

SPICES NEWS

ICAR-Indian Institute of Spices Research
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From the Director's Desk

Greetings!

2021 has arrived with a ray hope and serenity. My new role as a director of this Institute was challenging. Eventhough the corona waves were tiding around at its peak we were still managed to contest without losing our energy in research. The focus on research and development was never deviated even during these difficult times. The achievements of IISR during these six months were remarkable as you can see the outputs. All of my colleagues deserve an appreciation in this regard.

I am thankful to the forerunners and the previous acting director, Dr. Santhosh J Eapen for all the good work done which allowed me to inherit and achieve the goal and sustain the progress of the institute.

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The research during this period was in a precise scale and direction. One of the important research areas was to analyze the suitability of various black pepper genotypes for different post-harvest operations based on dry recovery and quality. Another aspect was to improve current production scenario by the use of improved potting mixture with soil, compost enriched rock phosphate and coir dust in 2:1:1 proportion as an alternative to normal potting mixture for the production of rooted black pepper cuttings. Co-inoculation of fungi and Zinc solubilizing bacteria in soil also enhanced plant growth and biomass. Crop protection area would tell us about the Piper DNA virus 1 and 2 associated with black pepper, found to be endogenous Para retroviruses integrated into chromosomes. Yet another information was that PCR assay could successfully detect fungal and bacterial pathogens from ginger rhizomes simultaneously.

Research becomes fruitful only when it reaches to the end-users.

ITM-BPD unit commercialized five technologies during January to June 2021. An amount of Rs. 15.5 lakhs earned as revenue through technology commercialization.

Frontline demonstration, on-farm testing, field trials etc. were done to test the viability of technology. Field day, hands on training, and extension activity was held for the benefit of farmers and stake holders in spice cultivation and post-harvest operations.

Institute was involved in development activities of each individual by offering training to the scientific, technical and administrative staffs in time to time based on the needs. Various events such as Swachhta Pakhwada, National Science Day, World Environment Day, International Yoga Day, Pradhan Mantri Kissan programme were conducted on the requisite of Nation. Other routine Institute activities like germplasm preservation, field trials, planting of seed material were also done on time.

The team work and dedication would always banquet the success. And I congratulate each and every one of IISR for these achievements. I wish this year would be filled with the goodness of aroma of spices

Research update

- Importance of pericarp in dry recovery and quality of black pepper

Pericarp is considered as a significant determinant of colour intensity, texture and yield of black pepper. However, pericarp thickness has not yet received its due importance as a trait selection criterion in breeding black pepper for enhanced productivity and quality. In this study, hypothesis tested was that thick pericarp is associated with high dry berry recovery without any reduction in primary (starch, protein and reducing sugars) and secondary metabolite contents (piperine, oleoresin and phenols) in the pericarp, which imparts odour, flavour

and pungency for which black pepper is known for. Eighteen black pepper genotypes were characterized for pericarp thickness, dry recovery and biochemical constituents such as piperine, oleoresin, protein, phenols, reducing sugars and starch content in pericarp and grouped them into thin and thick pericarp groups. Pericarp thickness ranged from 1.22 to 2.04 mm and pericarp dry recovery from 26.30 to 43.24 %. The pericarp contained 0.38 to 0.66 % and 1.60-4.35% of piperine and oleoresin, respectively. Wide variation was also observed for phenols, protein, reducing sugars and starch content in pericarp. Pericarp fresh weight, dry recovery, piperine and starch content differed significantly between thin and thick pericarp group genotypes. Thin pericarp in black pepper is more advantageous than thick pericarp for realizing high dry recovery (%). For white pepper production thin pericarp genotypes may have advantage in terms of recovery and processing as there is no significant difference between

thin and thick pericarp for primary and secondary metabolite contents.



PiperDNA virus 1 and 2 are endogenous pararetroviruses integrated into chromosomes of black pepper (*Piper nigrum* L)

A previous study named 7178 and 892 base pair contigs obtained through high-throughput sequencing (HTS) of black pepper as Piper DNA virus 1 (PDV-1) and PDV-2 respectively. In the present study, HTS results were confirmed through polymerase chain reaction and Sanger sequencing.

The sequenced region of both PDV-1 and PDV-2 contained partial genomes with motifs characteristic of pararetroviruses. BLAST analysis of PDV-1 and PDV-2 against the whole genome sequence of the black pepper showed integration of the PDV-1 at 22 loci in chromosome number 14, and PDV-2 at two loci in chromosome number 12 of black pepper. The integration was confirmed through amplification and sequencing of the junction regions. The study suggests that both PDV-1 and PDV-2 occur as endogenous viruses in black pepper. Further studies are needed to determine whether these endogenous occur in episomal forms, their complete genome sequence and whether they become active under abiotic stress conditions.

Simultaneous detection of fungal and bacterial pathogens from ginger rhizomes using PCR assay

A multiplex PCR was developed for the detection of *Pythium* spp. *Ralstonia pseudosolanacearum*, *Macrophomina phaseolina* and *Sclerotium rolfsii* from in ginger

rhizomes. Primers were designed and multiplex PCR assay was standardized by manipulating the annealing temperature and primer as well as MgCl₂ concentrations. The assay could successfully detect the pathogens both single and in combinations and does not show any cross reaction with other fungal pathogens of Ginger.

