For official use only

PROCEEDINGS OF THE XXX ANNUAL GROUP MEETING AND TECHNICAL PROGRAMME FOR 2021-22

Virtual meeting through video conference
22-24th November, 2021

भा.कृ.अनु.प. - अखिल भारतीय समन्वित ताड़ अनुसंधान परियोजना
भा.कृ.अनु.प. - केंद्रीय रोपण फसल अनुसंधान संस्थान
कासरगोड़, केरल, भारत - 671124

ICAR- All India Co-ordinated Research Project on Palms
ICAR-Central Plantation Crops Research Institute
(Indian Council of Agricultural Research)
Kasaragod, Kerala, India – 671 124

For Official use only

PROCEEDINGS OF THE XXX ANNUAL GROUP MEETING AND TECHNICAL PROGRAMME FOR 2021-22

(ICAR-ALL INDIA COORDINATED RESEARCH PROJECT ON PALMS)

Virtual meeting through video conference
22-24th November, 2021

ICAR- All INDIA CO-ORDINATED RESEARCH PROJECT ON PALMS
ICAR CENTRAL PLANTATION CROPS RESEARCH INSTITUTE
(Indian Council of Agricultural Research)
KASARAGOD - 671124, KERALA, INDIA

Citation:

AICRP on Palms. 2021. Proceedings of the XXX Annual Group Meeting of ICAR-AICRP on Palms and Technical Programme for 2021-22. (Eds. Ravi Bhat, Sumitha. S and Latha. K. R). ICAR- CPCRI, Kasaragod. 126 p

Published by:

Dr. Anitha Karun.
Director and Project Co-ordinator (Palms)
ICAR – Central Plantation Crops Research Institute
(*Indian Council of Agricultural Research*)
Kasaragod – 671 124, Kerala, India
Phone: 04994 – 232733, Fax: 04994-232614
E mail: pcpalms.cpcri@icar.gov.in
Website: http://www.cpcri.gov.in / www.aicrppalms.res.in

Compiled and edited by

Dr. Ravi Bhat
Dr. Sumitha, S
Dr. Latha, K. R

December, 2021

CONTENTS

1. PREFACE

The XXX Annual Group Meeting of ICAR-All India Coordinated Research Project on Palms was held during 22th to 24th November 2021 through video conferencing. During the meeting, progress made during 2020-21 at coordinating centres was reviewed and technical programmes for the year 2021-22 were formulated. The brief achievements and technologies developed were discussed and recommended for transfer to extension agencies. In this report, the guidelines for technical programme and recommendations of each session have been compiled and presented. The technical programmes for 2021-22 were arranged session wise *viz*., Genetic Resources and Crop Improvement, Crop Production, Disease Management, Pest Management, Post Harvest Technologies in Palmyrah and Transfer of Technology in this document along with details of observations to be recorded.

I would like to record my sincere gratitude to Dr. A. K. Singh, DDG (Hort. Sci.), and Dr. B. K. Pandey ADG (Hort. Sci. II), ICAR, New Delhi for their support and guidance during various stages in organizing XXX AGM of AICRP on Palms. I record my gratefulness to Dr. R. K. Mathur, Director, ICAR-IIOPR, Pedavegi, Dr. Eaknath B. Chakurkar, Director, ICAR- CIARI, Port Blair for their constant support in functioning of ICAR-AICRP on Palms.

I thank Dr. H. P Maheshwarappa (Director of Research, UHS, Bagalkot) and Dr. Ravi Bhat, Actg. Head (Crop Prodn.) & In-charge, PC Cell for their coordination in taking forward ICAR-AICRP on Palms. I am extremely thankful to the scientists working in different centres for providing the information in required format on time. Help rendered by Dr. S. Sumitha, Mrs. K. Narayani, Dr. Balanagouda Patil, Dr. Latha K R-and Mr. Karunakara S. in compiling and bringing out this document is highly appreciated and acknowledged.

Kasaragod **(Dr. Anitha Karun)**

15th December, 2021 **Director & Project Co-ordinator (Palms)**

2. PROGRAMME

XXX Annual Group Meeting

ICAR – All India Co-ordinated Research Project on Palms

ICAR-CPCRI, Kasaragod, Kerala

Venue	**Virtual meeting through Video Conference**
Period	**November 22 - 24 , 2021**
22.11.2021 **10.00 AM to 11.00 AM**	INAUGURAL SESSION **Welcome address & Project Coordinator Report**: Dr. Anitha Karun, Director & PC (Palms) (Acting), ICAR-CPCRI **Presentation of ATR**: Dr. Ravi Bhat, Actg. Head (Crop Production) & In-charge, PC Cell **Address by Chief guest :** Dr. A.K. Singh, DDG (Hort. Sci.) **Address by Guest of honour** : Dr. B.K. Pandey, ADG (HS II)

TECHNICAL SESSIONS

Technical session-I	**Genetic Resources and Crop Improvement**	
22.11.2021 **11.00 AM to 6.30 PM**	Panel Experts	Dr. R. K. Mathur Director, ICAR-IIOPR, Pedavegi , AP
		Dr. Anitha Karun Director (Actg), ICAR-CPCRI, Kasaragod
	Convener	Dr. Siva Kumar, CRS, Aliyarnagar Dr. Sunil Ghavale, RCRS, Bhatye
Technical session-II	**Crop Production**	
23.11.2021 **03.00 AM to 3.30 PM**	Panel Experts	Dr. B.A. Jerard ICAR-CIARI, Port Blair
		Dr. Ravi Bhat, Actg. Head, Crop Production, ICAR-CPCRI, Kasaragod
	Convener	Dr. P. Subramanian ICAR-CPCRI, Kasaragod Dr. V.V. Shinde, RCRS, Bhatye
Technical session-III	**Disease Management**	
23.11.2021 **4.00 PM to 7.00 PM**	Panel Experts	Dr. B.K. PandeyADG (HS II) ICAR, New Delhi
		Dr. Vinayaka Hegde, Actg. Head, Crop Protection, ICAR-CPCRI, Kasaragod
	Convener	Dr. Govardhan Rao AICRP Centre, Ambajipeta Dr. Kiran Kumar, HRES, Arsikere

Technical session-IV	**Pest Management**	
24.11.2021 **9.30 AM to 11.30 PM**	Panel Experts	Dr. Chandrika Mohan PS (Retd.) ICAR-CPCRI RS, Kayamkulam
		Dr. Joseph Rajkumar, PS, ICAR-CPCRI RS, Kayamkulam
	Convener	Dr. B. Vinoth Kumar, CRS, Aliyarnagar Dr. G. S. Chandrasekhar, HRES, Arsikere
Technical session-V	**Post harvest technology in palmyrah**	
11.30 AM to 12.00 PM	Panel Expert	Dr. K.B. Hebbar, Actg. Head, PB & PHT , ICAR-CPCRI, Kasaragod
	Convener	Dr. P.C. Vengaiah, HRS, Pandirimamidi Dr. C. Ravindran, TNAU, Killikulam
Technical session-VI	**Transfer of Technology**	
12.00 PM – 1.00 PM	Panel Expert	Dr. K. Muralidharan, Actg. Head (Social Sciences), ICAR-CPCRI, Kasaragod
	Convener	Dr. Jagdeesha, HRES, Arsikere
		Dr. Rinku M. Phukon, HRS, Kahikuchi
Technical session-VII	**:PLENARY SESSION**	
2.00 PM – 3.30 PM	Chairman	Dr. A.K. Singh, DDG (HS), ICAR, New Delhi
	Co-chairman	Dr. B.K. Pandey, ADG (HS II), New Delhi
	Convener	Dr. Ajith Arun Waman ICAR-CIARI, Port Blair
Presentation of Achievements & Recommendations		
	Remarks by Chairman/Co-chairman	
	Vote of Thanks	Dr. Ravi Bhat, Actg. Head (Crop Prodn.)& In-charge, PC Cell

3. EXCERPTS OF INAUGURAL SESSION

The 30th Annual Group Meeting of All India Co-ordinated Research Project on Palms organized by Central Plantation Crops Research Institute, Kasaragod through virtual mode was inaugurated on November 22, 2021. Dr. B. K. Pandey, Assistant Director General (Horticultural Sciences II), ICAR, New Delhi was the Chief Guest of the event. Dr. R. K. Mathur, Director, ICAR-IIOPR, Pedavegi and Dr. Eaknath B. Chakurkar, Director, ICAR- CIARI, Port Blair participated in the Inaugural Session. Dr. Anitha Karun, Director and Project Co-ordinator (Acting), CPCRI, Kasaragod welcomed the dignitaries and delegates in which she applauded the unstinted support rendered by the Deputy Director General (Horticultural Sciences) and the Assistant Director General (Hort. Sci. II) for the progress of the AICRP (Palms) scheme by providing first hand information on diverse arena. She presented the report of the AICRP (Palms) for the year 2020-2021. The action taken report of the recommendations of the AGM held on 10th – 11th August 2020 was presented by Dr Ravi Bhat, Acting Head (Crop Production) and Scientist In Charge, PC Cell. The Assistant Director General (Horticultural Sciences) in his inaugural address suggested bringing out a publication on "Fifty Years of AICRP (Palms)" on the eve of Golden Jubilee Celebrations of the AICRP (Palms). He envisaged the need for the collection, conservation and evaluation of trait specific germplasms devoid of duplicates, enhancing input use efficiency with special reference to micronutrients, identification of alternatives for red labelled chemicals towards hassle free plant protection and demonstration of cutting edge research technologies to the farm front through KVKs of the states and digitization of data for easy reference by the scientists. He appreciated AICRP (Palms) centres for the exemplary work and wished the Palm Scientists to reach the pinnacle of success on technological platform. Development of T x T coconut hybrids, coconut based multispecies cropping system, location specific integrated farming system models, management of stem bleeding disease in coconut through *Trichoderma harzianum* and *T.reesei*, technology capsule for the management of Rugose Spiraling Whitefly in coconut, integration of coriander in arecanut system, bioagents for the control of crown choke disease in arecanut and identification of best performing cocoa clones *viz.,* VTCH -2, 16, 20, 17 and 4 for intercropping in coconut gardens are the noteworthy contributions made during 2020. Effective Transfer of Technology from lab to land through diverse tools and modes and need based diagnostic field visits despite COVID curfew remain the major strength of this programme. Dr.R.K.Mathur, Director, ICAR-IIOPR, Pedavegi invited researchers to explore alternative pesticides, to develop cropping systems approach and to enhance resource use efficiency in cropping systems. Dr E. B. Chakurkar, Director, ICAR-CIARI, Port Blair appreciated the work of Palm Scientists and requested them to come out with location specific farming system models which can double the income of small and marginal farmers. About 72 participants from different AICRP centres and ICAR-CPCRI were connected through virtual mode. The crops experts also provided their valuable suggestions / recommendations for further improving the efficacy of the AICRP on Palms. The detailed progress made during 2020-21 was presented and the technical programmes for ensuing next year were finalized during the meeting. The inaugural session was followed by technical sessions on genetic resources and crop improvement, crop production, crop protection, post harvest technology and transfer of technology.

Action taken report on the recommendations of the XXIX th Annual Group Meeting held through Video Conference (Virtual meeting) during 10th -11th August, 2020

General Recommendation		
SI. No	**Recommendation**	**Action Taken**
Crop Improvement		
1	Uniform observations concerning the growth and yield parameters should be strictly followed.	Observations were recorded uniformly by following the proforma circulated from PC cell, ICAR-CPCRI, Kasaragod, Kerala
2	Uniform template for quality presentations maybe provided to all centres	Uniform template was circulated to all AICRP on palms centres to ensure quality presentation.
3	Fertigation system may be installed for experimental palms in all AICRP (palms) centres	Provision is made in the EFC 2021-26 for installation of fertigation systems in all the experiments.
Crop production		
1	Replicated experiments over different stations may be combined and presented for more clarity.	All the results of multi-location trials were combined and analysed where ever feasible.(Agron. 14. Expt. 3: Organic farming in coconut-based farming system (Centres: Aliyarnagar, Ambajipeta, Kasaragod and Arsikere)
2	Follow the latest internationally accepted nomenclature system for fertilizer applic ation or nutrient doses in (Eg. N, P, K etc.). The nutrient content in soil should be pre sented as 'ppm' or '%' instead of kg/ha.	Available nutrient status in the soil is being expressed in ppm instead of kg /ha.
3	The information on 'Coconut replacing area under rice cultivation' in Pollachi area should be documented and their co-existence on coconut.	The information on coconut replacing area under rice and other food crops and the decadal trends in area fluctuations has been compiled and submitted to the Project Co-ordinator, ICAR – AICRP (Palms) for onward transmission (24.5.2021) to the Deputy Director General (Horticulture), ICAR, New Delhi.An article captioned "Two Decades of Expanding Acreage of Coconut in Tamil Nadu – Perceptible Shift or Obscure Drift on Food Security Perspective" has been submitted to Current Science Journal.

Disease Management		
1	All the fungicides banned recently have to be dropped and new alternate fungicide to be tested under disease management trials	As per the recommendations given by ICAR-CPCRI all the recently banned fungicides have been dropped. The alternate new fungicides suggested by the authority have been included and tested in disease management trials.
Pest Management		
1	The population dynamics of whitefly complex and their co-existence on coconut in each region should be documented by all centres	Recorded and documented population dynamics of whitefly complex and their co-existence on coconut. Mostly observed co-existence of rugose spiralling whitefly and Bondars nesting whitefly however other invasive whiteflies *Paraleyrodes minei*, *Aleurotrachelus atratus* were not observed in the surveys carried out.
2	Location specific alternate host plants of invasive whiteflies have to be documented for careful introduction as banker's crop in each region for system approach	Identified new hosts *viz.,* Elephant foot yam *Amorphophallus paeoniifolius*, Cassava – *Manihot esculenta*, Denai – *Nelumbo nucifera*, Spanish cherry – *Mimusups elengi* and Arrow root – *Maranta aurandinacea* as new hosts for RSW.
3	The chysopid predator, *Apertochrysa astur* was found as a potential predator against all invasive whiteflies infesting coconut. This predator should therefore be mass multiplied at all centres. Dr. Chalapathi Rao, Pr.Scientist, HRS Ambajipeta may arrange a web-based training for the mass production of *Apertochrysa astur* for the benefit of other AICRP (Palms) centres.	Project Coordinator , AICRP on Palms and HRS, Ambajipeta conducted a web based training program on the mass production of *Apertochrysa astur* for other AICRP (Palms) centres on 04.08.2021
Suggestions/ Recommendations Related to Projects		
Genetic Resources and Crop Improvement		
Coconut		
Coc/Gen. 1: Conservation and evaluation of coconut genetic resources in different agro climatic regions		
Expt. 2: Collection, conservation and evaluation of location specific germplasm		
1	The duplication of germplasm accessions at different centres may be excluded	The duplicates germplasm has been excluded.
2	The evaluation trials may be concluded after 4 years of attaining the yield stability	The trial with the four years of yield stability will be concluded.

Expt. 3: Evaluation of elite germplasm		
1	The centres having similar set of genotypes may be pooled and presented together in the forthcoming Annual Group Meets	Centres having similar set of genotypes have been pooled and will be presented together.
Coc./Gen. 2: Evaluation of coconut hybrids in different agro climatic regions		
Expt. 4: Evaluation of Tall x Tall coconut hybrids		
1	At Navsari centre, the local check variety Gan Devi selection may be excluded from the experiment	Local check variety Gan Devi selection excluded from the experiment
2	Recovery pattern of cyclone affected palms could be studied in detail especially for time taken for recovery	Damaged palms were recorded 24-36 months for recovery i. If the crown damage is 25-30%, the recovery in 18-20 months ii. If the crown damage is more than 50%, recovery in 24-30 months If the crown damage is 80-90% the recovery in 36 months
Expt. 5: Evaluation of location specific Tall x Tall coconut hybrids		
1	Data on yield stability over the years may be recorded in all the centres	Data on yield and yield attributes are recorded as per the guidelines.
2	Number of female flowers and fruit set per cent may be recorded in all the centres	Number of female flowers and fruit setting percentage is being recorded and it is in progress.
3	Mother palm gardens of recommended hybrid is to be raised at concern centres by procuring the planting material from CPCRI, Kasaragod for further production and distribution of hybrid seedlings	Nucleus seed gardens of released varieties in coconut (For production of quality planting materials) has been established in nine coconut centre
Expt. 6: Evaluation of Dwarf x Dwarf coconut hybrids in different agro climaticconditions		
1	Endosperm quality characters study to be included in all the centres	It is followed as per the recommendations
2	The data on annual leaf production per palm at Ambajipeta and Veppankulam centres may be recorded	The data on annual leaf production per palm recorded regularly and it is in progress.
3	The tender nut weight and tender nut water content may also be observed	It is followed as per the recommendations

Oil palm		
OP./Gen. 8C: Evaluation of new cross combinations in oil palm (Pattukkottai centre)		
1	Bunch analysis may be done and oil data may be recorded and documented before concluding the experiment	Bunch analysis work is initiated
OP./Gen. 8C (I) Evaluation of new cross combinations in North East region (Pasighat)		
2	Bunch analysis should be done to assess oil yield	Bunch analysis work is initiated
OP./Gen. 8D (II): Evaluation of D x P hybrids for dwarfness and yield in oil palm		
1	Bunch analysis should be done to assess oil yield	Bunch analysis work is initiated
Palmyrah		
1	Neera yield may be recorded and included in the future AGMs in Gen. 9 experiment	Neera yield was recorded and included in the yield parameters
2	Data of number of female flowers may be recorded in Gen 10 experiment	It is followed as per the recommendations
Cocoa		
1	Pruning time and calendar of operation for cocoa should be maintained in all centres	Pruning time (July –August) and calendar operations like fertilizer application, harvesting, processing were recorded and maintaining at the station
Crop Production		
Coc. /Agron. 5: Studies on fertilizer application through micro-irrigation technique in coconut		
1	Impact of fertigation on frost injury and its recovery may be studied including setting percentage	Studies has been initiated during 2021 and will be presented during reporting year 2022
2	Impact of fertigation on inflorescence production pattern may be under taken	Studies has been initiated during 2021 and will be presented during reporting year 2022
Coc./Agron. 10(A): Development of coconut based farming systems		
1	**Expt. 1 and Expt 2 :** Integration of cows and sheep in coconut based cropping system (Arsikere)Appropriate water harvesting and moisture conservation practices need to be followedin IFS model.	The water harvesting and moisture conservation techniques were initiated in this year in IFS model

Expt.7: Coconut based multispecies cropping systems under coastal littoral sandy soil		
1	Yield of different intercrops taken may be labelled properly in the presentation with units.	It is followed as per the recommendations
2	Quantification of nutrient supplied need to be worked out.	Soil nutrient status was recorded and nutrients applied were quantified.
Coc./Agron. 14: Soil and nutrient management in coconut		
Expt. 2: Organic farming in coconut based farming system		
1	Nutrients status and nutrients applied may be quantified and reported	Soil nutrient status was recorded and nutrients applied were quantified
Oil palm		
OP./ Agron 22. Studies on intercropping in bearing oil palm plantation		
1	Intercropping experiments may be initiated in oil palm plantations at Pasighat centre.	Inter cropping experiment will be initiated at Pasighat in March 2022.
Palmyrah		
Palmy./Agron. 23 - Standardization of rooting media and containers for Palmyrah seedling production.		
1	Multi-location trial for germination of palmyrah shall be undertaken only after development of technology.	Germination trail was conducted two times and technology yet to confirmed
2	In case of germination trial in the palmyrah palm, the multiple accessions, which have started bearing, could be used for comparing the germination response.	Multiple accession which started bearing was used for comparison
Arec./Agron. 20: Studies on crown chocking disorders in arecanut		
1	Nutrient condition of soil and plant to be analysed	It is followed as per the recommendations
Disease Management		
Coc./Path.1: Survey and surveillance of coconut disease		
1	Uniform templates for recording data to be used by all the centres and templates to be finalized in consultation with CPCRI and distributed to all AICRP centres.	Templates developed by ICAR- CPCRI authority have been adopted.

