Establish an integrated national surveillance network for invasive pests and pathogens.
- Develop rapid, sensitive and cost-effective diagnostic tools.
- Implement certification systems for pest- and disease-free planting material.
- Map pest- and disease-free areas and promote production of clean planting material.
- Develop state-wise inventories of endemic pests and diseases.
- Establish mandatory reporting, verification, risk assessment and containment mechanisms for invasive species and emerging diseases.

Biosecurity concerns on planting materials – prospects and challenges

A Workshop-I entitled "Biosecurity Concerns on Planting Materials – Prospects & Challenges" was chaired by Dr. T. P. Rajendran, Former ADG (Plant Protection & Biosafety), ICAR, New Delhi, with Dr. J. Dinakara Adiga, Director, ICAR-DCR, Puttur and Dr. B. A. Jerard, PC, ICAR-AICRP on Plantation Crops as Co-Chairs. Dr. V. H. Prathibha and Dr. N. R. Nagaraja, Senior Scientists, ICAR-CPCRI convened the workshop. This workshop highlighted the importance of healthy, certified planting materials in preventing the introduction and spread of invasive pests and pathogens. Lead and invited lectures covered biosecurity risks in cashew, horticultural planting materials, tropical tuber crops, imported flowering and foliage crops, and the use of pheromones and semiochemicals for sustainable pest management. The potential of AI and digital technologies, including the *NeophyteID* application, for real-time invasive plant detection and surveillance was also demonstrated. The deliberations emphasized the need for strengthened quarantine, certification, nursery accreditation, advanced diagnostics, digital surveillance, and stakeholder awareness to ensure safe movement of planting materials.

Recommendations

- Develop safe soilless substrates for production of planting materials.
- Standardize quarantine procedures based on the plant stage and purpose of introduction.
- Study factors influencing pest and pathogen movement between locations.

Quarantine, regulations and impact on horticultural crops

The Technical Session on Quarantine, regulations and impact on horticultural crops was chaired by Dr. N. V. Radhakrishnan, Professor & Head, Division of Plant Pathology, College of Agriculture, Vellayani, and co-chaired by Dr. Josephrajkumar A., Principal Scientist, ICAR-CPCRI, RS Kayamkulam. Dr. M. Shareefa, Principal Scientist and Dr. Thava Prakasa Pandian R., Scientist, ICAR-CPCRI served as convenors.

The session focused on quarantine regulations, biosecurity preparedness, advanced diagnostics, and coordinated surveillance for protecting horticultural crops from invasive pests, diseases, and plant species. Two plenary lectures addressed quarantine regulations, diagnostics, capacity building, and the role of plant quarantine in safeguarding biosecurity and facilitating horticultural trade. A lead lecture focused on biosecurity challenges in tropical tuber crops, while an invited talk highlighted emerging threats from ambrosia beetles to plantation crops under changing climate.

Recommendations

- Establish a comprehensive national biosecurity framework, including consideration of a dedicated Department of Biosecurity, to strengthen regulation, preparedness, and international collaboration.
- Develop advanced diagnostic and surveillance systems, including AI-enabled technologies and a national monitoring network, for early detection and effective management of invasive pests and diseases.



Valedictory Address by Dr. N.K. Krishnakumar (Former DDG – Horticultural Science)

Mitigation strategies – research, innovations and case studies

This session focused on research-based and practical strategies for strengthening biosecurity through advanced diagnostics, sustainable crop protection, and field-level innovations. The session was chaired by Dr. Celia Chalam V., Head, Division of Plant Quarantine, ICAR-NBPGR, New Delhi with Dr. T. Makeshkumar, Principal Scientist, ICAR-CTCRI, Thiruvananthapuram and Dr. M. K. Rajesh, Head, ICAR-CPCRI RS, Vittal as Co-Chairs. Lead lectures covered detection of unauthorized GM crops, emerging bio-invasions in coconut, and leaf blast disease of ginger. Invited and oral presentations addressed integrated pest and disease management, biological and biodiversity-based control, emerging diseases of rubber, fall armyworm management, native endophytic bacteria in cacao, biosecurity extension through nutri-gardens, biological control of coconut scale and cucurbit pests, and quality assessment of agricultural inputs. The session emphasized early detection, innovative research, ecological approaches, and stakeholder participation for effective biosecurity risk mitigation and sustainable agricultural production.

