PROCEEDINGS
XXXIII ANNUAL IRC

2020
10-12 June

भाकृअनुप
ICAR

ICAR-Indian Institute of Spices Research

Marikunnu PO, Kozhikode-673012, Kerala, India

www.spices.res.in

PROCEEDINGS

XXXIII Institute Research Committee Meeting- 2020

10-12 June 2020

The Annual IRC meeting (XXXIII) of ICAR-IISR, Kozhikode, Kerala was held from 10-12 June 2020. Detailed presentation on achievements of each project was made by the respective principal investigators, seven projects were closed and five new project proposals were approved. All the projects were critically examined by the IRC and recommendations were made. Technologies for transfer, technologies for multi-location testing and IPR were shortlisted.

General decisions

- Reorient the ongoing Mega projects and research projects in the light of QRT recommendations.

- New projects may be formulated to short list germplasm using omics tools and for developing diagnostics for soil-borne pathogens.

- Revisit the manpower deployment in various research projects and restrict the number of projects handled by each scientist.

- Collaborate with Spices Board in Social Science projects so as to bring in more convergence in implementing schemes.

- Make a compendium on spice research covering the last 75 years, which can be published by ICAR.

- Formulate new programs that rely on modern tools especially ICT to enhance spice production and double farmer's income.

- Develop a reliable, simple and low cost technique instead of DNA barcoding and detection to identify the country of origin and solve all trade related issues.

- The concentrated solar thermal turmeric curing unit may be certified by ICAR-IISR so that Spices Board can provide this equipment to the farmers on subsidy basis in Post-Harvest schemes.

- Vertical farming technology on spices may be developed by the institute.

- Disease forecasting models may be given priority for early detection and management.

- Newer molecules may be tested for pest and disease management. A discussion on pesticides will be organized by Spices Board in the near future.

Division of Crop Improvement and Biotechnology

General decision:

- Strict quarantine measures should be taken while collecting germplasm. The quarantine facility at the main campus should be used.

Project I: Conservation, characterization and sustainable utilization of genetic resources of spices [Project leader: Dr. K.V. Saji]

1. Gen. XXVIII (813): Conservation and characterisation of *Piper* germplasm (2008-2020) [Dr. K.V. Saji, Dr. Shivakumar M.S. & Dr. Honnappa Asangi]

Decisions:

- Mr. Gopu will be associated in the project.
- The project is extended for five years with emphasize on characterization.
- Germplasm collection should be need based.
- New and advanced tools must be used in germplasm characterization.

Technical programme (2020-21)	Quarterly work schedule				Personnel
	I	II	III	IV	
Conservation of germplasm (nursery and field gene bank) at Peruvannamuzhi.	✓	✓	✓	✓	KVS, Gopu
Conservation of field gene bank at Kozhikode.	✓	✓	✓	✓	KVS
Conservation of field gene bank at CHES, Chettalli.	✓	✓	✓	✓	SMS, HA
Clearing and planting of standards for extending FGB at CHES. Chettali	✓	✓	✓	✓	SMS, HA
Characterization and evaluation of germplasm accessions.	✓	✓	✓	✓	KVS, Gopu, SMS, HA
Collection of germplasm for specific traits.	✓	✓	✓	✓	KVS, Gopu, SMS, HA

2. **Gen.XIX (813): Conservation, characterisation, evaluation and improvement of *Zingiber* and *Curcuma* sp. (2007-2020) [Dr. D. Prasath, Dr. Aarthi S. & Dr. N. K. Leela]**

Decisions:

- Project is extended for three years.
- Dr. K.V. Saji, Dr. H.J. Akshitha and Dr. Honnappa Asangi may be dissociated from the project.
- Dr. N. K. Leela may be associated with the project.
- Yield evaluation of *C. aromatic* may be initiated.

Technical programme (2020-21)	Quarterly work schedule				Personnel
	I	II	III	IV	
Maintenance of ginger and turmeric germplasm.	✓	✓	✓	✓	DP, SA
Characterization of turmeric germplasm (200 accessions).	✓	✓	✓		SA, DP
Evaluation of extra-long and bold turmeric lines and characterization of open pollinated seedling progenies.	✓	✓	✓	✓	DP, SA
Quality characterization of ginger and mango ginger genotypes.	✓	✓	✓		NKL, DP
Evaluation of turmeric genotypes under AICRPS CVT.	✓	✓	✓	✓	DP, SA

3. **Gen. XXXIII (813): Identification of core collection, characterisation and maintenance of cardamom germplasm (2012- 2020) [Dr. Honnappa Asangi, Dr. Akshitha, H.J., Dr. Ankegowda, S. J., Dr. Mohammed Faisal Peeran & Dr. Balaji Rajkumar, M]**

Decisions:

- Dr. Sharon Aravind and Dr. Anees K may be dissociated from the project.
- Project is extended for three years

Technical programme (2020-21)	Quarterly work schedule				Personnel
	I	II	III	IV	
Maintenance of cardamom germplasm.	✓	✓	✓	✓	HA, HJA, SJA, MFP

Biochemical characterization of cardamom germplasm.	✓	✓	✓	✓	HA, HJA
Multiplication of thrips, leaf blight tolerant and dual tolerant to rhizome rot and leaf blight.	✓	✓	✓	✓	HA, MFP, BRM, HJA
Recording of yield observations from the germplasm accessions.			✓	✓	HA, HJA

4. **Gen. XXXVII (813): Conservation of vanilla spp. and their utilization in crop improvement (2018-2023) (Dr. Aarthi, S., Mr. Muhammed Nissar V. A., Dr. Mohammed Faisal Peeran & Ms. R. Sivaranjani)**

Decision:

- TBGRI may be contacted for vanilla germplasm exchange

Technical programme (2020-21)	**Quarterly work schedule**				**Personnel**
	I	**II**	**III**	**IV**	
Maintenance of Vanilla germplasm at ICAR IISR, Chelavoor.	✓	✓	✓	✓	SA, MN
Multiplication of germplasm for alternative germplasm site.	✓	✓	✓	✓	SA
Vanilla planting material production.	✓	✓	✓	✓	SA
Collection of vanilla germplasm.			✓	✓	SA, MN, MFP
Vanilla germplasm planting at Appangala.			✓	✓	SA, MFP
Processing and quality profiling of vanilla germplasm.			✓	✓	SA, RS

5. **Gen. XXXVI (813): Genetic resources management in tree spices (2018- 2023) [Mr. Muhammed Nissar V. A., Dr. J. Rema & Dr. Honnappa Asangi] (External support: Dr. Shivakumar M.S.)**

Decisions:

- *Pimento sp* identification may be clarified with the competent authority.
- TBGRI may be contacted for tree spices germplasm exchange
- Dr Anees K may provide external support.
- Dr. Shivakumar M.S. may be dissociated from the project and provide external support.