Coc./Path. 2: Basal stem rot of disease		
1	In already approved ongoing experiments, the fungicides namely Carbendazim, Mancozeb, Zineb or any combi fungicides containing any of these fungicides listed in the recently banned 27 pesticides by Govt of India are to be removed. The new treatments and fungicides to be used for the field experiment on management of basal stem rot disease have to be fixed in consultation with CPCRI (List of fungicidal treatments enclosed).	Total 25 fungicides (15-single fungicides and 10 combi products) fixed for evaluation of fungicides against BSR disease under in vitro conditions with the consultation with ICAR-CPCRI.
Coc./Path.3: Stem bleeding disease in coconut		
1	Fungicidal treatments for evaluation under field condition to be fixed in consultation with ICAR-CPCRI (List of fungicidal treatment enclosed).	Total 25 fungicides (15-single fungicides and 10 combi products) fixed for evaluation of fungicides against stem bleeding disease under in vitro conditions with the consultation with ICAR-CPCRI.
Coc./Path. 5: Leaf blight disease of coconut		
1	The disease Incidence to be included apart from disease intensity while recording the data. Experiment on yield loss assessment to be continued. It is suggested to record the incidence of other pests and diseases also if any in addition to leaf blight incidence the experimental plots.	Data on disease incidence was included in all the experiments in addition to disease intensity.Experiment on yield loss assessment is being continued. The incidence of other pest and diseases are being recorded
Coc./Path. 6: Root (wilt) disease of coconut		
1	Survey has to be undertaken in identified areas regularly to create awareness among the farming community.	Regular survey on root (wilt) incidence is undertaken in identified to ensure continuity in observation and two awareness programmes were conducted on spread and management of the disease
2	The scientists, Aliyarnagar should publish extension literature in local languages to make aware of the root wilt diseases and management of the same.	Extension literature viz., Pamphlet on root wilt was prepared and distributed to the farmers in the awareness programme and during diagnostic field visits and survey programme
Arecanut		
1	All New technical programmes to be conducted for the year 2020-21 and treatments may be finalized in consultation with CPCRI. (New treatment details given. Dr. Damodaran, Principal Scientist, ICARCSSR	The work was initiated as per the technical programme and treatments were finalized in consultation with Dr. Vinayak Hedge, CPCRI, Kasaragod

	has not yet sent the bioformulation requested. He may be contacted once again and if he is not able to supply in time, experiments on management of leaf stripe of arecanut may be conducted with other treatments).	
Pest management		
Coc./ Ent. 1: Pest surveillance in coconut		
1	Red palm weevil is the potential lethal pest on coconut that exceeded 1% damage percentage in certain regions of Maharashtra and Andhra Pradesh. Hence, a systematic curative management (Imidacloprid 0.02%) by spot application should be taken up area-wide in all pest affected regions through State Department	Regular cyclones and continuous new planting without removal of old fallen coconut logs is one of the main reasons for high incidence of rhinoceros beetle and off late red palm weevil entry is observed in the crown region where rhinoceros beetle damage incidence is observed . Hence, in the roving surveys awareness on adopting IPM for rhinoceros beetle and red palm weevil was emphasized and meetings were organised with Department of Horticulture and regular campaigns are contemplated to create more awareness on these pests
2	Statistical analysis on pest incidence should be correlated with weather data available on long-term basis.	Data on pest incidence and weather factors is being collected at standard week intervals and correlated with weather data.
3	The incidence of rhinoceros beetle was found severe on juvenile palms in Andhra Pradesh. Hence, a holistic prophylactic measure especially leaf axil filling of equal volume of neem cake (250 g) admixed with sand is recommended for adoption in all pest prone regions	Due to regular cyclones, continuous new planting and timely non removal of dead logs the incidence of rhinoceros beetle is increasing in juvenile palms and recommendation of leaf axil filling of equal volume of neem cake (250 g) admixed with sand is communicated to Department of Horticulture for large scale adoption.Information on IPM practices for rhinoceros beetle is communicated to all Assistant Directors of Horticulture of various districts, and awareness camps are also being conducted by HRS, Ambajipeta
Coc./ Ent. 4: Production and supply of natural enemies		
4	Natural enemies of RSW should be supplied to all sub centres for mass multiplication and area-wide release	Mass production of predator *Apertochrysa astur* technology was taken up at HRS., Ambajipeta and training was imparted to 7 private firms too on MoA basis for enhancing the supply . Further, with financial assistance of CDB, Kochi one biocontrol lab at Sompeta , Srikakulam was strengthened and new bio control lab at Venkataramnangudem , West Godavari district has started for predator *A. astur* production.

5	Success stories on the augmentative release of stage specific parasitoids in the bio suppression of black headed caterpillar need to be published in ICAR website	Biology control of coconut black headed caterpillar in coastal Andhra Pradesh https://icar.org.in/content/biological-control-coconut-black-headed-caterpillar-coastal-andhra-pradesh
Post harvest technology in palmyrah		
Palmy./PHT.1 Standardization and commercialization of inflorescence sap (neera) extraction and inflorescence sap based products (jaggery, palm sugar and candy)		
1	Thermal processing for preservation of palmyrah sap, the temperature of 65^0C may be used instead of 85^0C similar to coconut sap to avoid color change.	Thermal processing was carried out as per recommendation and observed that shelf life was poor, further studies with combination of other methods is in progress.
2	For checking adulteration in Jaggery potassium content to be estimated	Estimation of potassium was observed as valid method identification of adulteration similar to coconut.
3	Modified CPCRI Chiller to use for both male and female palms for sap collection.	Modified chiller to be procured, observation taken from farmers.
4	Palmyrah products to be analyzed at NABL accredited labs for its nutritional values.	Few samples were analysed, further is in progress

5. RECOMMENDATION AND TECHNICAL PROGRAMMES

5.1 Session I - Genetic resources and Crop improvement

Chairman : Dr. R. K. Mathur, Director, ICAR-IIORR, Pedavegi

Co-chairman : Dr. Anitha Karun,Director (Actg), ICAR-CPCRI, Kasaragod

Convener : Dr. Siva Kumar, CRS, Aliyarnagar

Dr. Sunil Ghavale, CRS, Bhatye

1. Number of reports presented

Crop	Coconut	Oil palm	Palmyrah	Arecanut	Cocoa
Number of reports	7	5	2	1	5

2. Centres where work has been done

Crop	Coconut	Oil palm	Palmyrah	Arecanut	Cocoa
Number of centres	14	5	4	4	9

3. Non reporting centre: NIL

4. Brief description of work done and salient achievements reported

A. COCONUT

At Ambajipeta centre, among the varieties/hybrids evaluated for a period of 2014-2020 Godavari Ganga recorded significantly higher yield/palm/year (144nuts) followed by VHC-2 (135 nuts) and Kera Ganga (133 nuts) with the highest fruit weight (1393 g).

Among the Dwarf x Dwarf combinations planted during 2011 at Ratnagiri, hybrid GBGD x MOD is a promising cross for the earliness. The hybrid COD x MYD recorded the highest tender nut yield (76.7 nuts) followed by the hybrid GBGD x MOD (68.3 nuts) among the entire Dwarf x Dwarf coconut hybrids. The hybrid COD x MYD recorded maximum volume of tender nut water (602.7 ml/nut) whereas, the hybrid GBGD x MOD recorded maximum TSS with a score of 5.7 ^{0} Brix**.**

Three Dwarf x Tall location specific hybrid cross combinations were planted during 2014 as Set II at Aliyarnagar centre. Based on the observations made among the cross combinations, KTD x ET recorded lowest palm height and proved its dwarf stature than other cross combinations. Highest nut yield (64.7 nuts/palm) was recorded in KTD X ET followed by COD X ET (57.5 nuts/palm) at the age of 5 years old.

The field experiment on performance evaluation of the dwarf genotype INGR 13065 (*Niu Lekha*) was initiated at Aliyarnagar centre as un-replicated trials along with local checks (COD and KTD) during July, 2015. The germplasm INGR 13065 was found to be highly vigorous than check varieties and spathe emergence was observed at the age of 33 months after planting.

At Ambajipeta, among the hybrids under evaluation, ECT X GBGD, ECT X MYD, SKL X COD, WCT X COD and WCT X GBGD performed better during the year in terms of yield as 108.5nuts/palm, 93.2nuts/palm/yr., 88.6nuts/palm/yr. 97.4 nuts/palm/y and 95.5 nuts/palm/y, respectively in different trials.

OIL PALM

Among the 10 hybrids evaluated at Pattukkottai for growth and yield parameters, the hybrid NRCOP 4 recorded significantly higher palm height of 5.27 m, while number of leaves produced per year (25.60) was highest in NRCOP 2. The highest bunch weight of 173.25 kg/palm and per ha yield of 24.78 t/ha was recorded in hybrid NRCOP 9.

COCOA

Cocoa genotypes are under evaluation in 7 AICRPP centres covering west coast, east coast and NE regions and different cropping systems including arecanut, coconut and oil palm gardens. From the 12 year old trial at Kasaragod (Kerala), Ambajipeta (AP) and Veppankulam (TN), VTLCH-2, VTLCH-2 and VTLCH-1 were identified as best performers respectively in the regions under coconut.

5. Programme proposed for coming years

Crop	Ongoing experiments	Closed experiments	New experiments
Coconut	10	-	-
Oil palm	5	-	-
Palmyrah	2	-	-
Arecanut	2	-	-
Cocoa	5	-	-

7. General guidelines for carrying out the work, recording observations and other aspects connected with the implementation of the programme

Coconut

Coc./Gen.1: Conservation and evaluation of coconut genetic resources in different agro- climatic regions

Expt. 1: Evaluation of conserved germplasms

- The traits specific observation tables may be framed for clustering of genotypes across the centres
- Comparison of genotypes with different years of planting is to be avoided
- No. of female flowers may be added in observations in all centers
- The experiments with 4-6 years of yield stability may be concluded with salient achievements

1: Expt. 2: Collection, conservation and evaluation of location specific germplasm

- The observations on de-husked nut weight, kernel weight and copra yield and other fruit components traits recorded with high precision by following the procedures prescribed by the ICAR-CPCRI, Kasaragod
- Since, coconut is an oil yielding crop, quantification of oil yield may be taken up in all the centres
- The ability of dwarf coconut palms to withstand the cyclone, needs to be studied at Bhubaneswar centre

- Recovery pattern between the tall and dwarf cyclone affected palms may be compared and damage index also to be calculated in the centres with cyclone effects
- The proper plant health management practices and nutrient management practices may be followed strictly at Mondouri centre to reduce the pest incidence and to explore the full potential of the genotypes

Expt. 3 : Evaluation of elite germplasm

- The genotypes may be compared character wise instead of comparing centres wise.

Expt. 4: Evaluation of INGR 13065

- The total leaf length is to be measured along with the petiole portion in all the centres.

Coc./Gen. 2: Evaluation of coconut Hybrids in different agro climatic regions

Expt. 2: Evaluation of new coconut hybrids of location specific cross combinations

- The pooled data analysis will be done across the centres with similar set of hybrid combinations if possible.

2: Expt. 4: Evaluation of Tall x Tall coconut hybrids

- The abbreviation for *Laccadive Ordinary Tall* may be followed as ***LCT*** instead of *LCO* in all the centres.
- The abbreviation for *Benaulim Tall* may be followed as ***BENT*** instead of *BGR* in all the centres.
- The pooled data analysis may be attempted across the centres, after 3-4 years of attaining yield stability.

Expt. 5: Evaluation of location specific Tall x Tall coconut hybrids

- The trail may be concluded with 4-6 years of stable yield in all the centres.
- Experiment is to be continued for further one more year to come out with conclusion.
- Mother palm gardens of top performing one or two hybrid may be raised at concern centres for further production and distribution of hybrid seedlings.

Expt. 6: Evaluation of Dwarf x Dwarf coconut hybrids in different agro-climatic conditions

- The adequate numbers of harvest may be done with proper interval to exploit potential nut yield.
- Palm wise harvesting data may be recorded along with the harvesting date and it should be communicated to the PC cell for pooled statistical analysis.
- Study on endosperm quantity and quality characters may be included in all the centres along with tender nut water quality.
- Observations are to be recorded in all the palms under study to get précised experimental results.
- In all the centres, stage of tender nut harvesting is followed uniformly for recording the observations by tagging the inflorescence.

Coc./Gen. 3: Establishment of mother blocks and production of quality planting material in coconut

Expt. 1: Demonstration of released coconut varieties in different agro-climatic regions

- The best performing genotypes in the concerned centres may be multiplied and distributed to farming community for commercial planting after attaining the yield stability.
- Since, all the centres having similar set of genotypes the data may be pooled based on the characters wise and presented together in the forthcoming Annual Group Meets.

OIL PALM

OP./Gen. 8C : Evaluation of new cross combination in oil palm

- The experiment may be concluded after completion of bunch analysis
- The NRCOP 9 may be recommended for cultivation in Cauvery Delta Zone of Tamil Nadu.
- The complete data along with bunch analysis may be presented in the next Annual Group Meeting.

OP./Gen. 8 C (I) : Evaluation of new cross combinations in North East region (Pasighat)

- The complete data along with bunch analysis may be presented in the next Annual Group Meeting.
- The financial assistance under Recurring Contingencies may be utilized for bunch analysis for engaging contractual technicians.

OP./Gen. 8D (I): Evaluation of new progeny crosses combination in oil palm

- The maintenance of the palms at Pasighat centre needs to be improved with good basin management system to exploit full potential of the oil palm genotypes.
- The data analysis at Pasighat centre may be done separately.
- Bunch analysis may be carried out in the all the centres and it may present in the next Annual Group Meeting.

PALMYRAH

- Palmyrah breeders meet may be organized to discuss and strengthen the crop improvement activities of palmyrah research.

Palmy./Gen. 9: Survey and collection of palmyrah germplasm and evaluation

- Indentified best performing genotypes may be explored for variety release.

Palmy./Gen. 10: Survey and in *situ* characterization and conservation of Palmyrah germplasms for special traits

- Survey and *in situ* characterization and conservation of palmyrah germplasm for special traits may be initiated in all the centres.

ARECANUT

Arec./Gen. 4: Evaluation of varieties and establishment of mother blocks and production of quality planting material in arecanut

Activity I - Evaluation of released arecanut varieties in different agro-climatic regions

- The plant height may be recorded precisely and uniformly across the centres.

Activity II - Nucleus seed gardens for varieties

- Palm morphological, yield and quality parameters of nucleus seed gardens may be recorded in all the centres and presented in the forth coming annual group meet.

COCOA

Cocoa/ Gen.5: Evaluation of Cocoa clones/ Hybrids

Expt. 1: Performance of cocoa varieties/ hybrids as intercrop in coconut garden

(Ambajipeta, Kasaragod, Veppankulam)

- Since the trial is 12 years old in Ambajipeta and Veppankulam, last 6 years data may be compiled and sent to Dr. Elain Apshara, Principal Scientist, CPCRI, RS, Vittal along with 50-100 fermented dry beans of each varieties to assess the industrial value and to select best performing varieties for the regions.
- Kasaragod trial is completed and closed and final report may be submitted to PC

Expt. 2: Multilocation trial (MLT) of cocoa clones under palms

(Aliyarnagar, Kahikuchi, Ratnagiri, Vijayarai)

- Since the trial is 8 years old, last 4 years data may be compiled and sent to Dr. Elain Apshara, Principal Scientist, CPCRI, RS, Vittal along with 50-100 fermented dry beans of each clones to assess the industrial value and to assess the early performance of clones in the regions and cropping systems.
- Since the Kahikuchi trial is of seedling progenies, best 5 genotypes or individual best trees may be selected, multiplied through grafting/ budding and to establish clonal garden/ scion bank with 12 plants/ clone to meet the planting material demand in the NE region.