Multi-trait PGPR for simultaneous suppression of ginger pathogens

Under glasshouse conditions, *Bacillus safensis* (IISR TB4) and *B. cereus* (IISRGB7 (3)) showed significant reduction in soft rot and foliar diseases in ginger caused by *Pythium myriotylum*, *Colletotrichum gloeosporioides* and *Exserohilum rostratum* respectively. Both the PGPR exhibited significant ($P < 0.05$) suppression of all three pathogens compared to the chemical method. In case of *P. myriotylum*, the PDI was 92.45 in the control and 53.04 in the treatment with metalaxyl-mancozeb, which decreased significantly to

12.05 (*B. safensis* alone), 14.22 (*B. safensis* + *B. cereus*) and 21.30 (*B. cereus* alone). Likewise, in case of foliar diseases, PDI decreased from 37.04 (chemical method) and 36.16 (control) to 12.84 (*B. cereus*), 10.22 (*B. safensis*) and 9.04 (*B. safensis* + *B. cereus*).

Zn solubilizing bacteria mediated expression of a novel Zn transporter gene (CIZIP1) in turmeric

About 11 genes of the Zn/Fe-regulated transporter (ZRT/IRT)-related protein (ZIP) gene family were identified from the rhizome specific transcriptome of turmeric. Among these a novel Zn transporter designated as CIZIP1 was selected for further study based on the maximum FPKM and contig length of 1000 bp with 77.2 % homology to Zn transporter from *Musa acuminata*. The complete ORF was cloned to get a sequence of 1268 bp. The gene clustered with Zn transporters belonging to *Musa acuminata* and showed >70.0 % identity to form a clade. Further, expression analyses indicated a tissue specific

differential profile under Zn replete and deplete conditions in the presence and absence of a promising Zn solubilising bacteria (ZSB-*Bacillus safensis*). In the presence of ZSB, the gene expression in the basal tissue of turmeric was markedly down regulated with a maximum at 100 ppm (88.0%).

Plant beneficial bacteria & AMF for nutrient solubilization/mobilization

Co-inoculation of AM fungi (*Rhizophagus* sp., NCBI-MN710507) and Zinc solubilizing bacteria (ZSB2- *Bacillus megaterium*, NCBI-KY687496) enhanced plant growth and biomass. Bacterial community analysis using 16S rRNA revealed changes in the diversity and composition of various taxa due to co- inoculation of AM and ZSB. Chloroflexi was the dominant phylum followed by Proteobacteria, Actinobacteria and Acidobacteria which accounted for 80% of all treated samples. LefSe (Linear discriminant analysis effect size) revealed the

dominance of ecologically significant genera such as *Bradyrhizobium*, *Candidatus*, *Pedomicrobium*, *Thermosporothrix*, *Acinetobacter* and *Nitrospira* in treatments with combined application of AM and ZSB.

Potting mixture for rooted black pepper cuttings

Availability of healthy planting material is a limiting factor in black pepper production. Besides this, basic ingredients of potting mixture namely, sand and farmyard manure is also expensive and is not available on time. Dairy waste compost enriched with rockphosphate/ poultry manure as one of the ingredients was evaluated for the production of rooted black pepper cuttings. Twelve treatments consisting of different potting mixtures were made by mixing the ingredients soil, FYM, sand, compost enriched with rockphosphate (CERP), compost enriched with poultry manure (CEPM) and coir dust in different proportions. Rooted black pepper cuttings of the variety IISR Sakthi was grown for 3 months by

serpentine method in polythene bags filled with different potting mixtures. The cuttings were harvested three months after planting (MAP). Two harvests of black pepper cuttings were taken in serpentine method. After 3 month growth vine length and number of leaf production was noticed. Pooled analysis of the growth parameters of the cuttings of two harvests in serpentine method has showed that plants raised in soil, CERP and coir dust 2:1:1 proportion produced maximum shoot length (182 cm), and number of leaves (22 Nos.) followed by those raised in soil, CERP and granite powder (2:1:0.5) proportion whereas less vine length (89 cm) and number of leaves (13) was observed in medium soil, FYM and sand in 2:1:1 proportion (control). Less production cost of cutting was noticed in the treatment soil, CERP and coir dust in 2:1:1 proportion (Rs 8/ rooted cutting) compared to control (Rs 10/cutting). The results indicated that, Soil, Compost Enriched Rock phosphate, coir dust 2:1:1 can be used as an alternative medium to normal potting mixture for the production of rooted black pepper cuttings.

News and Events

Technology Week celebrated

The technology week was celebrated during the second week of February 2021. Training programme on cultivation of summer season vegetables and two days training programme on milch cow management were organized during the period. Exhibitions showcasing the latest technologies related to agriculture and allied fields were also arranged in connection with the Technology Week. Farmers from various parts of the district were benefitted from the programme.