Technical programme (2020-21)	Quarterly work schedule				Personnel
	I	II	III	IV	
Collection of genetic resources of cinnamon.		✓	✓	✓	MN, JR
Collection of genetic resources of clove and all spice.		✓	✓	✓	MN, JR,HA
Collection of genetic resources of garcinia.	✓	✓	✓	✓	MN, JR
Characterization of germplasm in Garcinia.	✓	✓			MN, JR,HA
In situ evaluation of clove accessions in farmers field.				✓	MN, JR
Maintenance of genetic resources in tree spices.	✓	✓	✓	✓	MN, JR, HA
Quality evaluation of the selected accessions of tree spices.	✓	✓	✓	✓	MN

Project II: Development of trait specific and improved varieties of spices through conventional breeding and biotechnological approaches [Project Leader: D. Prasath]

1. **Gen XXXI (813): Breeding black pepper for high yield, quality and resistance to stresses (2012- 2017) [Dr. Shiva Kumar M.S., Dr. K. V. Saji, Dr. P. Umadevi & Dr. K.S. Krishnamurthy] (External support: Dr. A. Jeevalatha)**

Decisions:

- Black pepper trial on higher elevation may be taken up at TATA Coffee Limited with official MoU.
- Varietal specific profiles in black pepper which was identified based on PnLRR-RLP genes may be verified using blind samples from Peruvannamuzhi germplasm.
- Dr. A. Jeevalatha may provide external support.

Technical program (2020-21)	Quarterly work schedule				Personnel
	I	II	III	IV	
Field planting of all core set black pepper accessions.		✓	✓	✓	SMS, KVS
Hybridization and identification of superior hybrid for economically important traits.	✓	✓	✓		SMS
Participatory plant breeding- surveying and identification of promising lines.			✓	✓	SMS
Maintenance of the trial plot and yield recording (4 PETs).	✓	✓	✓	✓	SMS, KVS, KSK
Screening promising lines for *Phytophthora* resistance and drought tolerance		✓	✓		SMS, KSK
Characterization of pepper genotypes using PnLRR-RLP under MultiNAplatform. ORF Analysis and further characterization of Protein kinase gene and analysis of more peptide derived functional gene primers for tagging *Phytophthora* resistance.	✓	✓	✓	✓	PU

2. Gen. XXVI (813): Evolving high yielding and high quality nutmeg clones by selection (2007- 2021) [Dr. J. Rema, Dr. K.V. Saji & Mr. V.A. Muhammed Nissar] (External support: Dr. N. K. Leela & Dr. S. Aarthi)

Decision:

- Dr. N. K. Leela & Dr. S. Aarthi may dissociate from the project and provide external support.

Technical programme (2020-21)	Quarterly work schedule				Personnel
	I	II	III	IV	
Collection and conservation of elite nutmeg.	✓	✓	✓	✓	MN, JR, KVS
Evaluation of nutmeg germplasm accessions for morphological, yield and quality parameters.	✓	✓	✓	✓	JR,MN
Conservation and evaluation of seedling/clonal progenies of monoecious nutmeg trees.	✓	✓	✓	✓	JR, MN,KVS

Evaluation of grafts of elite lines having high myristicin and elemicin in nutmeg and mace oils.	✓	✓	✓	✓	JR, KVS
Evaluation of grafts of elite lines having low myristicin, elemicin and safrole and high sabinene in nutmeg and mace oils.	✓	✓	✓	✓	JR, KVS
Evaluation of seedling progenies of yellow maced nutmeg.	✓	✓	✓	✓	JR, KVS

3. **Gen. XXXIV (813): Induction of variability in ginger through induced mutation for yield and disease resistance (2012-2020) [Dr. D. Prasath & Dr. R. Ramakrishnan Nair]**

Decisions:

- Project is closed. RPP III may be submitted
- Ph.D. work may be reported in ginger germplasm project

4. **Gen. XXXV (813): Genetic improvement in turmeric through seedling selection and hybridization (2013-2020) [Dr. R. Ramakrishnan Nair & Dr. S. Aarthi]**

Decisions:

- Project may be extended for two years
- Mr. Gopu R will be associated with the project

Technical Programme (2020-21)	**Quarterly work schedule**				**Personnel**
	I	**II**	**III**	**IV**	
Maintenance of seedlings, inbreds, hybrids and somaclones.	✓	✓	✓	✓	RRN, SA
Replicated trial of second generation OP seedlings of SLP 389/1.	✓	✓	✓	✓	RRN
Chromosome number analysis in second generation OP seedlings of SLP 359/4.		✓	✓		RRN
Pollination studies in inbreds.		✓	✓		RRN
Multiplication of intercross hybrids.		✓	✓	✓	RRN
Multiplication and quality profiling of first generation inbreds of SLP 69/5/22.		✓	✓	✓	SA
Selfing in first generation inbreds of SLP 69/5/22.			✓	✓	SA

5. **Gen. XXXVI (813): Evolving high yielding, biotic and abiotic stress resistant cardamom lines through selection and hybridization [Dr. Akshitha, H. J., Dr. S. J. Ankegowda, Dr. Balaji Rajkumar, M and Dr. Shivakumar M. S.]**

Decisions: Nil

Technical Programme (2020-21)	Quarterly work schedule				Personnel
	I	II	III	IV	
Multiplication of parental lines and hybridization.		✓	✓	✓	HJA, SMS
Raising of open pollinated progenies.		✓	✓	✓	SMS, BR
Field planting of OP progenies for drought screening.		✓	✓	✓	SMS, SJA
Maintenance of the trial plot and yield recording. 1. CVT on farmer's varieties of cardamom. 2. CVT on hybrids of small cardamom – 2018 Series VII.	✓	✓	✓	✓	HJA, SMS

6. **ICAR- CIB 2: Computational and experimental biology approaches for delineation of selected secondary metabolite pathways and antimicrobial peptides (AMPs) in major spices (2018-2020) [Dr. P.Umadevi, Dr. A. Jeevalatha, Ms. R. Sivaranjani, Dr. Dinesh Kumar, Dr. Sarika, Dr. M.A. Iquebal & Dr. U.B. Angadi (IASRI)] (External support: Dr. R. Praveena)**

Decisions:

- Project is closed. RPP III may be submitted

Technical programme (2020-21)	Quarterly work schedule				Personnel
	I	II	III	IV	
Analysis of gene resources, identification of genomic regions for trait association for *Phytopthora* & drought tolerance in black pepper.	✓	✓	✓	✓	PU
Cloning, expression of AMP.	✓	✓	✓	✓	PU, AJ
Identification of target genes of siRNA design.	✓	✓	✓	✓	AJ, PU

7. Biotech. XIV (813): DNA fingerprinting and barcoding in spices (Dr. T.E. Sheeja & Dr. Shivakumar M.S. (2018 - 2023)

Decisions:

- Dr. D. Prasath may be dissociated from the project
- Efforts for NABL accreditation may be intensified

Technical programme (2020-21)	Quarterly work schedule				Personnel
	I	II	III	IV	
Screening of important cultivars/varieties of black pepper and identification of polymorphic markers.	✓	✓	✓	✓	TES, SMS
Optimization of DNA isolation and PCR protocols in spice samples including seed spices from various centers of AICRPS.	✓	✓	✓	✓	TES
Developing DNA fingerprinting techniques in major and minor spices from various centers of AICRPS for varietal registration by CVRC and report preparation.	✓	✓	✓	✓	TES
Screening of important cultivars/varieties of black pepper and identification of polymorphic markers.	✓	✓	✓	✓	TES, SMS

8. Biotech. XV (813): Identification & characterization of gene editing targets for *Ralstonia* resistance in ginger (2018-2021) (Dr. P. Umadevi & Dr. A. Jeevalatha)

Decisions:

- Dr. D. Prasath may be dissociated from the project
- Dr. R. Ramakrishnan Nair may help in establishing ginger culture
- One Plant Pathologist may be associated in the project

Technical programme (2020-21)	Quarterly work schedule				Personnel
	I	II	III	IV	
Selection of potential effectors from WGS of *Ralstonia* & molecular docking.	✓	✓	✓	✓	PU, AJ
Analysis of culture filtrate.	✓	✓	✓	✓	PU
Developing callus culture.	✓	✓	✓	✓	PU, AJ

9. **DBT-CIB VIII: Survey, identification and characterization of unique ginger and turmeric landraces endemic to North Eastern Region (NER) of India (2018-2021) (Dr. D. Prasath & Mr. V. A. Muhammad Nissar)**

Decisions: Nil

Technical programme (2020-21)	Quarterly work schedule				Personnel
	I	II	III	IV	
Development a molecular profiles for ginger genotypes collected from NER.	✓	✓	✓	✓	DP
Evaluation of unique NER collections.	✓	✓	✓		DP, MN
Conservation of the unique ginger and turmeric genetic wealth at NAGS.	✓	✓	✓	✓	DP,MN

10. **DUS project: Dr. K. V. Saji, Dr. J. Rema, Dr. Aarthi S. (External support: Dr. Shivakumar M. S.)**

Decisions:

- Dr. Shivakumar M S may be dissociated from the project and provide external support.