Expt.4: Establishment and maintenance evaluation of polyclonal cocoa clones in oil palm gardens (Vijayarai)

- Material Transfer Agreement (MTA) to be processed for the bi-clonal and poly-clonal orchards established at Vijayarai.
- Due care may be taken to maintain low canopy in cocoa and to safeguard damage by oil palm fronds.

Expt.5: Evaluation of fifteen clones/ hybrids under Arecanut (Sirsi)

- Selective clones will be provided from ICAR- CPCRI, RS, Vittal with MTA.

General recommendation:

- The uniform pest and disease scoring procedures may be followed across the centres to record the pest and disease incidences and intensity.
- Uniform nomenclature may be followed in all the centres while presenting the result for easy understanding.
- A uniform standardized procedures may be followed in all the centres to measure the palm girth in oil palm to get précised observations.
- Data of 8 harvests during main season may be taken for average dry bean yield/ tree/ year. Remaining may be given as potential yield.
- Incidence of major cocoa pests and diseases may be documented in the coming years as a general observation

9. Technical Programme (Project wise): 2021-22

Sl. No.	Trials	Code No.	Centre allotted	No. of centres
Coconut				
Coc./Gen.1: Conservation and evaluation of coconut genetic resources in different agro-climatic regions				
1	Evaluation of conserved germplasm	Coc./Gen.1: Expt. 1	Bhubaneswar, Navsari and Sabour	3
2	Collection, conservation and evaluation of location specific	Coc./Gen. 1: Expt. 2	Aliyarnagar, Ambajipeta, Arsikere, Bhubaneswar, Jagdalpur, Kahikuchi, Mondouri, Navsari, Pilicode, Ratnagiri, Sabour and Veppankulam	12
3	Evaluation of elite germplasm	Coc./Gen. 1: Expt. 3	Aliyarnagar, Ambajipeta, Arsikere, Bhubaneswar, Ratnagiri and Veppankulam	6
4	Evaluation of INGR 13065	Coc./Gen. 1: Expt. 4	Aliyarnagar and Ratnagiri	2
Coc./Gen. 2: Evaluation of coconut hybrids in different agro climatic regions				
5	Evaluation of new coconut hybrids of location specific cross	Coc./Gen. 2: Expt. 2	Aliyarnagar, Ambajipeta, Arsikere, Bhubaneswar, Kahikuchi, Mondouri, Ratnagiri and Veppankulam	8
6	Evaluation of Tall x Tall coconut hybrids	Coc./Gen.2: Expt. 4	Aliyarnagar, Ambajipeta,Arsikere, Bhubaneswar,Kahikuchi, Navsari, Ratnagiri and Veppankulam	8

7	Evaluation of location specific Tall x Tall coconut hybrids	Coc./Gen.2: Expt. 5	Ambajipeta, Ratnagiri and Veppankulam	3
8	Evaluation of Dwarf x Dwarf coconut hybrids in different agro climatic conditions	Coc./Gen.2: Expt. 6	Ambajipeta, Mondouri,Ratnagiri, Veppankulam and Pilicode	5
Coc./Gen. 3: Establishment of mother blocks and production of quality planting material in coconut				
9	Demonstration of released coconut varieties in different agro-climatic regions	Coc./Gen.3: Expt. 1	Aliyarnagar, Ambajipeta,Arsikere, Bhubaneswar,Jagdalpur, Kahikuchi,Mondouri, Navsari, Ratnagiri, Sabour and Veppankulam	11
10	Nucleus seed gardens for released varieties	Coc./Gen.3: Expt. 2	Aliyarnagar, Ambajipeta,Arsikere, Jagdalpur, Kahikuchi, Mondouri, Pilicode, Port Blair, Ratnagiri and Veppankulam	10
Oil palm				
1	Evaluation of new cross combination in oil palm	OP./Gen.8 C:	Pattukkottai	1
2	Evaluation of new cross combinations in North East region (Pasighat)	OP./Gen. 8C (I)	Pasighat	1
3	Evaluation of new progeny cross combinations in oil palm	OP./Gen. 8D (I)	Mulde, Pasighat, Pattukkottai and Vijayarai	4
4	Evaluation of D x P hybrids for dwarfness and yield in oil palm	OP./Gen. 8D (II)	Vijayarai	1
5	Evaluation of dwarf oil palm hybrids	OP./Gen. 9	Pattukkottai, Mulde, Pedavegi	3
Palmyrah				
1	Survey and collection of palmyrah germplasm and evaluation	Palmy./ Gen. 9	Killikulam and Pandirimamidi	2
2	Survey and in *situ* characterization and conservation of Palmyrah germplasms for special traits	Palmy./ Gen. 10	Sabour and Konda Mallepally	2

Arecanut				
Arec./Gen. 4: Evaluation of varieties and establishment of mother blocks and production of quality planting material in arecanut				
1	Evaluation of released arecanut varieties in different agro climatic regions	Arec./Gen.4: Activity I	Wakawali and Shivamogga	2
2	Nucleus seed gardens for varieties	Arec./Gen. 4: Activity II	Goa, Port Blair, Shivamogga and Wakawali	4

Cocoa				
Cocoa/Gen. 5: Evaluation of cocoa clones/hybrids				
1	Performance of cocoa varieties/ hybrids as intercrop in coconut garden	Expt. 1	Ambajipeta and Veppankulam	2
2	Multilocation trial (MLT) of cocoa clones under palms	Expt. 2	Aliyarnagar, Kahikuchi, Ratnagiri and Vijayarai	4
3	Establishment and maintenance of polyclonal garden for the production of quality planting material	Expt. 3	Thrissur	1
4	Establishment and maintenance evaluation of polyclonal cocoa clones in oil palm gardens	Expt. 4	Vijayarai	1
5	Evaluation of fifteen clones / hybrids under arecanut	Expt.5	Sirsi	1

10. Technical Programme (Centre Wise): 2021-22

Centre	**Project number**	**Number of experiments/ activities**	**Centre**	**Project number**	**Number of experiments/ activities**
Coconut			**Oil palm**		
Aliyarnagar	Coc./Gen. 1 Coc./Gen. 2 Coc./Gen. 3	3 2 2	Mulde	OP./Gen.8D (I) OP./Gen.9	1 1
Ambajipeta	Coc./Gen. 1 Coc./Gen. 2 Coc./Gen. 3	2 4 2	Pasighat Pattukkottai	OP./Gen.8C (I) OP./Gen. 8D (I) OP./Gen. 8 C	 11 1

Arsikere	Coc./Gen. 1	2		OP./Gen.8D(I)	1
	Coc./Gen. 2	2		OP./Gen.9	1
	Coc./Gen. 3	2	Vijayarai	OP./Gen.8D(II)	1
Bhubaneswar	Coc./Gen. 1	3			
	Coc./Gen. 2	2		OP./Gen.8D (I)	1
	Coc./Gen. 3	1	Pedavegi	OP./Gen.9	1
Jagdalpur	Coc./Gen. 1	1	**Palmyrah**		
	Coc./Gen. 3	2	Killikulam	Palmy./Gen. 9	1
Kahikuchi	Coc./Gen. 1	1	Pandirimamidi	Palmy./Gen. 9	1
	Coc./Gen. 2	2	**Arecanut**		
	Coc./Gen. 3	2	Wakawali	Arec./Gen. 4	2
Mondouri	Coc./Gen. 1	1	Shivamogga	Arec./Gen. 4	2
	Coc./Gen. 2	2	Goa	Arec./Gen. 4	1
	Coc./Gen. 3	2	Port Blair	Arec./Gen. 4	1
Navsari	Coc./Gen. 1	2	**Cocoa**		
	Coc./Gen. 2	1	Aliyarnagar	Cocoa/Gen 5	1
	Coc./Gen. 3	1	Ambajipeta	Cocoa/Gen 5	1
Pilicode	Coc./Gen. 1	1	Kahikuchi	Cocoa/Gen 5	1
	Coc./Gen. 2	1			
	Coc./Gen. 3	1	Ratnagiri	Cocoa/Gen 5	1
Ratnagiri	Coc./Gen. 1	3			
	Coc./Gen. 2	4	Veppankulam	Cocoa/Gen 5	1
	Coc./Gen. 3	2	Vijayarai	Cocoa/Gen 5	1
Sabour	Coc./Gen. 1	2	Thrissur	Cocoa/Gen 5	1
	Coc./Gen. 3	1	Sirsi	Cocoa/Gen 5	1
Veppankulam	Coc./Gen. 1	2			
	Coc./Gen. 2	4			
	Coc./Gen. 3	2			
Port Blair	Coc./Gen. 3	1			

11. b. Detailed Technical Programme: 2021-22

Coc./Gen. 1: Conservation and evaluation of coconut genetic resources in different agro climatic regions

Expt.1: **Evaluation of conserved germplasm**

Sl. No.	Name of the centres	Project period	
		From	To
1	Bhubaneswar	2004	Cont.,
2	Navsari	2011	Cont.,
3	Sabour	2011	Cont.,

Objectives:

- Conservation and multi-location testing of the coconut germplasm.
- Evaluation of germplasm for their yield, reaction to biotic stresses.

Experimental materials:

Centre	Genotypes/germplasm to be evaluated
Bhubaneswar	COD, MYD, MGD, Gangabondam, Sakhigopal, St.Vincent, SSG, Guam Type I, BSI, Andaman Ordinary, Zanzibar Tall, San Ramon, Benaulim Tall, WCT, Tiptur Tall and Java Tall
Navsari	COD, CGD, MYD, Gangabondam, Benaulim, PHOT, Kappadam, Seychelles, Borneo, FMS, LCT, ADOT, San Ramon, Guam, New Guinea Tall, WCT Spicata, BRR, BGL and BYL
Sabour	COD, MOD, MYD, GBGD, LCT, PHOT, ADOT, Tiptur Tall, Arasampatti Tall, ECT, Gonthembili Tall, Zanzibar Tall, Hazari Tall, Assam Green Tall and Benaulim.

Experiment details:

Replications: Un-replicated observational trial.

Plot size: Sabour - 10 palms/genotype

Bhubaneswar and Navsari: 5 palms/genotype

Activity for 2021-22

- Recording of morphological observations , **as listed in the annexure**
- Management of palms with recommended package of practices

Note:

- The germplasm in other centres may be maintained as conservation plots.
- While presenting the results, year of planting and age of palm should be given

Expt. 2: Collection, conservation and evaluation of location specific germplasm

Sl. No.	Name of the centres	Project period	
		From	To
1	Aliyarnagar	2004	Cont.,
2	Ambajipeta	2013	Cont.,
3	Arsikere	2009	Cont.,
4	Bhubaneswar	2003	Cont.,
5	Jagdalpur	2011	Cont.,
6	Kahikuchi	2005	Cont.,
7	Mondouri	2007	Cont.,
8	Navsari	2013	Cont.,
9	Pilicode	2014	Cont.,
10	Ratnagiri	2007	Cont.,
11	Sabour	2014	Cont.,
12	Veppankulam	2005	Cont.,

Objectives:

- To collect, conserve and evaluate the local land races of coconut.
- To evaluate for yield and reaction to biotic stresses.

Evaluation materials:

- 10 - 15 local germplasm collection.

Experimental design:

- 5 local germplasm in RBD, other local germplasm will be maintained as an observational trial.

Activity for 2020-21:

- Trait specific collection of local germplasm (Sabour centres)
- Recording of morphological and yield attributing observations, as listed in the annexure, in 5 palms / genotype
- Management of palms with recommended package of practices
- Recording tolerance to biotic and abiotic stress

Expt. 3: Evaluation of elite germplasm

List of elite germplasm planted in different AICRP centres

Varieties	Bhubaneswar	Ambajipeta	Arsikere	Aliyarnagar	Veppankulam	Ratnagiri
Verikkobari Tall	✔	✔	✔	✔	✔	✔
St.Vincent Tall		✔	✔			✔
Guam-II Tall		✔	✔		✔	
Guam-III Tall	✔			✔		✔
Zanzibar Tall		✔				✔
Strait Settlement		✔	✔	✔		✔
Green						
Markham Tall			✔	✔	✔	
Laguna Tall	✔				✔	
Nigerian Green	✔		✔	✔	✔	✔
Palawan Tall	✔			✔	✔	
Kenya Tall	✔	✔				
Local check	✔	✔	✔	✔	✔	✔

Objectives:

- Evaluation of coconut elite germplasms for higher copra out turn and tender nut water under different agro ecological conditions.
- Evaluation of coconut elite germplasm selections for reaction to biotic stresses.

Trial details:

Treatments: 6 +1 Local check, Design: RBD, Number of replications: 3

Plot size: 4 palms/genotype/replication, year of planting: 2015

Activity for 2021-22

- Recording of morphological observations, as listed in the annexure, in 5 palms/ genotype
- Management of palms with recommended package of practices

Expt. 4: Evaluation of INGR 13065 (Niu Leka)

Sl. No.	Name of the centres	Project period	
		From	To
1	Aliyarnagar	2015	Cont.,
2	Ratnagiri	2015	Cont.,

Objectives:

- Evaluation of INGR13065 for its growth and yield in different agro-climatic regions.

Activity for 2021-22:

- Management of palms with recommended package of practices.
- Recording growth and yield observations, as listed in the annexure, in 5 palms/ genotype

Expt. 2: Evaluation of new coconut hybrids of location specific cross combinations

Sl. No.	Name of the centres	Project period	
		From	To
1.	Aliyarnagar	2012	Cont.,
2.	Ambajipeta	2011	Cont.,
3.	Arsikere	2009	Cont.,
4.	Bhubaneswar	2008	Cont.,
5.	Kahikuchi	2009	Cont.,
6.	Mondouri	2009	Cont.,
7.	Ratnagiri	2006	Cont.,
8.	Veppankulam	2006	Cont.,

Objective:

- To evaluate the performance of newly developed hybrids involving location specific combinations in respect of yield and reaction to biotic stresses.

Genotypes*:* 5-6 location specific cross combinations.

Sl. No.	Centres	Location specific combinations to be evaluated
1.	Aliyarnagar	Arasampatti Tall x MGD, MGD x Arasampatti Tall, Kenthali x Arasampatti Tall, COD x Arasampatti Tall, COD x WCT
2.	Ambajipeta	ECT x Cochin China, GBGD x Cochin China , ECT x PHOT, GBGD x PHOT, PHOT x GBGD
3.	Arsikere	Tiptur Tall x PHOT, Tiptur Tall x LCT, LCT x MYD, LCT x MOD, Tiptur Tall x MYD, Tiptur Tall x MOD
4.	Bhubaneswar	Sakhigopal x COD, MGD x Sakhigopal , Sakhigopal x GBGD, GBGD x IND025, COD x CRP794 (IC- 0612461)
5.	Kahikuchi	Assam Green Tall (AGT) x CCNT, AGT x MYD, AGT x PHOT, Bengal Hazari x AGT, Assam Yellow Tall x PHOT
6.	Mondouri	LCT x PHOT , PHOT x LCT, ECT x Java Tall, ECT x Jamica, ECT x Bengal Hazari

7.	Ratnagiri	COD x Benaulim yellow round, COD x Pratap, COD x Benaulim Green Long, Benaulim Yellow Round x COD, Pratap x COD, Benaulim Green Long x COD
8.	Veppankulam	WCT x Kenthali, WCT x MOD, MOD x WCT, ADOT x COD,WCT x MGD and Kenthali x WCT

Experimental design: RBD; No. of Replications: Four; Plot size: 6 palms/ hybrid/ replication

Activity for 2021-22:

- Recording growth and yield observations, as **listed in the annexure**, in 5 palms/ genotype.
- Management of palms with recommended package of practices.

Expt. 4: Evaluation of Tall x Tall coconut hybrids

Sl. No.	Name of the centres	Project period	
		From	To
1.	Aliyarnagar	2011	Cont.,
2.	Ambajipeta	2011	Cont.,
3.	Arsikere	2012	Cont.,
4.	Bhubaneswar	2013	Cont.,
5.	Kahikuchi	2013	Cont.,
6.	Navsari	2013	Cont.,
7.	Ratnagiri	2011	Cont.,
8.	Veppankulam	2011	Cont.,

Evaluation materials : Five Tall x Tall hybrids *viz.,* LCT x ADOT, ADOT x ECT, BGR x ADOT, ECT x LCT, WCT x TPT + local check

Objective:

- To evaluate five Tall x Tall hybrids (developed from CPCRI) at various agro climatic regions for their growth and yield.

Experimental details

Design: RBD; Replications: 4, Number of palms per genotype per replications- 6

Activity for 2021-22:

- Recording growth and yield observations, as **listed in the annexure**, in 5 palms/ genotype.
- Management of palms with recommended package of practices.

Expt. 5: Evaluation of location specific Tall x Tall coconut hybrids

Sl. No.	Name of the centres	Project period	
		From	To
1.	Ambajipeta	2011	Cont.,
2.	Ratnagiri	2009	Cont.,
3.	Veppankulam	2009	Cont.,

Objectives:

- To evaluate location specific TxT combinations at different centres
- To evaluate for yield and reaction to biotic stresses

Seven location specific Tall x Tall combinations + 1 Check

Centres	Combinations
Ambajipeta	Java Tall x ECT, PHOT x ECT, Fiji Tall x ECT, ECT x PHOT, LCT x ECT, Cochin China x ECT, ECT x Fiji Tall
Ratnagiri	PHOT x Benaulim Green Round Tall, Benaulim Green Round Tall x PHOT, PHOT x CRP 513, CRP 513 x PHOT, CRP 514 x PHOT, PHOT x CRP514, LCT x Benaulim Green Round Tall
Veppankulam	WCT x PHOT, WCT x Cochin China, PHOT x WCT, San Ramon x ECT, ECT x Zanzibar , ECT x Java Giant, ECT x PHOT

Experimental details:

Design: RBD; Replications: 3; Number of palms per genotype per replications- 6

Activity for 2021-22:

- Recording growth and yield observations, as **listed in the annexure,** in 5 palms / genotype.
- Management of palms with recommended package of practices.