Research Advisory Committee meeting

The second meeting of the IX RAC of ICAR- IISR was held from 10 - 11 January 2022 on a virtual platform (Cisco Webex). Dr. N. K .Krishnakumar, Former DDG (Horticulture) ICAR,

Chairman of IX RAC chaired the meeting. The other members of the RAC were Dr Umesh Srivastava, Former ADG (Hort.), ICAR; Dr Jitendra Kumar, Director, Institute of Pesticide Formulation Technology (IPFT), Gurugram, Delhi; Dr (Mrs.) VG Malathi, Former Principal Scientist (Plant Pathology), ICAR-Indian Agricultural Research Institute, New Delhi; Dr Hemendra C Bhattacharya, Former DEE, AAU Jorhat & Dean, Daffodil College of Horticulture, Guwahati (Metro), Assam; Dr VC Mathur, Former Professor, Division of Agricultural Economics, ICAR-IARI, New Delhi; Shri Jayachandran Master TP and Shri. NanjundanBhojan (IMC members); Dr Vikramaditya Pandey, ADG (HS-I) ICAR, New Delhi; Dr J Rema, Director, ICAR-IISR, Kozhikode and Dr CK Thankamani, Member Secretary, IX-RAC.

News from Institute Technology Management Unit

ITM-BPD unit commercialized five technologies from January to June 2021. An amount of ₹15.5 lakhs earned as revenue through technology commercialization.

- Tripartite agreement was between Keladi Shivappa Nayaka University of Agricultural & Horticultural Sciences, Shivamogga, ICAR-IISR and Karnataka State Agricultural Produce Processing and Export Corporation Limited, PMFME scheme as mentoring institute for establishment of Common Incubation Center.

- MoU executed between ICAR-IISR and CSIR-Institute of Himalayan Bioresource Technology for Rural Development in Himachal Pradesh through transfer of innovations, propagation, capacity building in the area of Cinnamomum verum.

- Conducted Online Collaborative Refresher Training Programme (RTP) on Spices Cultivation and Business opportunities from 29-31st March 2021in collaboration with MANAGE, Hyderabad.
- Implemented a convergence program with KudumbashreeAttapady Special Project (Comprehensive tribal and particularly Vulnerable Tribal Groups Development Program) for creating seed hubs for Ginger and Turmeric.
- Dr. T. E. Sheeja, PI, IPR lectures delivered on Technology commercialization and Product development in Spices - Prospectus and approaches in Collaborative Refresher Training Programme (RTP) Promoting Spices Crop cultivation and Business opportunities for Established Agripreneurs under AC&ABC Scheme on 30 March 2021.

News from Library

IISR Library strives towards ensuring excellent academic services through online and offline to the users. Library has a collection of 5653 books and 6010 bound journals. IISR Library is part of the Consortium of electronic Resources in Agriculture (CeRA) and more than 3500 full text journals on agriculture and allied subject are accessible. Library has subscribed 25 Indian Journals and 8 Foreign Journals during the year in addition to journals accessible under CeRA. Library also maintain the Institutional Digital repository software 'DSpice'. Library also provided other academic service like detection of plagiarism in research thesis for Institute users.

News from AICRPS

In order to monitor the research trials,Dr. Sharon Aravind,Project Coordinator and the scientist of PC cell visited AICRPS centre at PRS, Panniyur and RARS, Ambalavayal on 23 and 29 January 2021

Hindi News

राजभाषा कार्यान्वयन समिति की बैठक
जनवरी-जून 2021 की अवधि में राजभाषा कार्यान्वयन समिति की दो बैठकें आयोजित की गयी। बैठकें दिनांक 20 जनवरी 2021 तथा 22 जून 2021 को निदेशक डॉ. जे. रमा की अध्यक्षता में संपन्न हुई। समिति ने राज भाषा कार्यान्वयन की गति विधियों की समीक्षा करके सुधारने के लिए सुझाव दिया।

हिंदी कार्यशाला

जनवरी- जून 2021 की अवधि में भाकृअनुप-भारतीय मसाला फसल अनुसंधान संस्थान के अधिकारियों तथा कर्मचारियों के लिए दो कार्यशालाएं आयोजित की गयीं। इन कार्यशालाओं में, श्री. के. राजेश, वरिष्ठ प्रबंधक, यूनियन बैंक ऑफ इंडिया, कोषिकोड, श्री के. अनिल कुमार, उप प्रबंधक (राजभाषा) भारतीय स्टेट बैंक, तिरुवनंतपुरम ने क्रमशः दिनांक 17.02.2021 और 28.06.2021 को राजभाषा नीति एवं हिंदी टिप्पणी तथा हिंदी को लोकप्रिय बनाने के लिए तकनीक प्रगति आदि विषयों पर व्याख्यान दिया।

नराकास गति विधियों में सह भागिता

डॉ. जे. रमा, निदेशक एवं सुश्री एन. प्रसन्नकुमारी, वरिष्ठ तकनीकी अधिकारी ने दिनांक 21 अप्रैल 2021 को आयोजित नगर राजभाषा कार्यान्वयन समिति की ऑनलाइन बैठक में भाग ली।

हिंदी प्रशिक्षण

डॉ. एन. के. लीला, प्रधान वैज्ञानिक एवं हिंदी अधिकारी तथा श्रीमती एन. प्रसन्नकुमारी, वरिष्ठ तकनीकी अधिकारी ने दिनांक 15-19 मार्च 2021 को केंद्रीय हिंदी प्रशिक्षण संस्थान, नई दिल्ली द्वारा आयोजित ऑनलाइन अभिमुखी कार्यक्रम में भाग लिया।