Technical programme (2020-21)	Quarterly work schedule				Personnel
	I	II	III	IV	
Maintenance of example varieties of black pepper at Peruvannamuzhi and Chettalli.	✓	✓	✓	✓	KVS
Maintenance of example varieties of cardamom at Reg. station, Appangala.	✓	✓	✓	✓	KVS
Maintenance of example varieties of Ginger and turmeric.	✓	✓	✓	✓	KVS,DP,SA
Facilitating farmers for registration of new varieties.	✓	✓	✓	✓	KVS,JR

New project

DBT-CIB IX: Quality enhancement of turmeric through comparative evaluation of genotypes for nutritional and quality profiles for sustainable turmeric production [Dr. D. Prasath, Dr. N. K. Leela & Dr. Aarthi S.]

Decisions:

- The project is approved.

Technical programme (2020-21)	Quarterly work schedule				Personnel
	I	II	III	IV	
Comparative evaluation of shortlisted turmeric genotypes under organic and integrated systems.	✓	✓	✓	✓	DP, SA
Development of nutritional and chemical finger prints of popular turmeric varieties and GI turmeric.	✓	✓	✓		DP, NKL
Curcumin and other novel compounds profiling in potential *Curcuma* sp.			✓	✓	NKL, DP

Division of Crop Production and Post-Harvest Technology

Project III: Development of resource conservation and management technologies for improving productivity of spices
[Project leader: Dr. V. Srinivasan]

1. Phy. X (813): Evaluation of black pepper and cardamom elite lines for yield and quality under moisture stress (2010–2020) [Dr. S.J. Ankegowda, Dr. K.S. Krishnamurthy, Dr. M. Alagupalamuthirsolai & Dr. Shivakumar M.S.]

Decisions:

- High elevation technology can be transferred to farmers as a package.
- Use of PEG method for rapid screening for moisture stress may be refined for research purpose.
- Project is extended for three years.

Technical programme (2020-21)	Quarterly work schedule				Personnel
	I	II	III	IV	
Recording of growth characters in different genotypes during establishment in cardamom.		✓		✓	SJA, APS
Field testing of black pepper germplasm accessions for drought tolerance.			✓	✓	KSK, SMS
Screening of black pepper germplasm accessions (100 nos) for drought tolerance.		✓	✓	✓	KSK, SMS
Assessment of impact of climate change on pepper and cardamom in distinct environments.		✓	✓	✓	SJA, APS

2. SSC VI (813): Nutrient cycling and soil C sequestering potential of spice crops under different management systems (2011-2021) [Dr. V. Srinivasan, Dr. R. Dinesh & Dr. K.S. Krishnamurthy] (External support: Dr. S.J. Ankegowda, Dr. A. Ishwara Bhat & Dr. M. Alagupalamuthirsolai)

Decisions:

- Contribution of other component plants needs to be taken into consideration while calculating carbon foot print.
- Dr. C.N. Biju may dissociate from the project.
- Dr. S.J. Ankegowda may dissociate from the project and provide external support.

Technical programme (2020-21)	Quarterly work schedule				Personnel
	I	II	III	IV	
Developing a DSS for fertilizer recommendation.	✓	✓	✓	✓	VS, RD
Working out the C budgeting of different inputs in spice based systems for working out the C foot print.			✓	✓	VS, RD, KSK, APS

3. ICAR Mega Seed Project (Agr. XXXVII (813): Production of nucleus planting materials of improved varieties of spice crops (2006-2022) [Dr. V. Srinivasan, Dr. K, Kandiannan, Dr. S. J. Ankegowda, Dr. T.E. Sheeja, Dr. P. Rajeev, Dr. Lijo Thomas & Dr. Sharon Aravind] (External support: Dr. J. Rema, Dr. D. Prasath, Dr. R. Praveena & Mr. Muhammad Nissar)

Decisions:

- Bio-priming of ginger for management and mass multiplication of seed material should be taken up.
- Dr. K.V. Saji and Dr. Honappa Asangi may dissociate from the project.
- Dr. J. Rema, Dr. R. Praveena and Mr. Muhammad Nissar may dissociate and provide external support.

Technical programme (2020-21)	Quarterly work schedule				Personnel
	I	II	III	IV	
Production of rooted black pepper cutting	✓	✓	✓	✓	VS, SJA, HA

Production of ginger and turmeric seed rhizomes.	✓	✓	✓	✓	VS & DP
Production of cardamom suckers.	✓	✓	✓	✓	SJA, HA
Production of cinnamon seedlings.	✓	✓	✓	✓	VS,HA
Varietal authenticity and purity identification of black pepper.	✓	✓	✓	✓	TES, DP
FLD on organic black pepper on large scale area.	✓	✓	✓	✓	VS, LT, SJA
MIDH Farmers training/Seminar.	✓	✓	✓	✓	LT, VS
Production of rooted black pepper cutting.	✓	✓	✓	✓	VS, SJA, HA

4. ICAR-CPPHT-4: Micronutrient management in spice crops for enhancing yield and quality (2014-2020) [Dr. R. Dinesh, Dr. V. Srinivasan, Dr. S.J. Ankegowda, Dr. C. Sarathambal & Dr. S. Hamza]

- Project is closed. RPP III may be submitted.
- Evaluation of PGPR related to nutrient mobilization may be continued in the new project proposed by Dr. R Praveena

5. AGR. XXXI (813). Development of fertigation schedule for better productivity in black pepper (2015-2018) [Dr. C.K. Thankamani, Dr. M. Alagupalamuthirsolai & Dr. K. Kandiannan]

Decision:

- Project to be extended for three years.
- Dr. R. Dinesh may dissociate from the project.

Technical Programme (2020-21)	**Quarterly Work Schedule**				**Personnel**
	I	**II**	**III**	**IV**	
Maintenance of plants for fertigation studies	✓	✓	✓	✓	CKT
Analysis of soil and leaf samples of black pepper in response to fertigation.		✓	✓	✓	CKT

Physiological parameters and yield influenced by fertigation.	✓	✓	✓	✓	CKT, APS

6. Phy. XII (813): Physiological interventions for yield improvement in small cardamom (*Elettaria cardamomum* Maton) under weather extremities (2016-2021) [Dr. M. Alagupalamuthirsolai, Dr. Sharon Aravind & Dr. M. Murugan] (External support: Dr. S.J. Ankegowda)

Decisions:

- The measured weather parameters may be correlated with plant physiological parameters and biochemical for better conclusion.