Expt. 6: Evaluation of Dwarf x Dwarf coconut hybrids in different agro climatic conditions

Name of the Centres	Project period	
	From	To
Ambajipeta	2011	Cont.,
Mondouri	2011	Cont.,
Ratnagiri	2011	Cont.,
Veppankulam	2011	Cont.,
Pilicode	2011	Cont.,

Objectives:

- To develop short statured hybrids for tender nut.
- To evaluate hybrids for tender nut, yield and quality.
- To screen the hybrids for pest and disease tolerance.

Experimental materials:

Five D x D hybrids (COD x MYD, COD x MGD, MYD x CGD, GBGD x MOD, CGD x MGD) + 1 local check.

Experimental details

Design: RBD; Replications: 4; Number of palms/ genotype/replications: 6

Activity for 2021-22:

- Recording growth and yield observations, as listed in the annexure, in 5 palms/ genotype and tender nut properties at 6th and 7th month of maturity of the nuts.
- Management of palms with recommended package of practices.

Coc./ Gen. 3: Establishment of mother palm blocks and production of quality planting materials in coconut

Expt. 1: Demonstration of released coconut varieties in different agro-climatic regions

Sl.No	Name of the Centres	Project period	
		From	To
1.	Aliyarnagar	2011	Cont.,
2.	Ambajipeta	2011	Cont.,
3.	Arsikere	2009	Cont.,
4.	Bhubaneswar	2013	Cont.,
5.	Jagdalpur	2012	Cont.,
6.	Kahikuchi	2012	Cont.,
7.	Mondouri	2011	Cont.,
8.	Navsari	2013	Cont.,
9.	Ratnagiri	2011	Cont.,
10.	Sabour	2011	Cont.,
11.	Veppankulam	2010	Cont.,

Objective:

- Demonstration trial of the performance of released cultivars in different agro climatic conditions.

Demonstration materials*:* Ten nationally released coconut cultivars

Varieties to be maintained: Kalyani Coconut -1, Gautami Ganga, Konkan Bhatye Hybrid, Kera Keralam, Kera Bastar, Kalpa Samrudhi, Kalpa Pratibha, Kalpa Mitra, Kalpa Raksha, Kalpa Dhenu and Local check.

No. palms/genotype: 10 palms.

Activity for 2021-22:

- Management of palms with recommended package of practices

Expt. 2: Nucleus seed gardens for released varieties

Varieties for large scale multiplication

Sl. No	AICRP centre	Varieties
1	Aliyarnagar	Kalpa Pratibha, Kera Keralam
2	Arsikere	Kalpatharu, Gautami Ganga
3	Ambajipeta	Gautami Ganga, Kalpa Pratibha, Kera Bastar
4	Jagdalpur	Kera Bastar
5	Kahikuchi	MYD
6	Mondouri	Kalyani Coconut 1, Kalpa Mitra, Kera Keralam
7	Ratnagiri	Gautami Ganga, East Coast Tall, Kera Bastar
8	Veppankulam	Kera Keralam, Kalpa Pratibha
9	Port Blair	CARI Annapurna, CARI Omkar, CARI Surya, CARI Chandan

Objectives:

- Establishment of nucleus seed garden for released varieties
- Production of quality planting materials

Activity for 2021-22:

- Establishment of nucleus seed garden (at Port Blair)
- Production and supply of quality seedlings of varieties and hybrids
- Management of palms with recommended package of practices

OIL PALM

OP./Gen. 8C: Evaluation of new cross combination in oil palm

Sl. No.	Name of the centres	Project period	
		From	To
1.	Pattukkottai	2006	Cont.,

Objective:

- To evaluate the performance of different hybrids for oil yield.

Ten hybrid combinations:

NRCOP 1	NRCOP 2	NRCOP 3	NRCOP 4	NRCOP 5
NRCOP 6	NRCOP 7	NRCOP 8	NRCOP 9	NRCOP 10

Design: RBD Replication: 3 No. of palms per treatment: 06

Year of planting: 2006, Spacing: 9m x 9m x 9m equilateral triangle method/Hexagonal.
Soil type: Red sandy loam

Activity for 2021-22:

- Recording of observations on growth and yield parameters, as **listed in the annexure.**
- Palm- wise bunch analysis may be undertaken
- Management of palms with recommended package of practices.

OP./Gen. 8C (I): Evaluation of new cross combinations in North East regions

Centre: Pasighat

Year of start: August, 2010

Treatments: 10 hybrid Combinations

NRCOP 21	NRCOP 22	NRCOP 23	NRCOP24	NRCOP25
NRCOP 26	NRCOP 27	NRCOP 28	NRCOP 29	NRCOP 30

Activity for 2021-22:

- Recording observations on growth and yield parameters, as **listed in the annexure.**
- Palm- wise bunch analysis may be undertaken.
- Management of palms with recommended package of practices.

OP./Gen. 8D (I): Evaluation of new progeny cross combinations in oil palm

Sl. No.	**Name of the Centres**	**Project period**	
		From	**To**
1.	Mulde	2011	Cont.
2.	Pasighat	2013	Cont.
3.	Pattukkottai	2013	Cont.,
4.	Vijayarai	2011	Cont.,

Objectives:

- Evaluation of oil palm hybrids for yield and quality

Treatment details:

NRCOP-31	NRCOP-32	NRCOP-33	NRCOP-34	NRCOP-35
NRCOP-36	NRCOP-37	NRCOP-38	NRCOP-39	NRCOP-40

Experimental design: RDB, Replications: 3, Spacing: 9 x 9 x 9m

Activity for 2021-22:

- Management of palms with recommended package of practices.
- Recording observations on growth parameters, as **listed in the annexure**.
- Recording observations on yield parameters.
- Palm wise bunch analysis may be undertaken

OP./Gen. 8D (II): Evaluation of D x P hybrids for dwarfness and yield in oil palm

Centre: Vijayarai, Year of start: 2013

Treatment details:

NRCOP-41	NRCOP-42	NRCOP-43	NRCOP-44
NRCOP-45	NRCOP-46	NRCOP-47	NRCOP-48
NRCOP-49	NRCOP-50	NRCOP-51	NRCOP-52

Activity for 2021-22:

- Management of palms with recommended package of practices.
- Recording observations on growth and yield parameters, as **listed in the annexure.**

OP./Gen. 9: Evaluation of dwarf oil palm hybrids

Centre: Mulde, Pattukkottai and Pedavegi

No. of entries: 7 (IIOPR 53 –IIOPR 59)

V1-IIOPR-53	V2-IIOPR-54	V3-IIOPR-55
V4-IIOPR-56	V5-IIOPR-57	V6-IIOPR-58
V9-IIOPR-59		

Plot size: 9 palms / plot Design: RCBD Replications: 4 Spacing: 8.5 m

PALMYRAH

Palmy./Gen. 9: Survey and collection of palmyrah germplasm and evaluation

Sl. No.	Name of the centres	Project period	
		From	To
1.	Killikulam	1995	Cont.,
2.	Pandirimamidi	1993	Cont.,

Objectives:

- To collect and conserve dwarf and high yielding palms from different parts of the country.
- Evaluation of the germplasm for growth and yield.

Activity for 2021-22:

- Survey needs to be conducted for collecting dwarf germplasm in Palmyrah growing regions based on index developed for dwarfness.
- Management of palms with recommended package of practices.
- The germplasm of palmyrah collected will be evaluated for various biometrical and yield related characters.

Palmy./ Gen 10: Survey, *In situ* characterization and conservation of Palmyrah germplasms for special traits

Centres: Konda Mallepally, Sabour

Objectives:

- To survey and identify special trait germplasms in palmyrah growing regions.
- Systematic documentation of the phenotypic traits
- In-situ conservation and further utilization of germplasm.

Activity for 2021-22:

Exploration missions will be carried out in Nalgonda Dist. of Telangana State and palmyrah growing regions in Bihar for *in situ* conservation of elite germplasm and data on special traits for different accessions will be recorded.

Observation to be recorded:

- Name of the village
- Source (wild / Farmers field)
- Plant height
- Collar girth
- Leaf number
- Fruit number

- Average no. bunches / tree
- Average no. fruits / bunch
- Average neera yield / tree

ARECANUT

Arec./Gen. 4: Establishment of mother blocks and production of quality planting material in arecanut

Activity I: Evaluation of released arecanut varieties in different agro-climatic regions

Centre: Wakawali

Varieties:

- Shriwardhani, Swarnamangala, Sumangala, Sreemangala, Mohitnagar, Mangala and Madhuramangala

Replications: 3, Varieties:7, Design: RBD, No. of palms / treatment: 6, Year of start July: 2015

Centre: Shivamogga

Varieties:

- Mangala, Sumangala, Sreemangala, Mohitnagar, Swarnamangala and Madhuramangala and Shriwardhani

Replications: 3, Varieties: 7, Design: RBD, No. of palms/replication: 6, Year of start August: 2015

Activity for 2021-22:

- Adopting package of practices
- Taking observations on growth characters.

Activity II: Establishment of nucleus seed garden of arecanut varieties.

Centres: Wakawali, Shivamogga, Port Blair and Goa

Wakawali:

- Shriwardhani- 500 plants
- Hirehalli Dwarf – 25 plants

Shivamogga:

- Hirehalli Dwarf – 50 plants (25 each planted during 2015 and 2016)
- SAS-1 – 200 plants

Port Blair:

- Samrudhi – 25 plants

Goa:

- Hirehalli Dwarf – 25 plants

Activity for 2021-22:

- Management of palms with recommended package of practices.
- Recording observations on growth characters.

COCOA

Cocoa/Gen.5: Evaluation of Cocoa clones/Hybrids

Expt. 1: Performance of cocoa varieties/ hybrids as intercrop in coconut garden

Sl. No.	Name of the centres	Year of Start	
		From	To
1	Ambajipeta	2008	Cont.,
2	Veppankulam	2008	Cont.,

Experimental details:

Ambajipeta and Veppankulam Centres

Cocoa variety/ hybrid: 6; VTLC-1, VTLCC-1, VTLCH-1, VTLCH-2, VTLCH-3 and VTLCH-4

Design: RBD; Replications: 4; No. of plants per treatment: 6

Spacing: Coconut: 7.5 m x 7.5 m; Cocoa: 3 m x 7.5 m;

Year of start: 2008-09 (Ambajipeta and Veppankulam);

Activity for 2021-22:

- Management of garden with package of practice.
- Recording of growth and yield parameters of cocoa and coconut, as **listed in the annexure.**

Expt. 2: Multilocation trial (MLT) of cocoa clones under palms

Sl. No.	Name of the centres	Year of Start	
		From	To
1.	Aliyarnagar	2013	Cont.,
2.	Kahikuchi	2015	Cont.,
3.	Ratnagiri	2013	Cont.,
4.	Vijayarai	2012	Cont.,

Objective: To assess the performance of cocoa clones under coconut/ Oil palm in different agro climatic regions

Experimental Details:

Aliyarnagar: 14 Cocoa clones (under coconut)

VTLCP-1, VTLCP-3, VTLCP-5, VTLCP-6, VTLCP-8, VTLCP-9, VTLCP-10, VTLCP-11, VTLCP-12, VTLCP-13, VTLCP-14, VTLCP-15, VTLC-16 and VTLC-9 (Control).
Design: RBD; Replications: 2; No. of plants per treatment: 6, Spacing: Coconut: 7.5 m x 7.5 m; Cocoa: 3.75m x 7.5 m.

Ratnagiri: 21 Cocoa clones (under coconut)

VTLCP-1, VTLCP-3, VTLCP-5, VTLCP-6, VTLCP-8, VTLCP-9, VTLCP-10, VTLCP-11, VTLCP-12, VTLCP-13, VTLCP-14, VTLCP-15, VTLCP-16, VTLC-1, VTLC –13, VTLC –15, VTLC –17, VTLC –18, VTLC –25, VTLC –37 and VTLC –128.

Design: RBD; Replications: 2; No. of plants per treatment: 6, Spacing: Coconut: 7.5 m x 7.5 m; Cocoa: 3.0-m x 7.5 m.

Vijayarai: 14 Cocoa clones/ hybrids (under Oil Palm)

VLTC-1, VLTC-9, VLTC-13, VLTC-17, VLTC-18, VLTC-20, VLTC-25, VLTC-36, VLTC-37, VLTC-57, VLTC-65, VLTC-128, VTLCH-3 and VTLCH-4.

Design: RBD; Replications: 2; No. of plants per treatment: 6, Spacing: Coconut: 7.5 m x 7.5 m; Cocoa: 3 m x 7.5 m.

Kahikuchi: 16 Cocoa clones/ hybrids
VTLC-13, VTLC-15, VTLC-17, VTLC-18, VTLC-20, VTLC-23, VTLC-25, VTLC-28, VTLC-36, VTLC-38, VTLC-39, VTLC-40, VTLC-128, VTLA-4A, EYT and VTLCH-1
Year of start: 2012-13 (Vijayarai), 2013-14 (Aliyarnagar and Ratnagiri) and 2015-16 (Kahikuchi)
Design: RBD; Replications: 2; No. of plants per treatment: 6, Spacing: Coconut: 7.5 m x 7.5 m; Cocoa: 3.0m x 7.5 m.

Activity for 2021-22:

- Management of gardens with package of practices.
- Recording of growth and yield parameters of cocoa and coconut, **as listed in the annexure.**

Expt.3: Establishment and maintenance of polyclonal garden for the production of quality planting material

Centre: Thrissur

Objective:

- Vegetative multiplication of genotypes with good combining ability
- Establishment of clonal garden
- Maintenance of existing clonal gardens

Sl. No	Clonal garden	No of parents	No. of plants
1	Poly clonal garden I	12	120
2	Poly clonal garden II	38	228
3	Poly clonal garden III	5	100
4	Poly clonal garden IV	8	1100
5	Poly clonal garden V	7	946
6	Poly clonal garden VI	10	400
7	Poly clonal garden VII	6	286
8	Poly clonal garden VIII	8	299
9	Poly clonal garden IX	5	178
	TOTAL	91	4900

Activity for 2021-22:

- Vegetative multiplication of already identified superior genotypes and released varieties
- Maintenance of existing clonal garden and nursery operations

Expt. 4: Establishment, maintenance and evaluation of polyclonal cocoa clones in oil palm garden

Centre: Vijayarai

Clones to be evaluated under Oil Palm (12 numbers):

VTLC-5 , VTLC-7 , VTLC-8 , VTLC-9 , VTLC-11 , VTLC-15, VTLC-19A , VTLC-30A , VTLC-63, VTLC-65 , VTLC-66 , VTLC-68.

Activity for 2021-22:

- Maintenance of existing clonal garden and nursery operations

Expt. 5: Evaluation of fifteen clones / hybrids under Arecanut

Centre: Sirsi

- VTLC-57, VTLC-65, VTLC-128, VTLCC-1, VTLCH-3, VTLCH-4, VTLC-9, VTLC-13, VTLC-15, VTLC-17, VTLC-18, VTLC-25, VTLC-36, VTLC-1, VTLC-37.

Activity for 2021-22:

- Planting and maintenance of 15 clones (Clones may be procured from ICAR-CPCRI RS Vittal)

5.3 SESSION III - CROP PRODUCTION

Chairman : Dr. B.A. Jerard, Head, ICAR-CIARI, Port Blair

Co-chairman : Dr. Ravi Bhat, Actg. Head, Crop Production, ICAR-CPCRI, Kasaragod

Convener : Dr. P. Subramanian, Principal Scientist, ICAR-CPCRI, Kasaragod

: Dr. V. V. Shinde, RCRS, Ratnagiri

1. Number of reports presented

Crop	Coconut	Oil palm	Palmyrah	Arecanut
Number of reports	6	3	1	2

2. Centres where work has been done

Crop	Coconut	Oil palm	Palmyrah	Arecanut
Number of centres	10	3	4	3

3. Non reporting centres: NIL

4. Brief description of work done and salient achievements reported

A. Coconut

- Evaluation of Coconut based multispecies cropping systems under coastal littoral sandy soil indicated maximum nut yield in Coconut + *Garcinia indica* + Pineapple cropping system with recommended nutrient application. The vegetable (snake guard) yield was maximum in Coconut + *Garcinia indica* + Vegetable crops cropping system with Green manuring + biofertilizers + organic recycling +100% RDF. The maximum pineapple (Kew) yield was recorded in Coconut + *Garcinia indica* + pineapple cropping system with Green manuring + biofertilizers + organic recycling + Soil test based nutrient application. Maximum height and girth of *Garcinia indica* was recorded in Coconut + *Garcinia indica* + Vegetable Crops cropping system with Green manuring + biofertilizers + organic recycling +100% RDF.

- Integration of coconut with pasture crops (*Cumbu Napier hybrid* + *Desmanthus*), fodder trees (*Sesbania grandiflora* + *Leucaena leucocephala* + *Glyricidia)* and Tellicherry breed of goats recorded net income of Rs. 2,54,206/- per ha with BC ratio (3.16) as compared to Rs. 1,51,312/- per ha with BC ratio(2.25) in the monocrop of coconut at Aliyarnagar centre.