हिंदी प्रकाशन

मसाला समाचार जुलाई-दिसंबर 2018

मसाला समाचार जनवरी-दिसंबर 2019

मसालों की महक 2020

आई सी ए आर-आई आई एस आर के वार्षिक प्रतिवेदनका कार्यकारी सारांश 2020

ए आई सी आर पी एस वार्षिक प्रतिवेदन का कार्यकारी सारांश 2020

राजभाषा रिपोर्ट

संस्थान के राजभाषा कार्यान्वयन की तिमाही एवं वार्षिक रिपोर्ट तैयार करके भारतीय कृषि अनुसंधान परिषद, नई दिल्ली को भेज दिया। राजभाषा कार्यान्वयन का अर्धवार्षिक रिपोर्ट तैयार करके नगर राजभाषा कार्यान्वयन समिति को प्रस्तुत किया।



Krishi Vigyan Kendra

SAC meeting

The Twenty first Scientific Advisory Committee (SAC) meeting of ICAR-Krishi Vigyan Kendra (ICAR-IISR, Kozhikode), Peruvannamuzhi was held on 03.02.2021 under the Chairmanship of Dr.J. Rema, Director, ICAR-Indian Institute of Spices Research, Kozhikode. Dr Jiju P. Alex, Director of Extension, KAU, Thrissur and Dr.Thimmapa, Principal Scientist & Nodal officer, Agricultural Technology Application Research Institute, Zone VIII, Bengaluru represented Director, ATARI, Bangalore joined the meeting online through Cisco webex.

Front Line Demonstration

Demonstration on value addition of mushroom was implemented with the objective of generating income for mushroom growers through value addition mostly making soup powder from dried mushroom. Five unemployed women from Kottur village

were selected and were given basic training on mushroom from production to marketing, including bed making, harvesting, grading, processing, packing etc. 50g packets of soup powder sold for Rs. 75 under the brand name 'Pratheeksha' with FSSAI registration number and reported a BCR as 3:1. The beneficiaries also prepared some other value-added products such as pickle, dry mushroom, rasam powder, chutney powder like mushroom with peanut, drumstick leaves with mushroom powder, coconut with mushroom powder etc.

On Farm Testing

Assessing the performance of Yard Long Bean varieties suitable for rainy season in Kozhikode district (2020-21)

Among the three varieties tested viz. KAU Mithra, Arka Mangala and Githika in Kozhikode district for their suitability for rainy season, KAU Mithra was found to be slightly superior with an average yield of 181.64 q/ha followed by Githika (179.76 q/ha) and Arka Mangala (177.56 q/ha).

Training Programmes

Crop Production

A total of thirteen on campus and six off campus one day trainings and two online trainings were organized by KVK during the period in different disciplines viz. Summer season cultivation of vegetables, integrated pest and disease management in vegetables, organic vegetable cultivation, milch cow management, aquatic plant culture and aquarium fitting, bush pepper production, value addition of mushroom, fertility management in cattle, nutrition education, processing of cassava, preparation of nutrient enriched diet, etc.

Farmer's Seminar

Farmer Scientist Interface on "Coconut cultivation" in association with ICAR-CPCRI, Kasaragod was held on 15.6.2021 with a total number of 120 participants.

FRANK - a society for ornamental fish farmers

FRANK (Fish Rearers association North Kozhikode), a society for promotion of ornamental fishes and aquatic plants was formed by KVK Kozhikode. It is the first registered society of ornamental fish farmers in the district involved in culture and trade of ornamental fishes and aquatic plants.. The main aim of the society is to help its members in marketing of their produce, reduce input cost through bulk purchase and distributing it to them, and taking up welfare activities for their upliftment. The society has started its first marketing outlet at KVK Peruvannamuzhi Kozhikode and is providing disease free quality fishes at reasonable price to customers which are produced at their farm.

Other Extension Activities

Field Days

ginger cultivation using bio-capsule	Naduvannur	17.02.2021
sowing of green gram(CO8)	Kottur	17.02.21
Turmeric harvestin	KVK IFS	15.02.21

Other events

International Women's Day on 08.03.2021

KVK supported woman farmer Mrs. Rekha T, was honoured by ICAR during the function for the outstanding achievements towards the promotion of aquaponics. Fourteen women farmers who adopted the technologies popularized by KVK were honored during the programme. Mushroom soup powder was released during the event, which was prepared by the FLD women partner farmers under the guidance of KVK.

World Bee Day on 20.05.2021

KVK organized a webinar for honeybee growers of the district. The programme was inaugurated by Dr. P. Ratha Krishnan, Programme Coordinator, KVK. Expert talk on "Apiculture during COVID period for additional income generation" was delivered by Dr. S. Devanesan, Former Dean, Faculty of Agriculture, KAU & Professor and Former Head (Principal Scientist), AICRP on Honey Bees and Pollinators,

Kerala Agricultural University in connection with the programme. The webinar was attended by 100 farmers from all over the district.

World Milk Day Celebration on 01.06.2021

KVK, IISR, Kozhikode organized seminar for dairy farmers on World Milk Day. The programme was inaugurated by Smt. Sinila Unnikrishnan, Deputy Director, Dairy Development Department, Kozhikode and presided by Dr P. Ratha Krishnan, Programme Coordinator, KVK, Kozhikode. Expert classes on Quality milk production by Smt R. Resmi, Quality Control Officer, Dairy Department, Kozhikode; Spice added milk value added products development by Dr E. Jayasree, Principal Scientist, IISR, Kozhikode and Dairy animal health management by Dr S. Shanmugavel, Subject Matter Specialist, KVK, Peruvannamuzhi were conducted. The programme was attended online by dairy farmers from all over Kozhikode district. About 60 farmers and 10 extension personnel attended the event.