Technical programme (2020-21)	Quarterly work schedule				Personnel
	I	II	III	IV	
Standardize the chemicals which reduce transpiration and observe yield and quality in cardamom.	✓	✓	✓	✓	APS, MM, SA
Study the effect of climatic parameters on yield and quality of cardamom.	✓	✓	✓	✓	APS, MM

7. ICAR-CPPHT 5: Delineation of spices zone beyond boundaries using climate analogue tools in changing climate (2016-19) [Dr. K.S. Krishnamurthy, Dr. K. Kandiannan, Dr. M. Alagupalamuthirsolai & Mr. K. Jayarajan]

Decisions:

- Project was closed in March 2020. RPP III may be submitted.
- The technology related to climate analogue sites for futuristic prediction of spices and area expansion may be submitted for technology transfer

8. Biochem. X (813): Study on spike abscission: Developing chemically induced method for harvesting black pepper (*Piper nigrum* L.) (2018-2022) [Dr. Anees K., & Dr. Biju C.N.](External support: Dr. K.S. Krishnamurthy)

Decision:

- Study related to *Colletotrichum* may be initiated.

- Dr. K.S. Krishnamurthy may dissociate from the project and provide external support

Technical programme (2020-21)	Quarterly work schedule				Personnel
	I	II	III	IV	
Dose optimization of antioxidant with Ethral for selective abscission of spike.	✓	✓			AK
To explore other chemical abscission inducers specific for fruit/ already in use for fruit thinning in other crops.			✓	✓	AK
Differential protein display in AZ of leaf and spike.			✓	✓	AK
Association of *Colletotrichum* with spike abscission.			✓	✓	AK, CNB

9. Phy. XIII (813) Development of drought mitigating physiological strategies in black pepper (2019-2020) [Dr. M. Alagupalamuthirsolai & Dr. C. K. Thankamani] (External support: Dr. K. S. Krishnamurthy & Dr. C. Sarathambal]

Decision:

- Dr. K.S. Krishnamurthy & Dr. C. Sarathambal may dissociate from the project and provide external support.

Technical Programme (2020-21)	Quarterly work schedule				Personnel
	I	II	III	IV	
Testing of chemicals and AMF to alleviate drought stress in pot culture.	✓	✓	✓		APS
Testing soil moisture conservation formulations in field .		✓	✓	✓	APS, CKT

Project IV: Development, refinement and demonstration of integrated cropping system for improved total factor productivity in spices [Project Leader: Dr. V. Srinivasan]

1. Hort. VII (813): Evaluation of nutmeg for its suitability for high density planting (2011-2021) [Dr. J. Rema, Dr. Sharon Aravind & Dr. C.K. Thankamani]

Decisions: Nil

Technical programme (2020-21)	Quarterly work schedule				Personnel
	I	II	III	IV	
Planting and evaluation of nutmeg grafts for its suitability for high density planting.	✓	✓	✓	✓	JR, SA
Nutrient management studies in nutmeg grafts.	✓	✓	✓	✓	CKT

Project V: Development, refinement and demonstration of organic production technology of spices for improved productivity, quality and soil health [Project leader: Dr. C.K. Thankamani]

1. ICAR-CPPHT-1: Network project on organic farming (2014-2025) [Dr. C.K. Thankamani, Dr. V. Srinivasan, Dr. R. Praveena, Dr. C. Sarathambal & Dr. S. Shanmughavel]

Decisions:

- An FLD with a farmer of basic amenities may be conducted with least financial liability to the institute.
- Fish to be included as one of the components in future. Black pepper to be included as one spice component, Dr. B. Pradeep, SMS from KVK may be associated in the project
- Project extended for five years.

Technical Programme (2020-21)	Quarterly Work Schedule				Personnel
	I	II	III	IV	
To study the impact of organic, conventional and integrated management practices on productivity and quality of turmeric varieties	✓	✓	✓	✓	CKT, VS, CS , RP

Budgeting the farming system model	✓	✓	✓	✓	CKT, VS, SSA, KP
Weed management in Turmeric	✓	✓	✓	✓	CKT, VS
Natural farming in turmeric	✓	✓	✓	✓	CKT, VS, CS, SSA, BP

2. ICAR-CPPHT-2: Network on Organic Farming in Horticulture Crops (2014-20) (Dr. V. Srinivasan, Dr. K. Kandiannan, Dr. R. Dinesh, & Mr. Honnappa Asangi) (External support: Dr. S.J. Ankegowda, Dr. C.N. Biju & Dr. C.M. Senthil Kumar)

Decisions:

- Project extended for one year.
- Dr. J. Rema and may dissociate from the project.
- Dr. S.J. Ankegowda, Dr. C.N. Biju and Dr. C.M. Senthil Kumar may dissociate from the project and provide external support.

Technical programme (2020-21)	Quarterly work schedule				Personnel
	I	II	III	IV	
Evaluating different management system for yield sustainability in cardamom and monitoring the soil health and pest and disease incidence under different management systems	✓	✓	✓	✓	VS, RD, JR, HA

Project VI: Development and refinement of post-harvest handling, processing and value addition technologies for minimization of post-harvest losses and diversified use of spices
[Project leader: Dr. N.K. Leela]

1. PHT VII (813): Developing energy efficient processing technologies for spices (2013-2020) [Dr. E. Jayashree & Dr. N.K. Leela]

Decisions:

- Project is closed. RPP III may be submitted.
- The technology on mechanical drying of turmeric may be commercialized.

2. ICAR-CPPHT-3: Network project on high value compounds and phytochemicals (2014-2020) (Dr. N.K. Leela, Ms. R. Sivaranjani & Dr. Santhosh J. Eapen)

Decisions:

- Project approved as institute project.
- Focus should be on those aspects where we have already obtained leads.
- Project report to be submitted ICAR.
- Dr. Anees K will provide external support.

Technical programme (2020-21)	Quarterly work schedule				Personnel
	I	II	III	IV	
In vivo studies using the cinnamon based product.	✓	✓	✓	✓	NKL
Phytochemical examination of solvent extracts of *C. caesia*.		✓	✓	✓	NKL

3. Kerala State Project on Establishing a value chain incubation facility for processing of spices (ginger and nutmeg) through value addition for entrepreneurship development at Indian Institute of Spices Research, Kozhikode (2017 - 2019) (Dr. E. Jayashree and Dr. Anees K.]

Decisions:

- Project is closed. RPP III may be submitted.
- Compile the information on equipment and models on processing and post them on institute website.
- Prepare extension pamphlet on the facility and spice products.

4. Biochem. IX (813): Evaluation of chemo-diversity and microencapsulation of selected spices (2018-2023) [Ms. R. Sivaranjani) (External Support: Dr. Leela N.K. & Dr. Anees K.)

Decisions:

- Documentation of data on quality of germplasm accessions of black pepper, ginger, cardamom and turmeric has to be completed within six months.

- A separate meeting for reporting the data on quality analysis under a single platform of germplasm characterization may be convened.

- Only core collection of germplasm accession needs to be taken for chemoprofiling.

- Microencapsulation work should be initiated.
- Data regarding *Pimento* sp. may be kept in abeyance until the authenticity of the species is confirmed.
- Dr. Leela N.K. and Dr. Anees K. may provide external support.