- Integrated farming system with coconut, fodder and sheep recorded more number of nuts and fodder yield during the period at Arsikere centre. Integrated farming system recorded higher net returns of Rs 3, 27,290 /ha when compared with Rs. 90,150 / ha in coconut monocropping.

5. Recommendations ready for transfer to extension agency if any:
Integrated nutrient management technologies to enhance the productivity and quality of tender nut in dwarf coconut

- Site Specific Nutrient Management with secondary ($CaSO_4$. $2H_2O$ – 1 kg and $MgSO_4$ – 500 g per palm per year) + Micronutrient mixture @ 1 kg per palm per year + Coconut frond mulching + *Azospirillum* – 100 g + *Phosphobacteria* -100 g + VAM -100 g per palm per year for enhanced productivity by 32 % over farmers' practice in Tender nut variety Chowghat Orange Dwarf. Net Returns and Benefit cost ratio were Rs. 4.38 lakhs per ha and 2.99 in INM package as against Rs. 3.10 lakhs per ha and 2.66 in farmer's practice respectively.

Burmese coriander as a suitable intercrop in arecanut plantations under Andaman Island conditions

- Burmese coriander is a popular herb grown in the Andaman and Nicobar Islands. In order to study the profitability of this herb as an intercrop in the warm humid tropical conditions of South Andaman Island, study was undertaken in bearing arecanut palms of variety Samrudhi. Results suggested that incorporation of Burmese coriander in the interspaces could give higher net returns of Rs. 13,03,065/- as against Rs. 9,59,600/- in the arecanut sole crop. The B:C ratio of this treatment was found to be 3.19 and hence, it could be recommended for the island farmers.

6. Programmes proposed for coming years

Crop	Ongoing experiments	Closed experiments	New experiments
Coconut	9	1	1
Oil palm	5	-	-
Palmyrah	1	-	-
Arecanut	3	-	-

7. General guidelines for carrying out the work, recording observations and other aspects connected with the implementation of the programme

Coconut:

Coc. /Agron. 5: Studies on fertilizer application through micro-irrigation technique in coconut

- Kernel / copra weight be taken along with yield observations
- During winter, the behaviour of palms in respect of leaf, inflorescence production, anther dehiscence and pollination be recorded to ascertain the winter injury
- Efforts may be taken to find out base temperature for coconut fruit set
- Kahikuchi centre may also take the observations on same line during cold in addition to Sabour and Mandouri centres

Coc./Agron. 10(A): Development of coconut based farming systems

Expt. 1: Integration of cows in coconut based cropping system (Arsikere)

Expt. 2: Integration of sheep in coconut based cropping system (Arsikere)

- Quantification of inputs applied and output obtained in IFS modules.
- Energy budgeting should be worked out
- Effect of IFS modules on soil nutrient enrichment be presented
- Comparison of pest and disease incidence be recorded
- Optimum number of animals raised from unit area of grass produced may be worked out
- Experiments may be continued for one more year

Expt. 3 & 4 : Integration of sheep in coconut based cropping system (Aliyarnagar and Veppankulam)

- Possibility of including other components in the IFS model may be explored.
- Study on emission of methane and sequestration of CO_2could be taken up. Soil microbial load has to be estimated

Coc./Agron. 11: Coconut based cropping systems for different agro-climatic regions

Expt. 5: Evaluation of coconut based cropping system models

- Goa centre may compile the data and bring out recommendations

Expt.7: Coconut based multispecies cropping systems under coastal littoral sandy soil

- Yield of different intercrops taken may be labelled properly in the presentation with units.
- Quantification of nutrient supplied need to be worked out.

Coc./Agron. 14: Soil and nutrient management in coconut

Expt. 1: Integrated nutrient management technologies to enhance the productivity and quality of tender nut in dwarf coconut

- Experiment is concluded and report may be submitted to PC cell .

Expt 3: Organic farming in coconut based farming system

- The experiment will be continued
- Record the nutrient budgeting in the system
- Record energy budgeting in the system. Study the effect of different treatments on oil yield, fatty acid composition.

Expt. 4: Management of Root (wilt) disease in coconut (Farmer's garden)

- The experiment will be continued
- Magnesium status in soil and plant may be studied and presented

Oil palm

Op./Agron. 12: Nutrient requirement studies in oil palm under North East region

- Possibility to be explored for increasing nutrient dose to 25 t/ha based on soil/leaf analysis report in T3 treatment.
- Nursery management studies can be taken up and finalize the technical programme with the help of IIOPR scientist

OP./Agron. 13: Demonstration on oil palm production potential in North-East region

- Proposal for intercropping under oil palm may be prepared and send to ICAR-IIOPR for finalization.

OP./Agron. 21: Plant geometry and optimization of nutrients in oil palm

Expt. 2 & 3 –

- Soil analysis data may be presented properly in ppm
- Soil and leaf analysis may be done once in two years.
- Light infiltration studies and Sex ratio be recorded may be taken up in all the spacing
- Pest and disease incidence may be recorded

OP./ Agron 22. Studies on intercropping in bearing oil palm plantation

- Suitable vegetable crops including non-traditional/ underutilized, shade loving crops may be evaluated.

Arec./Agron.18:Development of arecanut based cropping systems for different agro climatic regions

Expt1. Evaluation of Arecanut based cropping system models

- Trial shall be concluded at Port Blair centre with the conclusion of better performance and profitability of Burmese coriander under arecanut gardens. The technology may be popularized through KVK.
- The final report may be submitted to PC Cell.

Arec./Agron. 20: Studies on crown chocking disorders in arecanut

- A team from CPCRI shall visit the experimental site to arrive at decision for the continuance.

New Expt. Proposed

Impact of tender nut harvesting and integrated nutrient management

- Only the identified harvesting practices shall be tried at different centres with recommended organic and inorganic fertilizers.
- Trial approved with suitable dwarf/ tall/ hybrid varieties at centres.

8. Recommendations (General)

- Replicated experiments over different stations may be combined and presented for more clarity.
- Uniform data observation template to be developed and used across the centres so that comparison and arriving at conclusions will be easier.

9. Technical programme (Project wise): 2021-22

Sl. No.	Trials	Code No.	Centre allotted	Number of centres
COCONUT				
1Coc./Agron. 5: Studies on fertilizer application through micro-irrigation technique in coconut				
i)	Studies on fertilizer application through micro-irrigation technique in coconut	Expt 1	Sabour	1
2	**Coc./Agron. 10A: Development of coconut based farming systems**			
i)	Integration of cows in coconut based cropping system	Expt. 1	Arsikere	1
ii)	Integration of sheep in coconut based cropping system	Expt. 2	Arsikere	1
iii)	Integration of goat in coconut based cropping system	Expt. 3	Aliyarnagar, Veppankulam	2
iv)	Integration of poultry in coconut based farming system	Expt. 4	Ratnagiri	1
3	**Coc./Agron. 11: Coconut based cropping systems for different agro-climatic regions**			
i)	Evaluation of coconut based cropping system models	Expt. 5	Goa and Port Blair	2
ii)	Coconut based multispecies cropping systems under coastal littoral sandy soil	Expt. 7	Bhubaneswar, Kasaragod, Ratnagiri	3
4	**Coc./Agron. 14: Soil and nutrient management in coconut**			
i)	Organic farming in coconut based farming system	Expt. 3	Aliyarnagar, Ambajipeta, Arsikere and Kasaragod	4
ii)	Management of Root (wilt) disease in coconut (Farmer's garden)	Expt. 4	Aliyarnagar	1
5	**Coc./Agron. 15: Studies on coconut harvesting frequency on growth and yield of coconut**			

i)	Studies on coconut harvesting frequency on growth and yield of coconut	Expt. 1	Aliyarnagar, Ambajipeta, Ratnagiri, Jagdalpur	4
OIL PALM				
1	**OP./Agron. 12: Nutrient requirement studies in oil palm under North East region**			
i)	Nutrient requirement studies in oil palm under North East region	Expt. 1	Pasighat	1
2	**OP./Agron. 13: Demonstration on Oil palm production potential in North East Region**			
i)	Demonstration on Oil palm production potential in North East Region	Expt. 1	Pasighat	1
3	**OP./Agron. 21: Plant geometry and optimization of nutrients in Oil palm**			
i)	Optimization of fertilizer dose for Oil palm plantation	Expt. 2	Bavikere	1
ii)	Plant geometry studies in Oil palm	Expt. 3	Bavikere	1
4	**OP./Agron. 22: Studies on intercropping in Oil palm plantation**			
i)	Studies on intercropping in bearing Oil palm plantation	Expt. 1	Mulde	1
PALMYRAH				
1	**Palmy./Agron. 23: Standardization of rooting media and containers for Palmyrah seedling production**			
i)	Standardization of rooting media and containers for Palmyrah seedling production	Expt. 1	Killikulam, Pandirimamidi Sabour K. Mallepally	4
ARECANUT				
1	**Arec./Agron.18:Development of arecanut based cropping systems for different agro climatic regions**			
i)	Intercropping in juvenile Arecanut garden	Expt. 2	Wakawali	1
2	**Arec./Agron. 20: Studies on crown chocking disorders in arecanut**			
i)	Studies on crown chocking disorders in arecanut	Expt. 1	Shivamogga	1

10. Technical programme (Centre wise): 2021-22

Centre	Project Number	Number of projects
Coconut		
Aliyarnagar	Coc./Agron. 10A, Coc./Agron. 14/Agron. 15	2
Ambajipeta	Coc./Agron. 14/Agron. 15	1
Arsikere	Coc./Agron. 10A, Coc./Agron. 14	2
Bhubaneswar	Coc./Agron. 11	1
Ratnagiri	Coc./Agron. 11, Coc./Agron. 10A/Agron. 15	2
Sabour	Coc./Agron. 5	1
Veppankulam	Coc./Agron. 10A	1
Goa	Coc./Agron. 11	1
Port Blair	Coc./Agron. 11	1
Kasaragod	Coc./Agron. 11, Coc./Agron. 14	2
Oil palm		
Pasighat	OP./Agron. 12, OP./Agron. 13	2
Bavikere	OP./Agron. 21	1
Mulde	OP./Agron. 22	1
Palmyrah		
Pandirimamidi	Palmy./Agron.23	1
Killikulam	Palmy./Agron.23	1
Sabour	Palmy./Agron.23	1
K. Mallepally	Palmy./Agron.23	1
Arecanut		
Wakawali	Arec./Agron. 18	1
Shivamogga	Arec./Agron. 20	1

11. Technical Programme 2021-22

Coc./Agron. 5: Studies on fertilizer application through micro-irrigation technique in coconut

Sl. No.	Name of the centres	Project period	
		From	To
1.	Sabour	2012	Cont.,

Objectives

- To compare the efficiency of soil application of fertilizers in coconut nutrition with drip fertigation
- To study the effect of fertigation on the productivity of coconut
- To work out the economic viability of fertigation over soil application

Treatments

T_1: Control (No fertilizer)

T_2: 25 % of the RDF (NPK) through drip system

T_3: 50 % of the RDF through drip system

T_4: 75 % of the RDF through drip system

T_5: 100 % of the RDF through drip system

T_6: 100 % of the RDF through soil application

Design: RBD, Replications: 4, Year of start: 2012-13

Date of planting of coconut: 2009; Number of palms/treatment: 4

1. Quantity of water: 66% of open pan evaporation with mulching using available sources within the farm
2. Source of nutrients:
   - Urea for Nitrogen
   - Diammonium Phosphate for Nitrogen and Phosphorus
   - Muriate of Potash for Potassium
3. Recommended dose of organic manure to be applied for all the palms

Activity for 2021-22:

- Management of palms as per the treatment schedule.
- Recording of observations **as listed in the annexure**

Coc./Agron. 10 A: Development of coconut based farming systems

Sl. No.	Name of the centres	Project period	
		From	To
1.	Arsikere	2013	Cont.,
2.	Aliyarnagar	2015	Cont.,
3.	Veppankulam	2015	Cont.,

Objectives:

- To develop location specific coconut - livestock integrated farming system models
- To study the effect of integration of livestock on the productivity of coconut
- To assess the impact of integration of livestock on soil fertility and plant nutrient content in coconut.
- To workout the economics of the model

Expt. 1: Integration of cows in coconut based cropping system

Sl. No	Name of the centre	Year of start	
		From	To
1.	Arsikere	2013	Cont.,

Treatment details:

T_1: Coconut + Fodder crops – Cows
T_2: Monocrop of coconut

IFS model: Coconut + Fodder crops – Cows system is compared with the monocrop of coconut. Area for each treatment: 0.40 ha; Year of start: 2013-14; Cows: 5

Fodder crops:

- Fodder grass: Hybrid Napier
- Fodder legumes: *Stylosanthes hamata* (in the intra-space of coconut)
- Fodder trees: Drumstick and *Sesbania grandiflora* (in the border of the plot).

Methodology: The fodder crops are raised under irrigated condition. The fodders are fed to cows through cut and carry system. The FYM from Dairy is used to partly supplement the nutrient requirement of coconut palms and grasses/ legumes. Recommended package of practices for coconut and fodder grasses/legumes will be followed.

Activity for 2021-22:

- Recording of observations **as listed in the annexure**
- Management of the system with package of practice
- Recording input and output in the system
- Energy budgeting and nutrient budgeting

Expt. 2: Integration of sheep in coconut based cropping system

Sl. No	Name of the centre	Year of start	
		From	To
1.	Arsikere	2014	Cont.,

Treatment details:

T_1: Coconut + Pasture crops – Sheep
T_2: Monocrop of coconut

IFS Model: Coconut + Pasture crops – Sheep system is compared with the monocrop of coconut. Pseudo replications will be used for taking observations.
Area for each treatment: 0.40 ha.; Year of start: 2014-15; Sheep: 20

Fodder crops: Pasture crops: *Cenchrus ciliaris* (Buffel grass) + *Stylosanthes hamata* (3:1)

Methodology: The pasture crops are raised under rainfed condition. Rotational grazing will be followed by making four compartments of 0.10 ha each. The sheep manure will be used to partly supplement the nutrient requirement of coconut palms and grasses. Recommended package of practices for coconut and pasture crops will be followed.

Activity for 2021-22:

- Recording of observations **as listed in the annexure**
- Management of the system with package of practice
- Recording input and output in the system
- Energy budgeting and nutrient budgeting

Expt. 3: Integration of goat in coconut based cropping system

Centres: Aliyarnagar, Veppankulam

Sl. No.	Name of the centres	Year of start	
		From	To
1.	Aliyarnagar	2015	Cont.,
2.	Veppankulam	2015	Cont.,

Treatment details:

T_1: Coconut + Fodder trees + Pasture crops – Goat
T2: Monocrop of coconut
Area for each treatment: 0.40 ha. Year of start: 2015-16

IFS Model : Coconut + Fodder trees + Pasture crops – Goat system is compared with the monocrop of coconut

Goat: Tellicherry breed (6 Female + 1 Male)
Pasture crops: *Cenchrus ciliaris* + *Stylosanthes hamata* (3:1) - Aliyarnagar Centre

Cumbu Napier- CO (BN5) + Desmanthus (3:1) - Veppankulam centre.
Fodder trees: *Sesbania grandiflora* + *Leucaena leucocephala* + *Glyricidia* (in the border of the plot)

Methodology: The pasture crops are raised under rainfed condition. Rotational grazing will be followed by making four compartments of 0.10 ha each. The goat manure will be used to partly supplement the nutrient requirement of coconut palms and grasses. Recommended package of practices for coconut and fodder crops will be followed.

Activity for 2021-22:

- Management of the system with package of practice
- Recording of observations **as listed in the annexure**
- Recording input and output in the system
- Energy budgeting and nutrient budgeting

Expt.4: Integration of poultry in coconut based farming system

Centre: Ratnagiri

Objectives

1. To develop location specific coconut-poultry based integrated farming system model

2. To study the effect of poultry manures on the productivity of coconut

3. To assess the impact of integration of poultry on soil fertility and plant nutrient content in coconut

4. To workout the economics of the model

Treatment details

T_1: Coconut + poultry (150 No.)

T_2: Monocrop of coconut

Area for each treatment: 0.40 ha; No. of birds: 50 (3 cycles/year)

Poultry breed: Giriraja / Kaveri; Coconut hybrid: D x T (31 years old)

Methodology

The one day old birds will be maintained in coconut garden. Coir pith will be used as bedding material in the poultry unit. There will be three cycles in a year. After each cycle, enriched coir pith will be recycled as manure in the coconut garden.