Other events at KVK

World Water Day was celebrated on 22-03-2021 and thirteen plus members were participated online. Annual review meeting of KVK was held on 20 to 22nd April 2021 with the participation of PC and all SMS. PM Kissan programme was held on 14-05-2021. Mass awareness campaign on organic farming in spices organized by ICAR-IISR on 27-05-2021. World environment day was celebrated on 05-06-2021 with the participation of ten male and four female candidates. Online training on VFFS jointly organized by UAHS, Shimoga and ATARI, Bengaluru was conducted on 14-06-2021. International Yoga Day was celebrated online on 21-06-2021. Haritha Keralam District Task Force meeting was held on 23-06-2021.

Publications

Research papers

- Ahamedemujtaba, V., Atheena, P.V., Bhat, A.I., Krishnamurthy, K.S. and Srinivasan, V. 2021. Symptoms of piper yellow mottle virus in black pepper as influenced by temperature and relative humidity. *Virus Disease*. 32:305-313.
<https://doi.org/10.1007/s13337-021-00686-3>.
- Biju, C. N., Jeevalatha, A.,Bhat, A. I., Peeran, M. F., Praveena, R., Sarathambal, C. and Eapen, S. J. 2021. Domestic quarantine: An introspection and future perspectives on biosecurity interventions to contain pathogen spread in vegetatively propagated spices in India. *Journal of Spices and Aromatic Crops*.30 (2): 142 - 162.

•Biju, C. N., Jeevalatha, A., Peeran, M. F., Suseela Bhai, R., FadlaBasima, V. A. Muhammed Nissar, Srinivasan, V. and Lijo Thomas. 2021. Association of Lasiodiplodiatheobromae with die-back and decline of nutmeg as revealed through phenotypic, pathogenicity and phylogenetic analyses. 3 Biotech. DOI: 10.1007/s13205-021-02961-y.

•Jeevalatha, A., Biju, C.N., and Suseela Bhai, R. 2021. Ypt1 gene-based recombinase polymerase amplification assay for Phytophthora capsici and P. tropicalis detection in black pepper. European Journal of Plant Pathology. 159:863-875.<https://doi.org/10.1007/s10658-021-02211-0>.

•Krishnamurthy, K.S. and Kandiannan, K. 2021. Source sink relationship, dry matter and starch partitioning in developing ginger rhizomes during different growth stages. Journal of Plantation Crops 49 (1): 14-19

•Mangalassery S, Nayak MG, Prabha Susan P, Rupa TR, Behera SK and Srinivasan V. 2021. Delineating the nutrient constraints and developing nutrient norms for cashew (*Anacardium occidentale* L.) in coastal India. Journal of Plant Nutrition, 44: 17,2627-2639.

•Praveena R, Biju C N and Sujatha AM. 2021. Deciphering primary incitant of rot complex of small cardamom plant by sequential inoculation of pathogens. Indian Phytopathology (1): 48-58.

•Rincy, M. K., Praveena, R., and Eapen, S. J. 2021. A modified semi-selective medium for isolation and enumeration of Pochoniachlamydosporia (Goddard) Zare & W. Gams: A semi-selective medium for Pochoniachlamydosporia. Journal of Spices and Aromatic Crops, 30(1), 117-125. <https://doi.org/10.25081/josac.2021.v30.i1.6923>

•Sarathambal, C., Dinesh, R., Srinivasan, V., Sheeja, T.E., Jeeva, V., Muhammed Manzoor.2021. Changes in bacterial diversity and composition in response to co-inoculation of Arbuscular mycorrhizae and Zinc solubilizing bacteria in turmeric rhizosphere Current Microbiol 79, 4. <https://doi.org/10.1007/s00284-021-02682-8>

•Shivakumar M. S., Krishnamurthy K. S., Saji K. V. and Sasikumar P. 2021. Pericarp as a new berry trait to define dry recovery and quality in black pepper (*Piper nigrum* L.). *Scientia Horticulturae*, 281, 109923.

<https://doi.org/https://doi.org/10.1016/j.scienta.2021.109923>

•Snigdha, M., Vidhya, V. and Prasath, D. 2021. Unravelling the differential expression of potential microRNAs in bacterial wilt-resistant and susceptible ginger species. *Physiological and Plant Molecular Pathology* 115, 101666. <https://doi.org/10.1016/j.pmpp.2021.101666>

•Suseela Bhai, R., Riya Alex, Vadivukkarasi, P. and Shivakumar, M. S. 2021. Peroxidase activity as a marker to evaluate resistance in black pepper against *Phytophthora* infection. *Indian Phytopathology*. <https://doi.org/10.1007/s42360-021-00335-1>

Book chapters

•Nirmal Babu, K., Lijo Thomas and Sharon Aravind. 2021. Realizing the export potential of spices: Challenges and Strategies. In Pandey S K, Reena Nair & Kanchan S Bhan (Eds.) *Horticultural crops Emerging issues and techniques*. Jawaharlal Nehru Krishi Vishwa Vidyalyaya, Jabalpur, Madhya Pradesh page 1-8.