In Special Plenary lecture, Dr. Ravi K. Khetarpal, Regional Director, APAARI, Bangkok emphasized that the Asia-Pacific region faces increasing biosecurity threats from emerging and transboundary pests of horticultural crops, highlighting the need for harmonized quarantine measures, effective surveillance, compliance with WTO-SPS standards, capacity building, regional cooperation, and a One Health approach to safeguard food security, livelihoods, and agricultural trade.

Recommendations

- Document the ecological effects of drone-based pesticide application on natural ecosystems.

Flash talk session

The Flash Talk session was chaired by Dr. M. L. Jeeva, Principal Scientist, ICAR-CTCRI, Thiruvananthapuram, with Dr. P. S. Prathibha, Senior Scientist, ICAR-CPCRI, Kasaragod, as Co-Chairperson, and coordinated by Dr. S. Indhuja, Dr. Daliyamol, and Dr. Jilu V. Sajan, Senior Scientists, ICAR-CPCRI. Presentations covered invasive pest and weed management, biological control, quarantine, pest-resistant crop breeding, use of native microorganisms, and sustainable crop production. The discussions emphasized the importance of multidisciplinary research, innovation, and collaboration in developing sustainable strategies for protecting horticultural ecosystems from emerging biosecurity threats.

Technologies and publications released

During the inaugural session, three technologies developed by ICAR-CPCRI, Regional Station, Kayamkulam, were officially released for farmers: Kalpa EPN Capsules, containing *Steinernema keralense* for red palm weevil management (Anes *et al.,* 2025); Kalpa *Anastatus* Egg Cards, using *Anastatus ramakrishnai* for biological control of the nut-crinkling coreid bug (Sajan *et al.,* 2026); and Kalpa Vriddhi, a PGPR-based talc formulation containing *Pseudomonas migulae* strain CPCRI-CR-NSB2 for improving soil health and nutrient availability in coconut plantations (Indhuja *et al.,* 2021).

Two technical bulletins, *Invasive Pests of Coconut: Biosecurity Risks and Mitigation Strategies* and *Coconut Health Management*, along with an updated technical folder on coconut cultivation practices, were also released.

Farmer recognition & Kalpa Vajra award

To recognize grass-roots innovation in coconut cultivation, the prestigious Kalpa Vajra Best Coconut Farmer Award 2026 was conferred upon Shri. I. Samsutheen, a progressive farmer from Tenkasi, Tamil Nadu. As a beneficiary of the Coconut Development Board funded, Laying Out of Demonstration Plot (LODP) project implemented by ICAR-CPCRI, Shri Samsutheen established an exemplary integrated farming model. The award carried a cash prize of ₹10,000, a citation, trophy, and traditional shawl of honour.

Valedictory session and strategic policy guidance

The valedictory address was delivered by Dr. N. K. Krishnakumar, Former Deputy Director General (Horticultural Science), ICAR. In a compelling policy directive, Dr. Krishnakumar stressed the urgent imperative to revive the long-pending Agricultural Biosecurity Bill and establish the statutory Agricultural Biosecurity Authority of India (ABAI). He voiced grave concern over the unregulated inter-state movement of uncertified planting materials, which facilitates transboundary pest corridors across India. Dr. Krishnakumar emphasized that modern biosecurity demands interdisciplinary coordination linking plant, animal, and human health surveillance systems under a functional 'One Health' umbrella. Dr. K. U. K. Nampoothiri, Former Director, ICAR-CPCRI, called for stricter domestic quarantine measures for inter-state movement of planting materials. Dr. Vinayaka Hegde,