Coc./Agron. 11: Coconut based cropping systems for different agro-climatic regions
Expt. 5: Evaluation of coconut based cropping system models

Centres: Goa and Port Blair

Objectives

- To develop location specific coconut based cropping systems for different agro-climatic regions
- To assess the effect of the cropping system on the productivity of coconut
- To workout the economics of the cropping systems

Experimental details: Goa Centre

Treatments

T_1: Coconut + Black pepper + Papaya + Drumstick
T_2: Coconut + Black pepper + Heliconia + Pineapple
T_3: Coconut + Black pepper + Banana + Lemon
T_4: Coconut + Black pepper + Passion fruit + Pineapple
T_5: Coconut + Black pepper + Annona
T_6: Coconut + Black pepper + Crossandra
T_7: Coconut monocrop (control)
Design: RBD; Replications: 3; Plot size: 4 palms per treatment; Year of start: 2015-16

Activity for 2021-22:

- Management of the garden with package of practice
- Recording of growth and yield parameters of coconut and component crops

Experimental details: Port Blair

Objectives:

- To identify high yielding black pepper variety suitable for coconut plantations under Andaman and Nicobar Islands condition

Treatment details:

- Coconut variety: ADOT
- Age of coconut palm: 25 years
- Number of treatments (black pepper varieties): 11 (Panniyur-1, Panniyur-2, Panniyur-5, Panniyur-6, IISR Girimunda, IISR Malabar Excel, IISR Panchami, IISR Sakthi, IISR Sreekara, IISR Subhakara, IISR Thevum)
- Number of replications per treatment: 3
- Number of vines per replication: 7
- Standard for trailing black pepper: *Glyricidia*
- Spacing for standard: 2 m × 2 m (9 vines/ coconut interspace)
- Experimental design: RBD

Activity for 2021-22:

- Initial soil and plant nutrient status in the coconut garden
- Gap filling of standards and black pepper vines
- Record of growth and yield observations in coconut

- Adoption of recommended soil and conservation measures
- Management of black pepper following recommended package of practices

Expt. 7: Coconut based multispecies cropping systems under coastal littoral sandy soil

Sl. No.	Name of the Centre	Project period	
		From	To
1.	Bhubaneswar	2016	Cont.,
2.	Kasaragod	2015	Cont.,
3.	Ratnagiri	2015	Cont.,

Objectives

- To study the performance of intercrops in the coconut under littoral sandy soils
- To elucidate the effect of nutrient management practices on the growth of intercrops and coconut
- To know the effect of intercrops on the productivity of coconut
- To work out the economics of the system

Treatment details:

Main plot –3; Cropping systems

Kasaragod	Bhubaneswar	Ratnagiri
CS_1: Coconut + Sapota + Vegetable crops	CS_1: Coconut + Sapota + Vegetable (rainy season)	CS_1: Coconut + *Garcinia indica* + Vegetable Crops (rainy season)
CS_2: Coconut + Sapota + Flower crops	CS_2: Coconut + Sapota + Pineapple	CS_2 : Coconut + *Garcinia indica* + Pineapple
CS_3: Coconut + Sapota + Fodder crops	CS_3: Monocrop of coconut	CS_3: Monocrop of coconut
CS_4: coconut monocrop		

Sub plot – 3; Nutrient management practices

N_1: Green manuring + biofertilizers + organic recycling + FYM (as per POP)

N_2: Green manuring + biofertilizers + organic recycling + Soil test based nutrient (chemical fertilizers) application

N_3: Green manuring + biofertilizers + organic recycling + 100 % RDF

- Husk incorporation is common to all the sub plot treatments. Husk will be placed in one layer in the trenches of planting zone.
- Biofertilizers: Azospirillum and Phosphobacteria
- Green manuring: Cowpea in the basin as well as in the available interspaces of coconut

- FYM: Recommended dose to coconut as well as component crops

Treatment combinations: 3 x 3 = 9; No. of palms per treatment: 6

Design: Split plot design; Replications: 3; Year of start: 2015-16

Activity for 2021-22:

- Growing of intercrops
- Imposition of nutrient management treatments
- Recording of observations **as listed in the annexure**
- Energy and nutrient budgeting

Coc./Agron. 14: Soil and nutrient management in coconut

Expt. 3: Organic farming in coconut based cropping system

Sl. No.	Name of the centres	Project period	
		From	To
1.	Aliyarnagar	2015	Cont.,
2.	Ambajipeta	2015	Cont.
3.	Arsikere	2015	Cont.
4.	Kasaragod	2015	Cont.

Experimental details

Treatments- 5

T_1: *In situ* organic matter recycling, + PGPR consortia + *In situ* green manuring + Husk burial

T_2: *In situ* organic matter recycling, + PGPR consortia + *In situ* green manuring + Husk burial + 25 kg FYM

T_3: T1 + 50 % recommended K_2O through the application of Sulphate of potash

T_4: T2 + 50 % recommended K_2O through the application of Sulphate of potash

T_5: Conventional method (Chemical fertilizer application)

Design: RBD Replications: 4; No. of palms per treatment: 6; Year of start: 2015-16

Cropping system to be followed at different centres:

Aliyarnagar: Coconut + Cocoa

Ambajipeta: Coconut + Cocoa + Banana

Arsikere: Coconut + Lime + Drumstick

Kasaragod: Coconut + Cocoa+ Vegetables+ cover cropping system

Activity for 2021-22:

- Imposition of nutrient management treatments
- Recording of observations as listed in the annexure
- Energy and nutrient budgeting

Expt. 4: Management of root (wilt) disease in coconut (farmer's garden)

Sl. No.	Name of the centres	Project period	
		From	To
1.	Aliyarnagar	2015	Cont.,

Objective:

- Validation of root (wilt) disease management technology

Locations: 3 farmers plot, Year of start: 2015-16

i) Kanakkapillaivalasai village of Tirunelveli district

ii) Manakkadavu village of Coimbatore district

iii) Melagudalur village of Theni district

Package practices proposed based on the soil test results:

- Addition of organic manure @ 25 kg per palm
- Application of *Trichoderma viride* @ 50 g/ palm
- Sowing dhaincha seeds in coconut basin @ 100 g/ palm and incorporation before flowering
- Application of recommended dose of fertilizers based on soil test data
- Addition of 50 g Zinc sulphate per palm

Activity for 2021-22:

- Imposition root (wilt) disease management package
- Recording of observations on disease intensity, yield of coconut

Agron. 15. Expt.1 Studies on coconut harvesting frequency on growth and yield of coconut

Objectives

- To study the impact of tender nut harvesting frequency on growth and production of coconut
- To study the impact of tender nut harvesting frequency on tender nut quality
- To study the economics of the system

Treatment Details

T1- Harvesting of Tender nuts throughout the year.

T2 - Harvesting alternate bunches for tender nuts.

T3 - Harvesting of tender nuts from January to June.

T4 - Harvesting of mature nuts throughout the year.

Design: RBD **Replications**: 5; No. of palms: 6 (120 palms)

Variety : WCT/ECT or hybrids **Year of start** : 2021-22

Activity for 2021-22:

- Selection of palms for study of tender nut harvesting
- Recording of observations as listed in the annexure

OIL PALM

OP./Agron. 12: Nutrient requirement studies in oil palm under Bihar and North East region

Sl. No.	Name of the centres	Project period	
		From	To
1.	Pasighat	2019	Contd...

Technical programme:

Treatments:

- 900:450:900 g NPK/p/y
- 1200:600:1200 g NPK/p/y
- 1500:750:1500 g NPK/p/y

The dose may be fixed based on the existing soil /leaf analysis report targeting 25 t/ha and the dose of different fertilizers may be modified based on the annual analysis report.

Spacing: 9 m hexagonal; Replications: Five; Design: RBD, No. of palms/plot-6. Date of planting: July, 2019

- Quantity of water may be applied through micro-irrigation system as recommended by the ICAR-IIOPR uniformly to all the treatments.
- Fertilizer may be applied in four equal splits in a year.
- In case of T_1, T_2 and T_3, one third of the dose during first year of planting, two-third of the dose during second year of planting and full dose from third year onwards should be applied.
- Magnesium and Boron dose may be applied in T_1, T_2 and T_3 treatments as recommended by ICAR-IIOPR, Pedavegi.
- Similar trial under rainfed condition should also be taken up as most of the area in North Eastern region is under rainfed condition.

Activity for 2021-22:

Pasighat:

- Nursery management
- Main land preparation
- Planting of oil palm

Observations to be recorded

- Soil and leaf Nutrient status (Soil: pH, EC, OC, Av N, P, K, Ca Mg, S & B. in leaves: N, P, K, Ca, Mg, S, B)
- Plant height
- Number of leaves
- Stem girth
- Sex ratio

OP./Agron. 13: Demonstration on oil palm production potential in Bihar and North East region

Sl. No.	Name of the centres	Project period	
		From	To
1.	Pasighat	2006	Cont.,

No of palms: Pasighat -29

Activity for 2021-22:

- Management of oil palm with package of practices
- Recording observations on growth and yield parameters in oil palm

OP./Agron. 21: Plant geometry and optimization of nutrients in oil palm

Expt. 2: Optimization of fertilizer dose for oil palm

Centre: Bavikere

Sl. No.	Name of the centres	Project period	
		From	To
1.	Bavikere	**2018**	**Cont.**

Objectives:

- To standardize the fertilizer requirement for oil palm under irrigated condition.

Treatments: N, P and K at three levels each

N: 0, 1200 and 2400 g / palm/year

P: 0, 600 and 1200 g / palm/year

K: 0, 1800 and 3600 g / palm/year

Treatment No.	Treatments	Treatment No.	Treatments
T_1	N0 P0 K0	T_{15}	N1 P1 K2
T_2	N0 P0 K1	T_{16}	N1 P2 K0
T_3	N0 P0 K2	T_{17}	N1 P2 K1
T_4	N0 P1 K0	T_{18}	N1 P2 K2
T_5	N0 P1 K1	T_{19}	N2 P0 K0
T_6	N0 P1 K2	T_{20}	N2 P0 K1
T_7	N0 P2 K0	T_{21}	N2 P0 K2
T_8	N0 P2 K1	T_{22}	N2 P1 K0
T_9	N0 P2 K2	T_{23}	N2 P1 K1
T_{10}	N1 P0 K0	T_{24}	N2 P1 K2
T_{11}	N1 P0 K1	T_{25}	N2 P2 K0
T_{12}	N1 P0 K2	T_{26}	N2 P2 K1
T_{13}	N1 P1 K0	T_{27}	N2 P2 K2
T_{14}	N1 P1 K1		

Design: 3 Factorial RBD
Replications: 3, Plot size: 9m x 9m x 9m (7 Palm in each plot)
Variety: Tenera crosses 163D x 76P, Date of planting: 23.02.2018, Treatments: 27

Note:

- Recommended doses of Mg SO4 and Borax are to be applied at different growth stages uniformly(No organic manure to be added)
- During the first and second year of plantation, 1/3 and 2/3 of the NPK dose of the concerned treatment has to be applied.

Expt. 3: Plant geometry studies in Oil palm

Centre: Bavikere (New Centre, UAHS, Shivamogga)

Sl. No.	**Name of the centres**	**Project period**	
		From	**To**
1.	Bavikere	**2019**	**Cont.**

Treatments:

- M_1- 9 x 9 x 9 m Hexagonal method
- M_2- 9 x 9 m square method
- M_3- 10 x 10 x 10 m Hexagonal method
- M_4- 10 x 10 m square method

Design: RBD, Number of treatments: 4, Number of Replications: Five, No. of palms per treatment: 28 palms in 4 rows, Date of planting: February, 2019

- Uniform irrigation to all plots as recommended by IIOPR, Pedavegi
- Magnesium Sulphate and Borax are to be applied to all palms uniformly as recommended by IIOPR, Pedavegi
- Recommended Dose of Fertilizer (1200: 600: 1200 g NPK/ palm/ year) is to be applied in four equal splits in a year

Activities for 2021-22: (Expt. 2 and 3)

- Imposition of treatment as per the schedule
- Maintenance of palms as per the package of practices
- Soil analysis and recording the observations

Observations to be recorded:

- Soil and leaf Nutrient status (in Expt 2) (Soil: pH, EC, OC, Av N, P, K, Ca Mg, S & B. in leaves: N,P,K,Ca,Mg,S,B)
- Plant height
- Number of leaves
- Stem girth
- Sex ratio

OP./Agron. 22: Studies on intercropping in bearing Oil palm plantation

Centre: Mulde

Objective:

- To test the feasibility of growing different crops as an intercrops in oil palm garden

Treatments: 7- Each treatment in 3 Oil Palm Block

- Oil Palm + Heliconia + Black pepper
- Oil Palm + Red Ginger + Black pepper 3m x 2m plot size at 60 x 45 cm spacing
- Oil Palm + Lily + Black pepper
- Oil Palm + Bush pepper + Black pepper (Bush pepper at 1.5 x 1.5 m spacing 3 x 3 m plot size)
- Oil Palm + Black pepper (6 Black pepper)
- Oil Palm + Dracaena (Foliage plants)
- Oil Palm (sole)

Note: Age of palms: 15yr (Year of planting inter crops: July 2017)

Replications: 3

Observations to be recorded:

- Soil Nutrient Analysis (Before & After Intercropping)
- Days required for flowering
- Flowering duration
- Yield per plot (kg/plot)
- Yield per hectare (kg/ha)
- FFB equivalent yield
- Cost of cultivation
- B: C ratio

PALMYRAH

Palmy/Agron.23: Standardization of rooting media and containers for Palmyrah (*Borassus flabellifer* L.) seedling production

Centres: Pandirimamidi, Killikulam, Sabour, K. Mallepally

Objectives:

- To standardize the rooting media for multiplication of palmyra seedlings through seed
- To standardize container for multiplication and field planting

Year of start : 2019

Media- Experiment I

- T_1 –Soil (Control)+ Imida 6g/kg+ GA31000mg/L
- T_{2-} Soil + Scarification against sand + Imida 6g/kg+ GA31000mg/L
- T_3-Soil, sand and FYM mixed in 2:1:1 ratio + Imida 6g/kg+ GA31000mg/L
- T_4-Soil, sand and vermicompost mixed in 2:1:1 + Imida 6g/kg+ GA31000mg/L
- T_5-Soil, sand and poultry manure mixed in 2:1:1 Imida 6g/kg+ GA31000mg/L
- T_6-Soil, sand and composted coir pith mixed in 2:1:1 + Imida 6g/kg+ GA31000mg/L

Container- Experiment II

- T_1 –Black polythene bag (12.5 x 50 cm)
- T_2-Bamboo tube (12.5 x 50 cm)

- T_3-PVC tube (12.5 x 50 cm)
- T_4- Banana pseudo stem sheath (12.5 x 50 cm)

Replication: 4

Design: Completely Randomized Block Design

Observation

- Days taken for sprouting (days)
- Percentage of germination (%)
- Number of leaves /seedlings on 210 DAS
- Seedling height (cm) on 210 DAS

ARECANUT

Arec./Agron.18: Development of Arecanut based cropping systems for different agro climatic regions

Expt. 2: Intercropping in juvenile Arecanut garden
Centre: Wakawali

Objectives:

- To study the growth and yield performance of various intercrops in arecanut
- To workout economics of the intercropping system

Design: R.B.D. Replication: Five, No. of plants of arecanut per treatments per replications: 12

No. of plots in experiment: 20 (4 treatments & 5 replications), Net plot size of experimental Plot: 20 x 45 m, (900 sq. m), Gross plot size of experimental plot: 33 x 117 m (3861 sq. m)

Treatment details:

- T1- Arecanut + Rose apple (*Syzygium samarangensis*) (Red local Variety)- 5
- T2- Arecanut + Lemon (*Citrus limon*) (Konkan lemon Variety)- 5
- T3- Arecanut + Nutmeg (*Myristica fragrans*) (Konkan Sanyukta Variety) - 3
- T4- Arecanut alone (Shriwardhani) (Control)

Activity for 2021-22:

- Growth and yield observation of arecanut
- Growth and yield observations of intercrops
- Economics of the system

Arec./Agron. 20: Studies on crown chocking disorder in Arecanut (Hidimundige)

Centre: Shivamogga

Objectives:

- To demonstrate management strategies to overcome the crown chocking disorders in arecanut

  Year of start: 2015, Area: 1 acre; Spacing: 2.7 x 2.7 m

Technical package:

- Providing better drainage (Depth maintained 15cm below the root zone)
- Providing water through drip irrigation
- Improving aeration by application of paddy/areca husk(5kg/plant).
- Root rejuvenation by soil application of Microbial consortia (*Trichoderma harzianum*+ *Pseudomonas fluorescens* and *Bacillus megaterium* (Shivamogga isolates) @100g/plant along with two kg neem cake and 10kg of FYM/decomposed compost.
- Growing intercrops (Such as cocoa and banana) in the arecanut garden.
- Two sprays of $ZnSo_4$ @0.5% during May-June and Sep-Oct .
- Application of fertilizers based on soil and leaf analysis.

Note: The above demonstration will be conducted in one areca gardens of one acre area at Anaveri (Bhadravathi Tq.). For comparison gardens with farmer practice will be taken and monitored for further observation.

Observations:

- Before imposition of treatments : No. of infected and healthy leaves/plant
- Soil analysis of for major and micronutrients (pre-experimental site and once in two years after imposing treatments)
- Initial microbial population in the rhizosphere soil (bio control agents) before imposition of treatments and every year after imposing the treatments.
- Initial mean no. of healthy roots/sq.ft. Area/plant before imposition of treatments and every year after imposing the treatments.
- Flowering or number of bunches and yield.

Note: 1. Quantity of fertilizers to be applied will be assessed based on soil analysis

2. Other cultural practices will be followed as per package of practice

Activity for 2021-22:

- Imposition of treatments as per technical programme
- Recording growth and yield observations

5.4 SESSION IV - DISEASE MANAGEMENT

Chairman : Dr. B. K. Pandey, ADG (Hort. Sci. II) ICAR, New Delhi

Co-chairman : Dr. Vinayaka Hegde, Head, Crop Protection, ICAR-CPCRI, Kasaragod

Convener : Dr. Govardhan Rao , HRS, Ambajipeta

: Dr. Kiran kumar K C, HRES, Arsikere

1. Number of reports presented

Crop	Coconut	Oil palm	Palmyrah	Arecanut
Number of reports	4	-	-	1

2. Centres where work has been done

Crop	Coconut	Oil palm	Palmyrah	Arecanut
Number of centres	4	-	-	1

3. Non reporting centres: Nil

4. Brief description of work done and salient achievements reported

COCONUT:

Management of basal stem rot disease in coconut through biocontrol agents

Root feeding of 50 ml of EPC5 (nutrient broth)/100 ml of water at 3 months interval was most effective in managing the disease incidence at field level against the *Ganoderma* disease

Management of coconut basal stem rot disease through fungicides

The fungicide Azoxystrobin 11% + Tebuconazole 18.3% SC was effective in arresting growth of pathogen under *in-vitro*.