Books edited

•Praveena R, Lijo Thomas, Prasath D and Santhosh J Eapen (Eds.) (2021) *Spicing Up Nation's Progress (IISR Booklet)* 24 p

Technical reports

•Srinivasan V.and Lijo Thomas (eds.) (2021). Black Pepper-Good Agricultural Practices, ICAR-IISR, 41 p.

Popular article

•Aarthi, S., Muhammed Nissar, V.A., Prasath, D. 2021. Curcuma as a natural source of starch. Indian Journal of Arecanut and Spices. 22(3): 13-17.

•Akshitha, H. J. and Ankegowda, S. J., 2021. High yielding varieties of cardamom (Kannada), Vijaya Karnataka (Krishi edition) published on 14.06.2021.

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•Mohammed Faisal Peeran, Biju C. N, Annaiah Mukkatira Sujatha, Rajan Gowri and S. J. Ankegowda. Phenotypic diversity, virulence and genetic characterization of *Colletotrichum gloeosporioides*, the incitant of leaf blight of small cardamom in South India.

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•Thankamani, C.K. 2021.Spices and varieties which can part of coconut based HDMSCS cropping system in a workshop organized by CPCRI 29 Jan 2021.

•Thankamani, C.K., Saranya, P., Srinivasan V, Sarathambal C, Shanmugavel S, Athira.T and Jayaraj K 2021. Evaluation of enriched dairy waste compost as ingredient in potting medium for the production of rooted black pepper cuttings. SYMSAC -X held at ICAR-IISR, Kozhikode during 9-12, February 2021.

•Thankamani, C.K., Srinivasan, V., Shanmugavel, M., Sarathambal, C., Lijo Thomas, Athira, T. and Subila, K.P. 2021. Performance of Integrated organic Farming System involving spice crops. International symposium on coastal agriculture 16th to 19th March 2021.

•Thankamani, CK, Srinivasan V, Hamza. S, Dinesh. R, Praveena. R, Sarathambal. C, Shanmugavel. M, Shajina. O and Athira. T. 2021. Response of different turmeric varieties to yield and quality. SYMSAC -X held at ICAR-IISR, Kozhikode during 9-12, February 2021.

•Theertha, A. P. and Krishnamurthy, K. S. Genetic variability for morpho physiological traits in elite black pepper accessions. In Biju CN, Alagupalamuthirsolai M, Senthil Kumar CM, Dinesh R, Prasath D, Ramakrishnan Nair R, Santhosh J Eapen (Eds) e-Abstracts- SYMSAC X 2021, 09-12 February 2021, International Symposium on Spices as Flavours, Fragrances & Functional Foods, Indian Society for Spices, Kozhikode, Kerala, India. Session IV - Digital Poster Presentation Spices - Cutting edge technologies for plant health, pp79.

•Theertha, A.P., Krishnamurthy, K.S., Shivakumar, M.S., Umadevi, P.,Rajesh, M.K., Shelvy, S., Fayad, M.A. 2021. Genetic variability among black pepper accessions for drought tolerance traits. In Gomathi R., Prakash M., Rajasekaran C., Viswanathan C., Bakshi Ram, V., Krishnapriya, T., Arumuganathan, G.S., Suresha, R., Valarmathi, P., Geetha, S.,

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•Umadevi, P., Sathya, S., Fayad, M., Shelvy, S., Rajesh, M. K., Saji, K.V. and Shivakumar, M. S. (2021). Genotyping of black pepper using a novel resistance related gene polymorphism. International Symposium on Spices as Flavours, Fragrances & Functional Foods (SYMSAC X) 09-12 February 2021

Ph.D. Registration

Student	Topic	University	Guide
Gayathri Pavithran	Influence of pelletized compost and growth substances on turmeric yield and quality under protected cultivation.	University of Calicut	Dr. C.K. Thankamani

New Appointment

Name	Post	Date of joining
Dr. Divya P S	Senior Scientist	27-01-2021
Dr. Neethu K C	Scientist	15-02-2021

Promotion

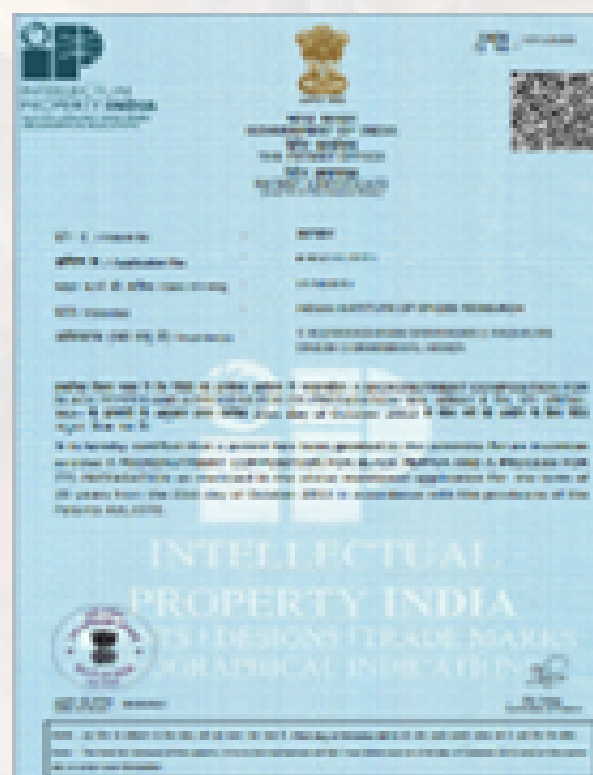
Name	Promoted as	Date
Mr. V.V.Sayed Mohammed	Assistant Administrative Officer	28-06-2021