Technical programme (2020-21)	Quarterly work schedule				Personnel
	I	II	III	IV	
Effect of chemical elicitors on improved quality of turmeric.	✓	✓	✓	✓	RS
Quality analysis of selected black pepper germplasm.	✓	✓	✓	✓	RS
Quality profiling in ginger.	✓	✓	✓	✓	RS
Chemoprofiling of Nityashree and Navashree and characterization of Garcinia accessions for fruit quality parameters.	✓	✓	✓	✓	RS

New projects

CPPHT VIII (813): Pesticide residue monitoring of major spices (Dr. Anees K., Dr. N. K. Leela, Dr. C. M. Senthil Kumar & Dr. Balaji Rajkumar)

Decisions:

- The project is approved
- NABL accreditation to be added as an activity in the project

Technical programme (2020-21)	Quarterly work schedule				Personnel
	I	II	III	IV	
Compilation on pesticide residue levels in spices and spice products.	✓	✓			AK, CMS, NKL
Standardization of protocol for multi-residue analysis for turmeric.	✓	✓	✓	✓	NKL, AK
Residue degradation kinetics in ginger and cardamom.		✓	✓	✓	AK

Monitoring of pesticide residues in ginger and cardamom.		✓	✓	✓	AK, CMS, NKL, BR

CPPHT IX (813): Functional product development of spices through value addition and by-product utilization [(Dr. E. Jayashree, Dr. Anees K & Dr. B. Dayakar Rao (ICAR-IIMR, Hyderabad)]

Decisions:

- External linkages with NRCS Ajmer, Milma Diary and IIMR, Hyderabad may be established.

Technical programme (2020-21)	Quarterly work schedule				Personnel
	I	II	III	IV	
Development of value added products dairy products with spices and evaluation of its quality and storage.	✓	✓	✓	✓	EJ, AK
Optimization of liquid blends for newer product development.			✓	✓	EJ, AK
Development of value added products dairy products with spices and evaluation of its quality and storage.	✓	✓	✓	✓	EJ, AK
Optimization of liquid blends for newer product development.			✓	✓	EJ, AK

DST-CPPHT-1: Aflatoxin management in spices: Development of novel preventive methods (Dr. Anees K., Dr. E Jayashree, Dr. C, Sarathambal, Muhammed Fahim Ansari)

Decision: The project is approved

Technical programme (2020-21)	Quarterly work schedule				Personnel
	I	II	III	IV	
Fractionation of turmeric leaf oil and its evaluation for antifungal activity.	✓	✓	✓		AK, CS
Developing water soluble lac resin based formulation for coating nutmeg seeds.			✓	✓	AK, EJ, MFA

Division of Crop Protection

General Decision

- A new project on diagnostics of soil-borne pathogens may be proposed under the leadership of Dr. A. Jeevalatha

Project VII: Bio-intensive management of pests in spices [Project Leader: Dr. C.M. Senthil Kumar]

1. ICAR-CP 1. ICAR-Consortium research project on borers in network mode (2014-2021) [Dr. C.M. Senthil Kumar & Dr. M. Balaji Rajkumar]

Decisions: Nil

Technical programme (2020-21)	Quarterly work schedule				Personnel
	I	II	III	IV	
Spray schedule optimization of low risk insecticides against shoot borer of ginger and turmeric.		✓	✓	✓	CMS, MBR
Field evaluation of *M. pingshaense* against shoot borer infesting ginger and turmeric.		✓	✓	✓	CMS, MBR
Influence of plant phenology and crop duration on the occurrence of shoot borer infesting turmeric.		✓	✓	✓	CMS, MBR

2. Ent. XV (813): Integrated management of mealy bug (Pseudococcidae: Hemiptera) infesting black pepper (2019 – 2022) [Dr. M. Balaji Rajkumar & Dr. C. M. Senthil Kumar]

Decisions:

- Some more new molecules should be included in screening against mealy bug.

Technical programme (2020-21)	Quarterly work schedule				Personnel
	I	II	III	IV	
Survey for mealybug in black pepper growing areas.	✓	✓			MBR, CMS
Collection and culturing of mealybug in laboratory.	✓	✓	✓	✓	MBR, CMS
Specimen processing and slide preparation for morphological studies.	✓	✓	✓	✓	MBR, CMS
DNA isolation and PCR amplification.			✓	✓	CMS, MBR
Screening of low risk insecticides under laboratory.		✓	✓	✓	MBR, CMS

3. Nema. VII (813): Prevalence of lesion nematodes in turmeric growing tracts of India and their economic significance (2018-2022) [Dr. C. Sellaperumal, Dr. Santhosh J Eapen & Dr. R. Praveena]

Decisions:

- All the experiments shall be repeated under controlled conditions with pure culture of nematodes.
- The efficacy of new fumigants to manage nematodes and fungal pathogens shall be studied in the nursery with formalin as a control.
- Research activities pertaining to *Radopholus similis* shall be reported under the project "Strategic approaches for management of black pepper diseases".
- Fungicidal effect of "Velum" shall be studied by involving a plant pathologist.

Technical programme (2020-21)	Quarterly work schedule				Personnel
	I	II	III	IV	
Study on population dynamics and survey of Lesion nematode infecting region of Turmeric.		✓	✓	✓	CSP, SJE
Study on interaction and pathogenicity of *Pratylenchus* sppand other soil borne pathogens associated with turmeric.	✓	✓	✓	✓	CSP, SJE, RP
Continuing maintenance of nematode cultures (*Pratylenchus* spp, *Radopholus*	✓	✓	✓	✓	CSP, SJE

similis and *Meloidogyne* spp) under *in-vitro* and *in-vivo.*					
Management of lesion nematode infecting in turmeric under field condition.	✓	✓	✓	✓	CSP, SJE

Project VIII: Integrated management of fungal and bacterial diseases of spices [Project leader: Dr. C.N. Biju]

1. Path. XXIV (813): Surveillance, documentation and development of decision support system for pests and diseases of major spice crops (2016-2020) [Dr CN Biju, Dr. Santhosh J. Eapen, Dr. A. Ishwara Bhat, Dr. C. M. Senthil Kumar, Dr. Lijo Thomas, Dr. C. Sellaperumal, & Mr. K. Jayarajan] (External Support: Dr. R. Praveena, Dr. Mohammed Faisal Peeran & Dr. M. Balaji Rajkumar)

Decisions:

- The project is extended for one year.
- Electronic version of the "Compendium on pests and diseases of major spices" may be brought out immediately.
- Dr. A Jeevalatha, Dr. C. Sarathambal, Dr. R. Praveena, Dr. Mohammed Faisal Peeran and Dr. M. Balaji Rajkumar may be dissociated from the project.
- Dr. M. Balaji Rajkumar, Dr. Mohammed Faisal Peeran and Dr. R. Praveena may provide external support.

Technical programme (2020-21)	Quarterly work schedule				Personnel
	I	II	III	IV	
Development of Decision Support System on pests and diseases of major spices	✓	✓	✓	✓	CNB, SJE, AIB, CMS, MFP, MBR, CSP, KJ
Preparation of Compendium on pests and diseases of major spices	✓	✓	✓	✓	CNB, SJE, AIB, CMS, MFP, MBR, CSP, LT

2. Path. XXV (813): Spatiotemporal dynamics in relation to ecology and epidemiology of fungal foliar diseases in ginger and turmeric and management (2016-2020) [Dr. R. Praveena, Dr. A. Ishwara Bhat, Dr. K S. Krishnamurthy, Dr. A. Jeevalatha & Dr. C. Sarathambal]

Decisions:

- Project is closed. RPP III may be submitted.
- Technical bulletin on foliar diseases in ginger and turmeric may be brought out.