Management of stem bleeding disease in coconut through biocontrol agents

The palms affected with stem bleeding disease completely recovered with application of *T. harzianum* and *T. reesei* cake formulation compared to the Copper oxychloride paste application.

Management of stem bleeding disease in coconut through fungicides

The new fungicide combiproducts Azoxystrobin 11% + Tebuconazole 18.3% SC and Hexaconazole 5% + validamycin 2.5% SC were effective against mycelial growth of *Thielaviopsis paradoxa* under *in-vitro* condition. The fungicide had 100 per cent inhibition of pathogen at its recommended concentration.

Management of leaf blight disease of coconut

Root feeding with Propiconazole @ 5ml in 100 ml of water at three months intervals (January, April, July and October) was promising in combating the leaf blight in coconut.

Sequential use of fungicides against leaf blight disease in coconut

Sequential application of fungicides as root feeding with Carbendazim @ 5g in 100 ml of water during Jan, July followed by Propiconazole @ 5ml in 100 ml of water during April and October was effective in controlling the leaf blight incidence.

Demonstration of integrated leaf blight disease management

Integrated disease management modules *viz.,* cutting and removal of the severely affected leaves, root feeding with carbendazim (2g+ 100ml water), soil application of *Pseudomonas fluorescens* @ 200g/ palms and spraying of Copper oxy chloride (0.25 %) was a promising strategy for the management of leaf blight. The above management strategy reduced the leaf blight from 20.71 PDI to 16.75 PDI after 18 months of treatment.

5. Recommendations ready for transfer to extension agency if any: Root feeding with propiconozole @ 5 ml in 100 ml of water at three months intervals during Jan, April, July and October reduced the leaf blight incidence by 27.0 per cent after 36 months of treatment. This treatment also recorded the highest nut yield of 138 nuts/ palm/year and the B:C ratio of 3.7 as against 97 nuts/ palm/ year in the untreated control.

6. Programme proposed for coming years

Crop	Ongoing experiments	Closed experiments	New experiments
Coconut	14	1	-
Oil palm	-	-	-
Palmyrah	-	-	-
Arecanut	3	-	-

7. General guidelines for carrying out the work, recording observations and other aspects connected with the implementation of the programme

Coc./Path.1: Survey and surveillance of coconut disease

- In roving survey, careful observation on symptoms has to be made to distinguish the dry and wet bud rot disease of coconut. The pathogen related with the disease has to be identified properly.
- In case of fixed plot survey, the house opined that standard operating procedures has to be formulated for survey of different diseases. A committee has been constituted with Dr.Vinayak Hegde, Dr.Joseph rajkumar and scientists of plant pathology from CPCRI and all the four AICRP (Palms) centers for the same.

Coc./Path. 2: Basal stem rot of disease

- Epidemiology experiment: The ongoing experiment in the farmer's field to study the epidemiology of BSR has to be continued even though the farmer has removed the intercrop like banana from the garden. If the farmer has removed even the coconut, then change the field.
- The BSR pathogen, *Ganoderma* sp. and the bio control agents used for the experiment has to be characterized to species level in consultation with CPCRI, Kasargod.
- While calculating the per cent disease reduction, it is suggested to calculate the per cent reduction over initial disease index rather than percent reduction over control plots. The committee constituted above will also work out the standard operating procedures for the experiments before formulating the next year technical programme.

Coc./Path.3: Stem bleeding disease in coconut

- While calculating the per cent disease reduction, it is suggested to calculate the per cent reduction over initial disease index rather the per cent reduction over control.
- Suggested to record soil moisture, humidity and temperature at the time of soil drenching and root feeding with fungicides. Methods used for drenching and root feeding of fungicides in all the centres need to be uniform.

Coc./Path. 5: Leaf blight disease of coconut

- In the Epidemiology experiment the weather parameters and correlation should be rechecked
- Coc/Path5 (Exp:3): Concluding remarks may be submitted for the experiment management of leaf blight disease of coconut

Arecanut

Areca./ Path. 8: Survey and surveillance of arecanut disease

- During survey, suggested to record the PDI apart from the incidence on arecanut foliar disease

Areca./ Path. 10: Management of Basal stem rot disease of arecanut

To record the observation on quarterly interval instead of annual interval.

8. Recommendations (General):

- All the fungicides banned recently have to be dropped and new alternate fungicide to be tested under disease management trials
- New Fungicide treatments will be decided in consultation with ICAR-CPCRI
- Uniform templates for taking up observations on disease management and survey trials to be used. Template to be developed in consultation with CPCRI.

9. Technical programme (Project wise): 2021-22

Sl. No.	Trials	Code No.	Centre allotted	Number of centres
COCONUT				
Coc./Path. 1: Survey and surveillance of coconut diseases				
i)	Roving survey of coconut diseases	Expt. 1	Aliyarnagar, Ambajipeta, Arsikere and Veppankulam	4
ii)	Fixed plot survey of coconut diseases	Expt. 2	Aliyarnagar, Ambajipeta, Arsikere and Veppankulam	4
Coc./Path. 2: Basal stem rot disease				
i)	Characterization of *Ganoderma* sp. associated with basal stem rot disease in coconut	Expt.1	Ambajipeta, Arsikere and Veppankulam	3
ii)	Epidemiology and disease forecasting	Expt. 2	Ambajipeta, Arsikere and Veppankulam	3
iii)	Management of coconut basal stem rot disease through biological control agents	Expt. 3	Ambajipeta, Arsikere and Veppankulam	3
iv)	Management of coconut basal stem rot disease through fungicide	Expt. 4	Ambajipeta, Arsikere and Veppankulam	3
Coc./Path. 3: Stem bleeding disease				
i)	Management of stem bleeding disease in coconut through biological control	Expt.1	Ambajipeta and Arsikere	2
ii)	Management of stem bleeding disease in coconut through fungicides	Expt. 2	Ambajipeta and Arsikere	2
Coc./Path.5: Leaf blight disease of coconut				
i)	Yield loss estimation: Procedure for yield loss assessment in leaf blight affected palms	Expt. 1	Aliyarnagar	1
ii)	Epidemiology of leaf blight disease in coconut	Expt. 2	Aliyarnagar 1	1

iii)	Management of leaf blight disease in coconut	Expt. 3	Aliyarnagar	1
iv)	Demonstration of integrated disease management on leaf blight	Expt. 5	Aliyarnagar ArsikereAnd Ambajipeta	3
Coc./Path. 6: Root (wilt) disease in coconut				
i)	Assessing the incidence of root (wilt) disease in Tamil Nadu	Expt. 1	Aliyarnagar	1
ARECANUT				
Arec./ Path. 8: Survey and surveillance of arecanut diseases				
i)	Survey and surveillance of arecanut diseases	Expt. 1	Shivamogga	1
Arec./ Path. 9: Leaf stripe disease				
i)	Leaf stripe disease	Expt. 1	Shivamogga	1
Arec. /Path. 10: Basal stem rot disease of arecanut				
i)	Basal stem rot disease of arecanut	Expt. 1	Shivamogga	1

10. Technical programme (Centre wise): 2021-22

Crop: Centre	Project Number	Number of experiments
Coconut		
Aliyarnagar	Coc./Path.1	2
	Coc./Path. 5	4
	Coc./Path. 6	1
Ambajipeta	Coc./Path. 1	2
	Coc./Path.2	4
	Coc./Path. 3	2
	Coc./Path. 5	1
Arsikere	Coc./Path. 1	2
	Coc./Path.2	4
	Coc./Path. 3	2
	Coc./Path.5	1

Veppankulam	Coc./Path.1	2
	Coc./Path.2	4
Arecanut		
Shivamogga	Arec./Path. 8	1
	Arec./Path. 9	**1**
	Arec./Path. 10	**1**

11. Technical Programme 2021-22

Coc./Path. 1: Survey and surveillance of coconut diseases

Sl. No.	Name of the centres	Project period	
		From	To
1.	Aliyarnagar	2004	Cont.,
2.	Ambajipeta	2004	Cont.,
3.	Arsikere	2012	Cont.,
4.	Veppankulam	2004	Cont.,

Expt. 1: Roving survey of coconut diseases

Objectives

1. Survey on the incidence/ intensity of major diseases of coconut in major growing areas
2. Documentation and identification of new/emerging diseases of coconut
3. Preparation of disease maps

Methodology:

- Roving survey will be conducted twice in the year during the months of September- October and March-April.
- Four districts in each state having maximum coconut area to be selected for surveying the disease incidence/ intensity. Under each district five taluks and three revenue villages per taluk on random basis should be selected during survey. In each village three gardens should be taken for survey. The sample size would be 30 coconut palms per garden.
- The new symptoms/diseases if observed will be documented and sample will be processed for further characterization up to genus level.
- Disease distribution map should be prepared.

Observations to be recorded:

- GPS Data, Name and address of the farmer
- Date of inspection
- Variety/hybrid grown
- Age of the palm
- Nature of soil
- Irrigation sources and method of irrigation
- Intercrops grown
- Yield data from farmer if available
- Major disease incidence/ intensity
- Any disease management practices adopted
- New diseases observed if any

Expt. 2: Fixed plot survey of coconut diseases

Objective:

- To understand the both spatial and temporal distribution of diseases in a fixed plot and also to study its relation with weather parameters

Methodology:

The one acre coconut garden with sole crop where no management practices (Plant protection measures) for any of diseases are taken will be selected. However, the general packages of practices are followed for management of crop in selected garden. The initial disease index/incidence will be documented in fixed plot. Further, incidence/index will be documented once in three months for all major diseases. The soil microbial population and population of soil borne pathogens of coconut will be assessed once in a year. Further, weather parameters prevailing over the period will also be documented.

Observations to be recorded:

- Initial disease incidence/index for all major diseases
- Disease incidence/index to be recorded at January, April, July and October months for all major diseases
- Basic soil parameters like pH, soil moisture, organic carbon content should be recorded
- Soil microbial population of both beneficial as well as soil borne pathogens to be assessed once in a year

- The weather parameters viz., RH, Maximum and Minimum temperature, Rainfall and soil temperature have to be recorded throughout the year
- The experiment will continue for 3 consecutive years to study the progress of disease (40-45% progression in case of BSR and 25% in case of Stem bleeding disease to be considered as severe stage of the disease and can change the field). Further these plots should be maintained as demonstration plot with IDM measures

Coc./Path. 2: Basal stem rot disease

Sl. No.	Name of the centres	Project period	
		From	To
1.	Ambajipeta	2000	Cont.,
2.	Arsikere	2012	Cont.,
3.	Veppankulam	2000	Cont.,

Expt. 1: Characterization of *Ganoderma* sp. associated with basal stem rot disease in coconut

Note: If basal stem rot is observed during roving survey, the sample will be further characterised

Expt. 2: Epidemiology and disease forecasting

Objectives:

1. To study the survival and spread of disease in coconut in relation to weather and soil parameters and to develop a simple disease forecasting model.

Methodology:

The coconut garden having 75 palms will be selected for the study. The weather parameters viz., Relative humidity, Maximum and Minimum temperature, rainfall and soil temperature will be recorded regularly. The vertical and horizontal spread of disease will be recorded at 3 months interval i.e. January, April, July and October months and same will be correlated with weather parameters (can continue the experiment in the infected field up to 40-45% disease progression).

Observations to be recorded:

- Disease incidence/index at three months interval i.e. January, April, July and October
- Weather parameters such as relative humidity, maximum and minimum temperature, rainfall and soil temperature
- Inoculum load in the initial stage and at three months interval
- Correlation of weather parameters and disease index/incidence

- The data from previous 8-10 years has to be compiled from all three centres and incorporate in developing disease forecasting model in consultation with the statistician from CPCRI.

Expt. 3: Management of coconut basal stem rot disease through biological control agents

Objectives:

- Isolation and selection of endophytes associated with apparently healthy palms
- Characterization of effective endophytes
- Standardization of delivery system for effective isolate

Methodology:

The apparently healthy looking palms from different places will be used for the isolation of endophytic bacterium and the same will be screened against *Ganoderma* sp. through dual culture technique. The effective isolates will be characterized through morphological and molecular means. The delivery system for the effective strain will be standardized through field studies.

The three bioagents from all the three centres (presently evaluating) are to be exchanged and screened in each centres against their *Ganoderma* isolates under *in-vitro* using dual culture technique. The one effective biocontrol agent among three should be tested under field condition in all the three centres.

Treatment details:

T_1- Soil application of endophytic effective bacterial strain 100 g Talc based formulation along with FYM 50 kg

T_2- Root feeding of endophytic effective bacterial strain 50 ml broth in nutrient medium of 10^8 CFU in 100 ml water

T_3- Root feeding of Hexaconazole 3 ml/100 ml water

T_4- Untreated control

Replications – 5, Treatments – 4 and Design –RBD

All treatments should be imposed at 3 months interval

Observations to be recorded:

- Assessing the introduced microbial populations at 3 months interval
- Disease index prior to initiation of experiment and also at Three months intervals
- Yield data

Expt. 4: Management of coconut basal stem rot disease through fungicides

Objectives:

- Screening of latest systemic fungicides against *Ganoderma* sp. at different concentrations

- Evaluations of identified systemic fungicides from *in vitro* studies against basal stem rot disease under field conditions

Methodology:

The fungicides listed below in their commercial formulation are to be screened at their different dosage against *Ganoderma* sp. using poisoned food method under laboratory. The effective fungicide should be tested under field conditions.

Fungicides to be tested:

	Single fungicides		Combi products
1.	Carpropamid27.8%SC	**1.**	Azoxystrobin 4.8% w/w + Chlorothalonil 40% w/w SC
2.	Cyazafamid 34.5% SC	**2.**	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC
3.	Difenoconazole25%EC	**3.**	Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC
4.	Dinocap 48% EC	**4.**	Fluopyram 17.7% w/w + Tebuconazole 17.7% w/w SC
5.	Flusilazole 40% EC	**5.**	Azoxystrobin 11% + Tebuconazole-18.3% SC W/W
6.	Fluxapyroxad 333 g/l FS	**6.**	Famoxadone16.6%+ Cymoxanil22.1%SC
7.	Isoprothiolan 40% EC	**7.**	Fluxapyroxad 62.5g/l FS + Epiconazole 62.5 g/L EC
8.	Kitazin 48% EC	**8.**	Fluxapyroxad 167 g/l + Pyraclostrobin 333 g/l SC
9.	Kresoxim-methyl 44.3% SC	**9.**	Hexaconazole 4% + Carbendazim 16% SC
10.	Metrafenone 500 g/l SC	**10.**	Hexaconazole 5.00% + Validamycin 2.50% SC
11.	Pencycuron 22.9% SC		
12.	Picoxystobin 22.52% w/w SC		
13.	Thifluzamide24%SC		

Treatment details for field experiment:

Treatments	Details
T_1	Root feeding of Azoxystrobin 11% + Tebuconazole-18.3% SC @ 4 ml in 100 ml water (at quarterly interval)
T_2	Soil drenching of Azoxystrobin 11% + Tebuconazole-18.3% SC (@ 2ml/litre) 15 litre/palm (at quarterly interval)
T_3	Root feeding of Azoxystrobin 11% + Tebuconazole-18.3% SC @ 4 ml in 100 ml water + Soil drenching (@ 2ml/litre) 15 litre/palm (at quarterly interval)

T_4	Root feeding of Hexaconazole 5% + Validamycin-2.5% SC @4 ml in 100 ml water (at quarterly interval)
T_5	soil drenching Hexaconazole 5% + Validamycin-2.5% SC (@2ml/litre) 15 litre/ palm (at quarterly interval)
T_6	Root feeding of Hexaconazole 5% + Validamycin-2.5% SC @4 ml in 100 ml water + soil drenching (@2ml/litre) 15 litre/palm (at quarterly interval)
T_7	Root feeding of Hexaconazole@ 3ml +100 ml water at three months interval
T_8	Control

Treatments -8; Replications -3; Design – RBD

- Minimum six palms for each treatment
- First select 48 infected palms
- Calculate PDI of the selected palms and arrange ascending order of PDI. Then group them in 8 groups. First six palms in the first group and second six palms in II group and so on. Allocate all eight treatments randomly in each group.

Observations to be recorded

Disease index (DI) = 23.6 + 17.7h+ 3.6r-0.6l (Bhaskaran *et al.,* 1996)

Where h = height in meters up to which bleeding symptom has spread

r= Score for reduction in leaf size (0to 4 scale) l= number of functional leaves in the crown

Index score:

15 or less than 15	Mild
15 to 40	Moderate
More than 40	Severe

Nut yield/palm

Time interval: 3 months interval

Coc./Path. 3: Stem bleeding

Sl. No.	Name of the centres	Project period	
		From	To
1.	Ambajipeta	2005	Cont.,
2.	Arsikere	2012	Cont.,

Expt. 1: Management of stem bleeding disease in coconut through biological control

Objectives:

- To develop biocontrol based management practices for stem bleeding disease.

Treatments:

T_1: *Trichoderma virens* cake application (Patch application on the stem)

T_2: *T. reesei* paste application (As swabbing)

T_3: Chemical control

T_4: Control

Treatment -4; Replication -5; Design - RBD

Observations to be recorded: Disease incidence and spread of the disease symptom

Expt. 2: Management of stem bleeding disease in coconut through fungicides

Objectives:

- Screening of latest systemic fungicides against *Thielaviopsis paradoxa* at different concentrations
- Evaluations of identified systemic fungicides from *in vitro* studies against stem bleeding disease under field conditions

Methodology:

The fungicides listed below in their commercial formulation are to be screened at their different dosage against Stem bleeding pathogen using poisoned food method under laboratory. The effective fungicide should be tested under field conditions.