Retirement

Name	Post	Date
Mr. M. K.Purushu	Skilled Support Staff (Voluntary Retirement)	01-04-2021
Mr. M. P. Ramesh Kumar	Chief Technical Officer	30-04-2021

Patent Awarded:

- Patent No: 361021 dated 12-03-2021, A NOVEL METHOD OF STORING AND DELIVERING PGPR/MICROBES THROUGH BIOCAPSULE
- Patent No: 367654 dated 26-05-2021, A MICRONUTRIENT COMPOSITION FOR BLACK PEPPER AND A PROCESS FOR ITS PREPARATION
- Patent No: 369407 dated 16-06-2021, BACTERIAL FERMENTATION TECHNOLOGY FOR PRODUCTION OF HIGH QUALITY 'OFF-ODOUR-FREE' WHITE PEPPER FROM MATURED GREEN PEPPER (PIPER NIGRUM L)



Personalia

Awards/Honours/ Recognitions

- Best Poster Award: Anees, K., Krishnamurthy, K. S., Biju, C. N. and Ashly, M. J. Biochemistry and anatomy of abscission in black pepper (*Piper nigrum*) reveals differential involvement of reactive oxygen species in leaf and spike abscission (Session II: Spices - Chemistry and functional foods). SYMSAC X 2021, 09-12 February 2021, International Symposium on Spices as Flavours, Fragrances & Functional Foods, Indian Society for Spices, Kozhikode, Kerala, India.
- K S Billigami Poster Award for "Fungicidal sensitivity of *Phytophthora* spp infecting Black Pepper (*Piper nigrum*)". ISMPP 41st Annual conference and National e-Symposium held on 28-30 January 2021

•Best organic farming center award Dr. C.K. Thankamani, Dr. V. Srinivasan, Dr. R. Praveena, Dr. C. Sarathambal and Dr. M Shanmughavel. AI-NPOF centers under ICAR-Indian Institute of Farming System Research (IIFSR Modipuram).

Participation in Symposia/ Seminars/Workshops/ Conferences/Meetings

- ICAR-IISR Conducted International symposium on spices as flavours, fragrances & functional foods (SYMSAC X) from 09-12 February 2021.
- Dr. A. Ishwara Bhat International conference on tackling global viral epidemics by World Society for Virology from June 16-18, 2021, South Africa. Institute Management Committee meeting, ICAR-DCR, Puttur, 9th February 2021.
- Institute Bioafety Committee meeting, ICAR-CPCRI, Kasaragod, 4th March 2021.

•Dr. Sharon Aravind

Consultative meeting on quality planting material production in the NE region, organized by the Mission Organic Value Chain Development for NE Region (MOVCD-NER) at ICAR- IISR, Kozhikode on 12 March 2021 at 4.30 pm.

•Dr. Akshitha H J

Webinar on “Plantation Crop Genomics: An Overview of Current Research” organized by ISPC, Kasargod in association with Bionivid technology Pvt. Ltd., Bangalore from 18.01.2021 to 20.01.2021.

•Dr. C.M. Senthil Kumar

International Congress on Invertebrate Pathology and Microbial Control that was held virtually from 28th June to 2nd July 2021 at Tours, Loire Valley, France.

•Ms. Sona Charles

Bioinformatics (GLBIO) conference from 10-13 May 2021 at Great lakes Bioinformatics Consortium, USA ()

•Dr. M AlagupalamuthirSolai&Ms.

Sivaranjani R International Plant Physiology Virtual Symposium 2021 from 11- 12 March 2021 at Sugarcane Breeding Institute, Coimbatore)

Lectures Delivered

Dr. Shivakumar

•Improved varieties of major spices, in a training programme on the topic “Advanced production technologies of major spices” organized ICAR-IISR Regional Station, Appangala at ICAR-IISR RS, Appangala on 24-03-2021 sponsored by DASD, Kozhikode.

Dr. T. E. Sheeja

•Technology commercialization and Product development in Spices - Prospectus and approaches in Collaborative Refresher Training Programme (RTP) Promoting Spices Crop cultivation and Business opportunities for Established Agripreneurs under AC&ABC Scheme on 30 March 2021.

Dr. Sharon Aravind

•High yielding varieties of black pepper, ginger & turmeric in Spices online Webinar jointly organized by RARS Pattambi and ICAR-IISR Kozhikode on 4 June 2021 and interacted with farmers.

•Spices as Medicinal plants in NMPB sponsored virtual National Training Programme on “Medicinal and Aromatic Plants Diversity, Utilization and their Conservation” on 9 June 2021

Dr. D. Prasath

- Prospects of ginger cultivation in Andhra Pradesh, 08 Jan 2021, Webinar on Pre and postharvest management and value addition of ginger, Spices Bard, Guntur, Andhra Pradesh.
- Varieties of black pepper, ginger and turmeric, 05 March 2021, Farmers seminar on Advances in production and processing of spices ICAR-Indian Institute of Spices Research, Kozhikode, Kerala.
- High curcumin turmeric varieties and crop management, 17 March 2021, Farmers meeting, KVK Hingoli, Maharashtra, organized by KISAN, Pune.
- Varietal choices in ginger and turmeric, 20 May 2021, Online trainers training programme titled "Good agricultural practices and technology advances in ginger and turmeric farming, ICAR-Indian Institute of Spices Research, Kozhikode, Kerala and PRADHAN.
- Technological interventions for doubling Technological interventions for doubling, 04 June 2021, Webinar on Recent production techniques in Turmeric to farmers and farm women from Namakkal District of Tamil Nadu, ICAR -Krishi Vigyan Kendra, Namakkal, Tamil Nadu.