Head, Division of Crop Protection, ICAR-CPCRI delivered the first Shri M. K. Varghese Memorial Plenary Lecture, detailing advancements in research on coconut root (wilt) disease and recognizing historical contributions of Shri M. K. Varghese. The recommendations of the workshop were presented by Dr. A. Josephrajkumar, Principal Scientist, ICAR-CPCRI, Regional Station, Kayamkulam. The session also featured the distribution of awards to the winners of the oral and flash talk presentations by Dr. N. K. Krishnakumar, recognizing outstanding research paper presentations made during the seminar.

Workshop on biosecurity outreach

On 24 April 2026, a Cruise Workshop on "Biosecurity Outreach", chaired by Dr. P. Anithakumari, Principal Scientist, ICAR-CPCRI, and co-chaired by Dr. R. M. Prasad, Former Associate Director of Extension, KAU, Dr. C. Thamban, Retired Principal Scientist, ICAR-CPCRI, and Dr. A. Abdul Haris, Principal Scientist, ICAR-CPCRI, was conducted on Vembanad Lake, the renowned backwaters of Alappuzha, Kerala and the Ramsar site of the country. The workshop provided a unique interactive forum for scientists, extension officials, and farmer delegates.

The workshop commenced with the keynote address by Dr. Regi Jacob Thomas, Head, ICAR-CPCRI Regional Station, Kayamkulam, who presented a historical perspective on plantation crops by drawing insights from the renowned *Hortus Malabaricus*. He emphasized the rich heritage of India's plantation biodiversity and highlighted the importance of integrating traditional knowledge with modern biosecurity frameworks to address emerging threats. This was followed by a plenary lecture by Dr. C. Thamban, who elaborated on the role of outreach, farmer participation, and community awareness in strengthening biosecurity preparedness and sustainable management of plantation ecosystems. An engaging panel discussion featured eminent experts. The panel deliberated on biodiversity literacy, the economic implications of invasive pests and diseases, public participation in biosecurity initiatives, science communication, and effective extension strategies for creating awareness among farmers, students, and the general public. The experts emphasized that biosecurity should be viewed as a shared responsibility requiring collaboration among researchers, extension agencies, policymakers, and farming communities. The workshop concluded with an interactive exchange of ideas among participants, reinforcing the need for innovative outreach approaches, strengthened stakeholder networks, and enhanced public awareness to build resilient agricultural systems. The unique cruise-based format facilitated meaningful discussions in an informal setting, making the workshop a memorable and impactful component of the seminar while underscoring the importance of translating scientific knowledge into practical biosecurity action.

Major recommendations of NSBR 2026

1. Establish a dedicated Department of Biosecurity and develop a comprehensive national biosecurity framework, fostering global collaboration to ensure strict regulation, preparedness, and an inclusive agri-food system.
2. Develop a digitized, crop-specific database on non-native and potential invasive species, and enforce stringent inter-state quarantine regulations to prevent their spread.
3. Implement National Diagnostic and Identification Technology Services with state-of-the-art infrastructure, integrating AI-based tools, along with the formation of a National Incursion Management Team for effective mitigation of biosecurity risks.
4. Promote agro-ecological crop protection through innovative biological solutions, supported by AI tools, to enable nature-based and sustainable farming systems.
5. Strengthen collaborative linkages between biosecurity awareness cells and media to enhance outreach, public engagement, and socio-economic impact assessment.

Concluding remarks

The National Seminar (NSBR 2026) served as a vital national platform to benchmark biosecurity vulnerabilities and chart actionable mitigation strategies for India's horticultural sector with special emphasis on plantation crops. By synthesizing institutional policy reforms, advanced biological control technologies, and grassroots outreach models, the seminar reaffirmed ICAR's leadership in safeguarding agricultural biosecurity and national food security.

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