3. Path. XXVI (813): Revisiting wilt diseases of vanilla and exploitation of associated microbiome for its management (2016-2019) [Dr. Mohammed Faisal Peeran, Dr. C. Sarathambal, Dr. M. Alagupalamuthirsolai & Dr. Aarthi, S.]

Decisions:

- Project is closed. RPP III may be submitted.

4. Path. XXVIII (813): Novel strategies for managing bacterial wilt and soft rot diseases of ginger (2018-2022) [Dr. Biju C. N. & Dr. Mohammed Faisal Peeran]

Decisions:

- Efficacy of *Methylobacterium komagate* to manage major diseases of ginger may be studied under field conditions.
- Novel strategies including new molecules and bioagents shall be developed under the project for storage of ginger seed rhizomes.

Technical programme (2020-21)	**Quarterly work schedule**				**Personnel**
	I	**II**	**III**	**IV**	
Evaluation of capsule formulation of *Bacillus licheniformis* under field conditions.	✓	✓	✓		CNB, MFP
Analyzing the effect of $CaCl_2$, *Methylobacterium komagate* and *B. licheniformis* on other major pathogens in ginger.	✓	✓	✓		CNB, MFP
Effect of chemical elicitors on soft and dry rot diseases of ginger.	✓	✓	✓		CNB, MFP

5. Path. XXVII (813): Development of microbial biostimulants for growth promotion and disease resistance in major spices (2018-2021) [Dr. C. Sarathambal & Dr. A. Jeevalatha] (External support: Dr. Mohammed Faisal Peeran & Ms. R. Sivaranjani]

Decision:

- Bioefficacy of mycorrhizal cultures isolated from ginger rhizosphere shall be studied.
- Ms. Sivaranjani and Dr. Mohammed Faisal Peeran may dissociate from the project and provide external support

Technical Programme (2020– 2021)	Quarterly work schedule				Personnel
	I	II	III	IV	
Screening of efficient arbuscular mycorrhizal fungi for plant growth and disease resistance in black pepper cuttings.	✓	✓	✓		CS, AJ
Effect of arbuscular mycorrhizal fungi on growth, nutrition and antioxidant enzymes of ginger.		✓	✓	✓	CS, AJ

6. Path. XXIX: Strategic approaches for management of black pepper diseases (2019– 2024) [Dr. Biju, C. N., Dr. A. Ishwara Bhat, Dr. Praveena, R., Dr. A. Jeevalatha, Dr. Mohammed Faisal Peeran, Dr. C. Sellaperumal & Dr. Santhosh J. Eapen] (External support: Dr. V. Srinivasan)

Decisions:

- The technical programme may be modified to involve all the scientists in the project.
- Dr. V. Srinivasan may dissociate and provide external support.

Technical programme (2020-21)	Quarterly work schedule				Personnel
	I	II	III	IV	
Establishment of demonstration plots with resistant/tolerant varieties, meristem and somatic embryo derived lines of black pepper at Peruvannamuzhi.	✓	✓	✓	✓	CNB, AIB, RP, AJ, CSP, SJE
Analyzing interaction of *Phytophthora capsici*, *P. tropicalis* and *Fusarium solani* with *Radopholus similis.*	✓	✓	✓		CSP, CNB, AJ, SJE
Assessing efficacy of Actinobacter consortium against foot rot and slow decline diseases of black pepper under field conditions.	✓	✓	✓	✓	MFP, CNB, CSP
Screening promising black pepper accessions against *Phytophthora capsici* and *P. tropicalis.*	✓	✓	✓		CNB, AJ
Evaluation of fumigants like metham sodium against nematodes under nursery conditions.	✓	✓	✓	✓	CSP, RP, CNB

Project IX: Development of diagnostic kits and integrated management viral diseases of spices [Project Leader: Dr. A. Ishwara Bhat]

1. **DST CP-I: Identification, characterization and development of diagnostics for unknown viruses associated with cardamom and ginger (2016-2020) [Dr. A. Ishwara Bhat & Dr. C. N. Biju]**

Decisions: Project is closed. RPP III may be submitted.

2. **DBT CP-VII: Characterization of episomal and endogenous pararetroviruses infecting black pepper (2018-2021) [Dr. A. Ishwara Bhat & Dr K.S. Krishnamurthy]**

Decisions: Nil

Technical Programme (2020– 2021)	Quarterly work schedule				Personnel
	I	II	III	IV	
Production of polyclonal antiserum against PYMoV.	✓	✓	✓		AIB
Development of quick detection assay for PYMoV.			✓	✓	AIB
Effect of tissue culture stress on symptom expression of PYMoV in different varieties of black pepper.	✓	✓	✓	✓	AIB, KSK
Biochemical changes in symptomatic and asymptomatic PYMoV infected black pepper plants	✓	✓			KSK
Occurrence of PYMoV, PDV-1 and PDV-2 in black pepper.			✓	✓	AIB

New project

Path. XXX: Development and formulation of Plant Beneficial Rhizosphere Microorganisms (PBRMs) for disease antagonism, soil nutrient solubilisation and plant growth promotion (2020-2024) [Dr. R. Praveena, Dr. R. Dinesh & Dr. C. Sarathambal] (External support: Dr. V. Srinivasan)

Decisions:

- Title shall be suitably modified.
- Toxicological data generation for strains of *Trichoderma harzianum* (MTCC5179) and *Pochonia chlamydosporia* (MTCC 5412) need to be addressed in this project.

Technical Programme (2020– 2021)	**Quarterly work schedule**				**Personnel**
	I	**II**	**III**	**IV**	
Evaluation of selected PBRMs for disease antagonism and plant growth promotion under greenhouse conditions.	✓	✓	✓	✓	RP, CS
Evaluation of selected PBRMs for nutrient (Zn & P) solubilization potentials under greenhouse conditions.	✓	✓	✓	✓	RD, RP
Evaluation of selected PBRMs for P solubilization potential and disease antagonism under field conditions.	✓	✓	✓	✓	RD,RP
Isolation and characterization of novel PBRMs for N & K mobilization traits from different rhizosphere niches.	✓	✓	✓	✓	RP, CS

Social Sciences section

Project X: Improving knowledge and skill of stakeholders for increasing production of spices [Project Leader: Dr. P. Rajeev]

General decision:

The social science section needs further strengthening in terms of manpower support. Hence, one scientist each from the three divisions and one scientist from Regional station, Appangala are to be associated with the social science section for effective coordination of activities of the section with other divisions and Regional station.

The following personnel from each division may be associated with the activities of social sciences section.

Division	Personnel
Crop Improvement and Biotechnology	Dr. S. Aarthi
Crop Protection	Dr. R. Praveena
Crop Production and PHT	Dr. M. Alagupazhamuthirsolai
IISR Regional Station Appangala	Dr. Honnappa Asangi

- The slides to be used as a standard teaching aid for basic crop cultivation practices of mandate crops need to be prepared in English, Hindi and vernacular language.
- Short video modules need to be prepared highlighting various aspects of technology development and cultivation practices of mandate crops.
- Develop a user-friendly farmer database.
- The record of activities of the social section/ATIC need to be maintained in a digital form.
- Collaborate with Spices Board in Social Science projects

1. **DBT-SS1: Distributed Information Sub-Centre (2000-2019) [Dr. Santhosh J. Eapen, Dr. D. Prasath & Dr. K. Jayarajan]**

Decisions:

- Project is closed. RPP III may be submitted.