Dr. V. Srinivasan

- Perspectives and constrains of seed production in spices and aromatic crops, College of Horticulture, Bidar, University of Horticultural Sciences, Bagalkot, 1st Jan 2021 Soil health management for spices productivity, MSSRF, Wayanad on 5th Jan 2021 Integrated nutrient management strategies for ginger and turmeric, Pradhan NGO - Good agricultural practices and technology advances in ginger and turmeric farming for FPOs across 7 states on 20 May 2021
- Production technology in black pepper, Agriculture information .com, 6th Jan 2022.

Dr. A. Jeevalatha

- Isolation and culturing of Phytophthora from black pepper for BSC students (RAWE programme) on 4th, Jan, 2021.
- Laboratory Biosafety practices to students and research fellows of ICAR-IISR, Kozhikode on 6th, March, 2021

Dr. Akshitha H J

- Class on institute activities and varieties of spices to 40 DAESI input dealers and 20 B.Sc. students from College of Horticulture, Mudigere

Dr. C. N. Biju

- Integrated pest and disease management in ginger and turmeric” during trainer’s training programme on “Good agricultural practices and technology advances in ginger and turmeric farming” organized by ICAR-IISR, Kozhikode and PRADAN at ICAR-Indian Institute of Spices Research, Kozhikode on 21.05.2021.

- Integrated pest and disease management in ginger, turmeric and black pepper” during Webinar on “Spices: Ginger, turmeric and black pepper” organized by Regional Agricultural Research Station, Pattambi, Kerala, Agricultural University, ICAR-IISR, Kozhikode and Block level agricultural extension centers, Palakkad at ICAR-Indian Institute of Spices Research, Kozhikode on 04.06.2021.

Dr. Praveena, R.

- Pest and Disease Management in Black Pepper, training and exposure visit for Wayanad Farmers under the project Biotech Kisan Hub on 22-01-2021 at ICAR-IISR, Kozhikode.

- Environment Friendly and Sustainable Agriculture Practices, for farmers, Regional Science Centre on 24-03-2021 at ICAR-IISR, Kozhikode.

Dr. Thankamani, C.K.

- Doubling farmers income from coconut garden by cultivation of Black pepper on 5 Jan 2021. District level seminar for Manassery Haritha group farmers society during the MIDH sponsored training programme on Advances in Production and Processing of Spices.

- Spices and varieties suited to coconut garden, Workshop on HDMSCS organized by CPCRI on 21 Jan 2021.

Training Attended

- Mr. V. C. Sunil :Training on Administrative Vigilance: Role of IO/PO, 11 -15 January 2021, ISTM, New Delhi.

- Dr. A. Jeevalatha :Participated in online programme on Integrated Scientific Project Management for Women Scientist/Technologists sponsored by DST and organized by Centre for Organization Development, Hyderabad during January 18-22, 2021.

- Ms. Sona Charles :Training on Artificial Intelligence, 19-29 January-2021, NIELIT Calicut.

- Mr. R. Bharathan :Training on Handling Parliamentary Matters, 28- 29 January to 2021, ISTM, New Delhi.

- Mr. JayarajanK :Online Workshop on E-Office, 25-26 February 2021, Institute of Secretariat training and management, New Delhi.

- One day Generic Online Training in Cyber Security for Central Government Ministries/ Departments, 29 April 2021, Ministry of Electronics & Information Technology, Govt. of India.

- Dr. C. M. Senthil Kumar &Mr. P. VijeshKumar :Training on Artificial Intelligence, 11-21 May-2021, NIELT, Kozhikode.

Video conference

- Review meeting of AICRPs at ICAR-IISR, Kozhikode on 15thJanuary 2021 to review the quarterly review of AICRPs centre.

- Review meeting of small cardamom centre of AICRPS on 28thMay 2021 to review the performance of AICRPS trials at small cardamom centre.

- Review meeting of ginger & turmeric centre of AICRPS on 24thJune 2021 to review the performance of AICRPS trials at ginger & turmeric centre.

Radio talk

- Dr. Akshitha H J :Cardamom katte disease and resistant varieties, AIR Madikeri, 1stFebruary 2021.

Extension activities

- Research Station Training program for the students of COA, Vellayani organized as a part of the Rural Agricultural work experience programme conducted during 01-06 January 2021.

- Largescale demonstration on bio intensive management of black pepper at Mattilayam Water shed area, Vellamunda Panchayath, Wayanad in 25 ha by distributing rooted cuttings of improve varieties, bio inoculants, micronutrient mixtures and constructed a nursery shed for field production of planting materials.

- FLDs on Bio Intensive management of black pepper in ten farmer's plots at Pulpally, Wayanad under BioKisan Hub project by distributing inputs like rooted cuttings of improved varieties, micronutrient mixtures and biocapsules of Trichoderma and PGPRs.

Publisher

Dr. J Rema Director,
ICAR-IISR Kozhikode

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