2. Ext. VI (813). Capacity building and front-line intervention programmes for (spice sector development in NE states and tribal empowerment (2014-20) [Dr. P. Rajeev & Dr. Lijo Thomas]

- The project shall be extended for three years
- Identify a contact person from Spices Board to effectively coordinate joint activities under the project and to broaden the scope of collaboration with the Board.
- More scientific personnel from institute should be associated with the activities carried out under the project.
- The MGMG programme should be revamped with the active involvement of Kattippara Grama Panchayath and Agricultural Department/line departments
- A document summarizing the activities carried out in the NEH states need to be brought out
- Explore the possibility of executing an MoU with Attapadi Cooperative Farming Society to formalize IISR's support and interventions in the region

Technical Programme (2020– 2021)	Quarterly work schedule				Personnel
	I	II	III	IV	
Demonstration of GAP in selected Tribal Locations and N E states.	✓	✓	✓	✓	PR, LT
Training and capacity building programs in selected Tribal locations and any states.		✓	✓	✓	PR, LT
Creation of Capital and Community assets for processing, value addition and farming.		✓	✓	✓	PR
Mass contact and media mobilisation programs for Institution building.		✓	✓	✓	PR

3. Eco. III (813): Economic analysis of technology, market dynamics and policy scenario in major spice crops (2014-19) [Dr. Lijo Thomas & Dr. P. Rajeev]

Decisions:

- Project is closed. RPP III may be submitted
- The information gathered from the project may be published in the form of suitable publications.

4. **Kerala State – CPPHT-4: Enhancing the economic viability of coconut based land use systems for land use planning in Kerala state. (2014-2019) [Dr. V. Srinivasan, Dr. R. Dinesh, Dr. R. Praveena, Dr. Lijo Thomas, Dr. S. Hamza, Dr. K.M. Prakash, Dr. P.S. Manoj, Dr. P. Ratha Krishnan & KVK, Ernakulam)**

   Decision:

   - Project is closed. RPP III may be submitted.

5. **Kerala State –CP-1. Area wide integrated pest management for wilt diseases in black pepper (2014-2019) [Dr. R. Suseela Bhai, Dr. Santhosh J. Eapen, Dr. Rajeev P & Dr. K.K. Aiswariya]**

   Decision: Project is closed. RPP III may be submitted.

New Project

Eco. IV (813): Developing models for enhancing technology and policy impact in spices sector (2020-2025) (Dr. Lijo Thomas; Dr. P. Rajeev & Mr. K Jayarajan)

Decisions

- The project is approved for a period of five years.
- Involve officials from Spices Board as Co-PIs.

Technical Programme (2020– 2021)	**Quarterly work schedule**				**Personnel**
	I	**II**	**III**	**IV**	
Identify and quantify monetary and non-monetary impact of high curcumin turmeric varieties.	✓	✓			LT,PR,KJ
Review the status of embedded varietal traits in spice crops.		✓	✓	✓	LT,PR,KJ
Develop comprehensive commercial viability model for black pepper and ginger.	✓	✓	✓		LT,PR,KJ
Database development for review of regional performance of crops for developing strategies for enhanced spice output.	✓	✓	✓	✓	LT,PR,KJ
Develop regional strategy for ginger and turmeric in major producing states.	✓	✓	✓	✓	LT,PR,KJ

PLENARY SESSION

The plenary session of the XXXIII IRC was held on 12 June 2020 at 10:30 AM using the Cisco Webex Platform (Meeting No 571371992). The meeting was chaired by Dr. Anand Kumar Singh, Deputy Director General (Hort. Sci.), ICAR, New Delhi and co-chaired by Dr. T. Janakiram, Assistant Director General (Hort. Sci.), ICAR, New Delhi and presided over by Dr. Santhosh J Eapen, Director, ICAR-IISR, Kozhikode.

The external experts were:

1. Dr. Homey Cheriyan, Director (DASD), Kozhikode, Kerala
2. Dr. A. B. Remashree, Director (Research), Spices Board, Kochi, Kerala
3. Dr. Jiju P Alex, Director (Extension), Kerala Agricultural University, Thrissur, Kerala.

The DDG welcomed everyone and in his opening remarks stated that this is a very challenging time and the therefore we will have to look into the next ten years and find out new ways to tide over the situation and explore new ideas and new opportunities. Programs that have not been providing the desirable results may be curtailed and new programs that rely on modern tools especially ICT to enhance spice production and double farmer's income may be given priority. After the opening remarks, the DDG inaugurated the new database on research projects named Spice Projects DB, that encompasses all the research projects carried out on spices at ICAR-IISR. The ADG (Hort. Sci.), Dr. T. Janakiram said that the top priorities should be to conserve spice genetic resources, produce quality planting materials, rapid testing kit for afflatoxins, document impact of technologies, varietal spread, secondary agriculture and value addition, GI based spice products and address issues on promotion of global spice exports.

The meeting continued with presentations on the summary of achievements (2019-20) of each division by the respective Head of Divisions in the following order:

- Division of Crop Improvement (Dr. R. Ramakrishnan Nair)
- Division of Crop Production (Dr. C. K. Thankamani)
- Division of Crop Protection (Dr. Santhosh J Eapen)
- Social Sciences and BPD (Dr. P. Rajeev)
- AICRPS (Dr. K. S. Krishnamurthy)

Dr. A.B. Remashree, Director (Research), Spices Board in her remarks stated that the DNA barcoding developed by IISR would help in identifying the country of origin especially during spice export and re-exports. The DDG stressed the need to develop a robust marker for rapid detection of adulteration, country of origin etc. While authentic samples are critical for precise fingerprinting, lining on the surface of black pepper, cardamom etc is unique and IISR may work on these lines. Dr. Homey Cheriyan, Director (DASD), Kozhikode,

Kerala stated that DNA finger printing facility could be established at the university level to cater to the needs of the respective states.

Dr. A.B. Remashree, Director (Research), Spices Board in her remarks stated that drying of turmeric is now an issue and the drier developed by the institute may be certified by IISR so that it can be included in Spices Board post-harvest subsidy schemes. Dr. Homey Cheriyan, Director, DASD, Kozhikode also reiterated the issue of drying and stated that this drier could be used very useful for the farmers especially at affordable rates. DrJiju P Alex wanted to know whether the solar drier technology is ready for transfer. The ADG, Dr. T. Janakiram further stated that vertical farming technology on spices and disease forecasting models should be developed by the institute. The Director replied that vertical farming technology and DSS have been included in the project proposal submitted to IIHR, Bengaluru. Dr. A.B. Remashree, Director (Research), Spices Board felt that there is an urgent need to test new molecules for pest and disease management and a discussion on pesticides will be organized by Spices Board. The Board will also extend all help for toxicological studies.

Technologies for transfer

- **IFS model for spice crops**

A farming system model plot with different component crops *viz*., black pepper, turmeric, fodder grasses (Congo signal grass, CO-3, CO-4), tapioca, banana, cowpea, arrow root, coconut, elephant foot yam, other yams, maize and pineapple was developed along with a dairy unit. Employment generated from this plot was 415 man days/year with a profit of Rs. 1.23 lakhs from one acre.

- **The best management practices (BMP) for black pepper and nutmeg under coconut intercropping systems of Agro Ecological Unit 9 & 11 of Kerala State was recommended**

  BMP for black pepper:

  - Lime/ Dolomite + Gypsum (based on soil analysis) – 500 + 500 g/vine
  - Application of 5 kg compost/ FYM enriched with Trichoderma/ PGPR & Pochonia – once at onset and supplementing with 1 kg compost/ FYM enriched with Trichoderma/ PGPR &Pochonia – at post monsoon
  - Supplementing P & K (if required, based on soil test basis) as RP/MOP
  - Micronutrient spray – twice (May/June and Aug/ Sept - @ 5 g/ L)
  - Application of Bordeaux mixture spray/ neem oil spray – twice (at onset & post monsoon).

BMP for nutmeg:

- Lime/ Dolomite + Gypsum (based on soil analysis) – 1000 + 1000 g/tree
- Application of 10 kg compost/ FYM enriched with Trichoderma
- Supplementing N, P & K (need based on soil test basis)
- Micronutrient spray – thrice (Jan/Feb, March/April and May/June - @ 5 g/ L

- **Fertilizer recommendation for targeted yield in cardamom**

  A model for target yield in cardamom has been developed. The economic optimum in terms of profitable response for money invested was worked out as Rs. 3.60/clump for N, Rs. 11.7/clump for P and Rs. 15.40/clump for K. Based on the model developed the fertilizer recommendation for various soil test values can be prescribed for cardamom.

- **Concentrated solar thermal turmeric curing unit**

  The prototype unit has a cooking vessel of capacity 50 kg turmeric/batch and experiments on turmeric curing indicated that complete cooking of turmeric could be achieved in 60 min. The time required for drying the cured turmeric was 12 days. The total cost of the unit was Rs 9.14lakhs after subsidy (in 2015).

- **Technology for the management of shoot borer (*Conogethes punctiferalis*) infesting ginger and turmeric with low risk insecticides**

  The technology involves spraying of low risk insecticides such as chlorantraniliprole, flubendiamide, spinosad at a dose of 0.5 ml/l or spraying chlorantraniliprole and spinosad alternatively at fortnightly intervals starting from second fortnight of July to the first fortnight of November for effective control of shoot borer in ginger and turmeric with reduced risk to the environment.

Just before signing off, the DDG suggested that a brief report on the IRC meeting be submitted to the SMD. Dr. Santhosh J Eapen, Director conveyed the vote of thanks.

The meeting came to close at 14:10.

Man months of scientists in Research Projects

Name	Man months	
	PI	Co-PI
Akshitha HJ	8 (1)	4 (1)
Anke Gowda	4 (1)	6 (3)
Alagupazhamuthirsolai M	6 (2)	6 (2)
Anees K	9 (3)	3 (1)
Balaji Rajkumar	5 (1)	7 (3)
Biju CN	7 (3)	3 (1)
Dinesh R	4 (1)	6 (3)
Gobu		(2)
Ishwara Bhat	6 (1)	6 (2)
Honnappa Asangi	4 (1)	8 (3)
Jayashree E	9 (1)	3 (1)
Jeevalatha A	-	12 (4)
Lijo Thomas	6 (1)	6 (3)
Leela NK	3 (1)	9 (3)
Krishnamurthy KS	-	12 (4)
Mohammed Faisal Peeran	-	12 (4)
Muhammed Nissar V A	4 (1)	8 (3)
Prasath D	9 (3)	3 (1)
Praveena R	4 (1)	8 (3)
Rajeev P	6 (1)	6 (2)
Ramakrishnan Nair R	12 (1)	
Rema J	6 (2)	4 (2)
Saji KV	6 (2)	4 (2)
Sarathambal C	4 (1)	8 (3)
Senthilkumar CM	4 (1)	8 (3)
Sellaperumal C	6 (1)	6 (2)
Sharon Aravind	-	8 (3)
Sheeja TE	6 (1)	3 (1)
Shivakumar MS	4 (1)	8 (3)
Sivaranjini R	4 (1)	8 (3)
Srinivasan V	6 (3)	4 (1)
Thankamani CK	6 (2)	4 (2)
Umadevi P	9 (2)	3 (1)

Figures in parentheses indicate the number of projects

List of participants

Name		Date
1.	Dr. Anand Kumar Singh, DDG (Hort. Sci.), ICAR, New Delhi	12 June 2020
2.	Dr. T. Janakiram, ADG (Hort. Sci.), ICAR, New Delhi	12 June 2020
3.	Dr. Homey Cheriyan, Director (DASD), Kozhikode	12 June 2020
4.	Dr. A. B. Remashree, Director (Research), Spices Board, Kochi	12 June 2020
5.	Dr. Jiju P Alex, Director (Extension), KAU, Trichur	12 June 2020
6.	Dr. Santhosh J Eapen, Director (Acting), ICAR-IISR, Kozhikode	10-12 June 2020
7.	Dr. C .K. Thankamani, Principal Scientist & Head in charge, Div. of Crop Production & Post Harvest Technology	10-12 June 2020
8.	Dr. J. Rema, Principal Scientist (Horticulture), & Head in charge, Div. of Crop Improvement and Biotechnology	10-12 June 2020
9.	Dr. R. Dinesh, Principal Scientist (Soil- Fert. /-Chem./-Microbiol.) and Member Secretary, IRC	10-12 June 2020
10.	Dr. A. IshwaraBhat, Principal Scientist (Plant Pathology)	10-12 June 2020
11.	Dr. R. Ramakrishnan Nair, Principal Scientist (Genetics & Cytogenetics)	10-12 June 2020
12.	Dr. K. S. Krishnamurthy, Principal Scientist (Plant Physiology)	10-12 June 2020
13.	Dr. N. K. Leela, Principal Scientist (Organic Chemistry)	10-12 June 2020
14.	Dr. K. V. Saji, Principal Scientist (Economic Botany)	10-12 June 2020
15.	Dr. P Rajeev, Principal Scientist (Agril. Extension)	10-12 June 2020
16.	Dr. V. Srinivasan, Principal Scientist (Soil- Fert. /-Chem./-Microbiol.)	10-12 June 2020
17.	Dr. T E. Sheeja, Principal Scientist (Biotechnology)	10-12 June 2020
18.	Dr. D. Prasath, Principal Scientist (Horticulture)	10-12 June 2020
19.	Dr. E Jayashree, Principal Scientist (Agricultural Engineering)	10-12 June 2020
20.	Dr. C M Senthil Kumar, Senior Scientist (Agricultural Entomology)	10-12 June 2020
21.	Dr. C N Biju, Senior Scientist (Plant Pathology)	10-12 June 2020
22.	Dr. R Praveena, Scientist (Plant Pathology)	10-12 June 2020
23.	Dr. P Umadevi, Scientist (Biotechnology)	10-12 June 2020
24.	Dr. Lijo Thomas, Senior Scientist (Agri. Economics)	10-12 June 2020
25.	Dr. S Aarthi, Scientist (Spices, Plantation Med. & Arom. Plants)	10-12 June 2020
26.	Dr. Sharon Aravind, Scientist (Spices, Plantation Med. & Arom. Plants)	10-12 June 2020
27.	Ms. R. Sivaranjani, Scientist (Plant Biochemistry)	10-12 June 2020
28.	Dr. C. Sarathambal, Scientist (Agricultural Microbiology)	10-12 June 2020
29.	Mr. V. A. M. Nissar, Scientist (Spices Plantation, Med. & Arom. Plants)	10-12 June 2020
30.	Dr. Jeevalatha, A, Scientist (Pl. Pathology)	10-12 June 2020
31.	Dr. C Sellaperumal, Scientist (Nematology)	10-12 June 2020
32.	Dr. Anees K, Scientist (Plant Biochemistry)	10-12 June 2020
33.	Dr. M Alagupalamuthirsolai, Scientist (Plant Physiology)	10-12 June 2020
34.	Mr. K Jayarajan, Asst. Chief Technical Officer	10-12 June 2020