Fungicides to be tested:

Single fungicides		**Combi products**	
1.	Carpropamid27.8%SC	**1.**	Azoxystrobin 4.8% w/w + Chlorothalonil 40% w/w SC
2.	Cyazafamid 34.5% SC	**2.**	Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC
3.	Difenoconazole25%EC	**3.**	Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC
4.	Dinocap 48% EC	**4.**	Fluopyram 17.7% w/w + Tebuconazole 17.7% w/w SC
5.	Flusilazole 40% EC	**5.**	Azoxystrobin 11% + Tebuconazole-18.3% SC W/W
6.	Fluxapyroxad 333 g/l FS	**6.**	Famoxadone16.6%+ Cymoxanil22.1%SC
7.	Isoprothiolan 40% EC	**7.**	Fluxapyroxad 62.5g/l FS + Epiconazole 62.5 g/L EC
8.	Kitazin 48% EC	**8.**	Fluxapyroxad 167 g/l + Pyraclostrobin 333 g/l SC

9.	Kresoxim-methyl 44.3% SC	**9.**	Hexaconazole 4% + Carbendazim 16% SC
10.	Metrafenone 500 g/l SC	**10.**	Hexaconazole 5.00% + Validamycin 2.50% SC
11.	Pencycuron 22.9% SC		
12.	Picoxystobin 22.52% w/w SC		
13.	Thifluzamide24%SC		

Treatment details for field experiment:

Treatments	Details
T_1	Root feeding of Azoxystrobin 11% + Tebuconazole-18.3% SC @ 4 ml in 100 ml water (at quarterly interval)
T_2	Soil drenching of Azoxystrobin 11% + Tebuconazole-18.3% SC (@ 2ml/litre) 15 litre/palm (at quarterly interval)
T_3	Root feeding of Azoxystrobin 11% + Tebuconazole-18.3% SC @ 4 ml in 100 ml water + Soil drenching (@ 2ml/litre) 15 litre/palm (at quarterly interval)
T_4	Root feeding of Hexaconazole 5% + Validamycin-2.5% SC @4 ml in 100 ml water (at quarterly interval)
T_5	soil drenching Hexaconazole 5% + Validamycin-2.5% SC (@2ml/litre) 15 litre/ palm (at quarterly interval)
T_6	Root feeding of Hexaconazole 5% + Validamycin-2.5% SC @4 ml in 100 ml water + soil drenching (@2ml/litre) 15 litre/palm (at quarterly interval)
T_7	Root feeding of Hexaconazole@ 3ml +100 ml water at three months interval
T_8	Control

Treatments -8; Replications -3; Design – RBD

- Minimum six palms for each treatment
- First select 48 infected palms
- Calculate PDI of the selected palms and arrange ascending order of PDI. Then group them in 8 groups. First six palms in the first group and second six palms in II group and so on. Allocate all eight treatments randomly in each group.

Observations to be recorded

Disease index (DI) = $1.8l + 4.3t$ (Jacob Mathew et al. 1989)

Where l = lesion size (in $1000cm^2$)

t= Tapering of the palm ranging from 0 to 4

Index score:

10 or less than 10	mild
10 to 25	moderate
More than 25	severe

Nut yield/palm

Time interval: 3 months interval

Observations to be recorded:

- Mycelial growth and per cent inhibition under *in vitro* studies
- Disease index and incidence and yield under field conditions

Coc./Path. 5: Leaf blight disease of coconut

Sl. No.	Name of the centres	Project period	
		From	To
1.	Aliyarnagar	2007	Cont.,

Expt. 1: Yield loss estimation

Objective: To estimate the loss of yield in terms of number of nuts due to leaf blight disease

Procedure for yield loss assessment in leaf blight infected palms

Twenty five coconut palms infected with leaf blight disease and not imposed any management practice will be selected. The yield of these palms at each harvest will be noted and the average yield per palm over period of one year will be calculated as below.

Average yield = Total no. of nuts harvested/ No of Palms taken

Simultaneously, twenty five healthy palms of same age as that of infected palms will also be selected and yield from these palms will be recorded at each harvest. The average yield of healthy palms will be calculated as above. The yield loss from the disease will be calculated from the above data.

Yield loss = Average yield of healthy palms – Average yield of infected palms

Expt. 2: Epidemiology of leaf blight disease in coconut

Centre: Aliyarnagar

Objective:

- Relationship between survival and spread of disease in coconut in relation to weather parameters to develop a simple weather based disease prediction model

Methodology:

The weather parameters viz., RH and Temperature will be recorded using automatic weather stations. The disease intensity will be recorded at weekly interval. The simple correlation model will be developed based on the data obtained.

Observations to be recorded:

- Disease intensity to be recorded at weekly interval
- Weather parameters (RH and Temp) to be recorded at hourly interval

Expt. 3: Management of leaf blight disease in coconut

Centre: Aliyarnagar

Objective:

- Evaluation of systemic fungicides against leaf blight disease under field conditions

Design: RBD, Treatments: 7, Replications: 3

Treatment details:

Treatments	Details*
T_1	Root feeding of Tebuconazole @ 2ml + 100 ml water
T_2	Root feeding of Tebuconazole @ 5ml + 100 ml water
T_3	Root feeding of Tebuconazole @ 10ml + 100 ml water
T_4	Root feeding of Propiconazole @ 2ml + 100 ml water
T_5	Root feeding of Propiconazole @ 5ml + 100 ml water
T_6	Root feeding of Propiconazole @ 10 ml + 100 ml water
T_7	Control

* Root feeding to be done at three months interval during Jan, April, July and October

Observations to be recorded:

- Record the disease intensity during Jan and July months
- Record the functional leaves and nut yield

Expt. 5: Demonstration of integrated disease management on leaf blight

Centre: Aliyarnagar, Arsikere and Ambajipeta

Objective:

- Demonstration of integrated disease management practices for leaf blight disease of coconut

Methodology:

One acre coconut garden with leaf blight infection is to be selected for the demonstration and a separate control with 1 acre palms should be maintained. Palms of the age 30 years or below only to be selected for the experiment and the following IDM practices to be followed for all the palms.

- Removal and destruction of severely affected fronds (once in 3 months)
- Spraying of Bordeaux mixture 0.5% or copper oxychloride 0.3% two times at 45 days interval during summer months (Feb /April).
- Root feeding of Propiconazole @ 2 ml+ 100 ml water (Root feeding to be done at three months interval during Jan, April, July and October)
- Basal application of *Bacillus subtilis* @ 200g along with 50 kg FYM per year.

Observations to be recorded:

- Record the disease intensity during Jan and July months
- Record the functional leaves and nut yield

Coc./Path. 6: Root (wilt) disease of coconut

Sl. No.	Name of the centre	Project period	
		From	To
1.	Aliyarnagar	2003	Cont.,

Expt. 1: Assessing the incidence of root (wilt) disease in Tamil Nadu

Objectives:

- To monitor the spread of root (wilt) disease in Tamil Nadu (Coimbatore, Tirupur, Theni, Tirunelveli and Kanyakumari districts)
- To prepare disease distribution maps.

Activity for 2021-22:

- Per cent disease incidence in the surveyed area have to be recorded (Number of palms affected in the surveyed garden/ total no. of palms x 100) - In each district cover minimum of four blocks and in each block 10 gardens to be surveyed encompassing as many villages possible.
- Impart training to the farmers by conducting periodical training at specific locations in collaboration with department of agriculture to identify the root (wilt) affected palms and motivate them for eradication of affected palms (2 programmes/year).

ARECANUT

Arec./Path. 8: Survey and surveillance of arecanut diseases

Roving survey:

Sl. No.	Name of the centre	Project period	
		From	To
1.	Shivamogga	2018	Contd.

Activity for 2021-22:

- Roving survey will be conducted in Shivamogga district to assess the occurrence of different Arecanut diseases *viz*., Fruit rot, Bud rot, Ganoderma wilt, Bacterial leaf blight, Crown chocking, Phyllosticta leaf spot, Leaf blight, yellow leaf disease and inflorescence die back. (Survey format attached for coconut may be followed. Minimm of 50 arecanut palms to be observed)

Arec./Path.9: Leaf stripe disease

Sl. No.	Name of the centre	Project period	
		From	To
1.	Shivamogga	2019	Contd.

Design	Randomized Block Design
Method of Application:	Foliar Spray
No. of treatments	Seven
No. of replications	Three
No. of plants/Replication	Five Plants
Place	Kunchenahalli, Shivamogga Taluk
No. of Application:	3 sprays at 15 days interval
Agronomic practices	Recommended agronomic practices will be followed as per the package of practice

Treatments Details:

T_1 : Copper oxy chloride @ 0.3 g/ lit

T_2 : Streptocycline @ 0.5 g/ lit

T_3 : Kasugamycin @ 3 mlL^{-1}

T_4 : Streptocycline (0.5 g/ lit) + COC (2 g/ lit)

T_5: Kasugamycin + COC (Conika) @ 1.25g/lit

T_6: Microbial Consortia (CSSR Bio) @2.5g/lit

T_7: Untreated control

Activity for 2021-22:

- Percent disease index (PDI) (Before and 15 days after the last treatment).
- Percent disease Control

Arec./Path.10: Basal stem rot disease of arecanut

Sl. No.	Name of the centre	Project period	
		From	To
1.	Shivamogga	2019	Contd.
Design		Randomized Block Design	

Method of Application:	Drenching to the soil in the root zone
No. of treatments	Nine
No. of replications	Three
No. of plants/replication	Three
Name of Place	Arabilachi, Bhadravathi Tq.
No. of Application:	2 at half yearly interval
Agronomic practices	Recommended agronomic practices will be followed as per the package of practice
Treatments Details:	

T_1: Soil application of *T. virens* (100g) along with 2kg neem cake per palm per year

T_2: Soil application of *P. fluorescens* (100g) along with 2kg neem cake per palm per year

T_3: Soil application of *T. virens* (100g) + *P. fluorescens* (100g) along with 2 kg neem cake per palm.

T_4: Soil application of 10lts of microbial Consortia (CSSR Fusicant) per palm @ 2.5g/lit

T_5: Soil application of 10 liters of hexaconazole 5EC @ 2ml/lit water /palm followed by soil application of *T. virens (15 days after chemical application) with neem cake* 2 kg per palm

T_6: Root feeding of hexaconazole @ 3 ml in 100 ml water

T_7: Soil application *T. virens and P. fluorescens* @100g each along with neem cake@ 2kg/palm + Root feeding of 3 ml of hexaconazole (5EC) in 100 ml water.

T_8: Drenching around the plant basin with 75-100 gm of captan in 25 liters of water (Check)

T_9: Untreated Control

Observations to be recorded:

- Assessing the pathogenic and introduced microbial populations at 3 months interval
- Disease index prior to initiation of experiment and also at three month intervals
- Yield data

Activity for 2021-22:

- Percent disease intensity (PDI) (Before imposition of treatments and six months after imposition of first treatment).

5.5 SESSION V- PEST MANAGEMENT

Chairman : Dr. Chandrika Mohan, Retd. Principal Scientist (Agril. Entomology), ICAR-CPCRI, Kerala

Co-Chairman : Dr. A. Joseph Rajkumar, Principal Scientist (Agril. Entomology)ICAR-CPCRI, Regional station, Kayamkulam

Conveners : Dr. B. Vinoth Kumar, Asst. Professor, (Agril. Entomology), Coconut Research Station, Aliyarnagar

: Dr. G. S. Chandrashekar, Asst. Professor (Agril. Entomology), HRES, Arsikere

1. Number of reports presented

Crop	Coconut	Oil palm	Palmyrah	Arecanut
Number of reports	4	-	-	-

2. Centres where work has been done

Crop	Coconut	Oil palm	Palmyrah	Arecanut
Number of centres	4	-	-	-

3. Non reporting centre: NIL

4. Brief description of work done and salient achievements reported

A. COCONUT

Spiralling whitefly

The Integrated Pest Management strategies effectively reduced the incidence and intensity of rugose spiralling whitefly (RSW). In the IPM strategies adapted plot the incidence and intensity of RSW was significantly reduced from 56.6% to 28.3% and 64.3 % to 32.2% respectively when compared to the natural control were the per cent incidence and pest intensity was increased from 48.2% to 60.2% and 60.4% to 71.6% respectively. Pesticide holiday approach successfully proved for conservation of natural enemies like *Encarsia* in all localities which was effectively managing rugose spiralling whitefly infestation.

5. Recommendations ready for transfer to extension agency if any Technology: Nil

6. Programme proposed for coming years

Crop	Ongoing experiments	Closed experiments	New experiments
Coconut	4	2	3
Oil palm	-	-	-
Palmyrah	-	-	-
Arecanut	-	-	-

7. General guidelines for carrying out the work, recording observations and other aspects connected with the implementation of the programme

Coc./ Ent. 1: Pest surveillance in coconut

- Incidence of pest was found highest during November to February and hence the roving survey may be undertaken during that period with systematic recording of all pestilence data
- Standard operating procedure for pest surveillance may be developed for uniform collection and report of the pest incidence data
- When the pest incidence was observed above ETL the information should be shared with Department of Agriculture / Horticulture of the state and suitable IPM packages need to be provided to the farmers for effective pest management
- The data collected during pest surveillance may be used for preparing pest distribution maps
- The possibility of developing prediction models maybe explored
- Apart from RSW and BNW incidences, the palm whitefly *Aleurotrachelus atratus* and the nesting whitefly, *Paraleyrodes minei* which are coexisting should be recorded and reported
- Fixed plot survey may be stopped and roving survey may be intensified

Coc./ Ent. 4: Production and supply of natural enemies

- Mass production of natural enemies shall be intensified based on the demand
- Identification of natural enemies with good passport data (Molecular characterization) needs to be done for all local isolates
- Explore the possibility of involving / mass production of ladybird beetles for the management of whitefly complex in coconut

Coc./ Ent. 6: Surveillance, assessment of natural enemies and management of rugose spiralling whitefly in coconut

- Title of the study need to be changed as "Surveillance, assessment of natural enemies and management of **whitefly complex** in coconut"
- Data on per-cent parasitism of RSW by *Encarsia guadeloupae* need to collected and presented.
- Alternate host plants suitable for rearing RSW and increased production of *Encarsia guadeloupae* should be identified

- IPM for whitefly is very well standardized and optimized; hence, area wide demonstration may be taken up in pest-prone area

8. Recommendations (General)

9. Technical Programme (Project wise): 2021-22

Sl. No.	Trials	Code No.	Centre allotted	No. of centres
COCONUT				
1	Pest surveillance in coconut	Coc./Ent. 1	Aliyarnagar, Ambajipeta, Arsikere and Ratnagiri	4
2	Multi location evaluation trial of the nylon net for the management of rhinoceros beetle in coconut palms	Coc./Ent. 2.	Aliyarnagar, Ambajipeta, Arsikere and Ratnagiri	4
	Production and supply of parasitoids	Coc./Ent. 4	Aliyarnagar, Ambajipeta, Arsikere and Ratnagiri	4
3	Surveillance, assessment of natural enemies and management of whitefly complex in coconut	Coc./Ent. 6	Aliyarnagar , Ambajipeta, Arsikere and Ratnagiri	4
I	Survey and assessment of natural enemies	Expt. 1		
II	Demonstration of Integrated Pest Management of Rugose Spiralling Whitefly (RSW)	Expt. 3		
4	Coconut-based crop-habitat diversification for pest regression.	Coc./ Ent. 7	Ambajipeta, Arsikere and Ratnagiri	3

10. Technical programme (Centre wise): 2021-22

Centre	Project number	Number of experiments/ activities
Coconut		
Aliyarnagar	Coc./Ent. 1	1
	Coc./Ent. 2	1
	Coc./Ent. 4	1
	Coc./Ent. 6	2
Ambajipeta	Coc./Ent. 1	1

	Coc./Ent. 3	1
	Coc./Ent. 2	1
	Coc./Ent. 6	2
	Coc./Ent. 7	1
Arsikere	Coc./Ent. 1	1
	Coc./Ent. 2	1
	Coc./Ent. 4	1
	Coc./Ent. 6	2
	Coc./Ent. 7	1
Ratnagiri	Coc./Ent. 1	1
	Coc./Ent. 2	1
	Coc./Ent. 4	1
	Coc./Ent. 6	2
	Coc./Ent. 7	1

11. Detailed technical programme (2021-22)

Coc./Ent. 1: Pest surveillance in coconut

Sl. No.	Name of the centres	Project period	
		From	To
1	Aliyarnagar	2016	Cont.,
2	Ambajipeta	2016	Cont.,
3	Arsikere	2016	Cont.,
4	Ratnagiri	2016	Cont.,

Roving survey

Methodology:

- Survey all major coconut growing tracts of the respective state (minimum 4 districts covering diverse geographical populations) at six monthly intervals *i.e.,* September-October & March-April.
- In a district cover minimum 5 taluks/ villages selecting five gardens in each village/taluk. From each garden 25 palms at random should be observed for detailed pest incidence
- Farm details as per following proforma may be collected.

Name & address of farmer : District: Taluk Village GIS	
Distance from the HQ	
Date of survey	
Age of the palms	
Number of palms /farmer holding	
Variety	
Management practices (fertilizer, organic manures etc)	
Irrigation	
Intercrops	
Pest status	
Weather parameters (temperature; RH)	
Pesticide / bioagent usage pattern	

Detailed pest wise observations

1. Rhinoceros beetle

- Per cent of palms infested (out of 100 palms /garden) – The top 10 fronds in each palm with single/ multiple cuts to be observed
- Per cent leaf damage (25 palms at random /garden) (infested /total number of leaves x100)
- Breeding sites in the vicinity to be recorded along with pest stages

2. Coconut eriophyid mite

- Per cent nut infested (mite infested nuts/total nuts) (25 palms at random /garden)
- Damage grade (mature bunch) (intensity 0-4 scale) (out of minimum 100 nuts /garden) using CPCRI scales as follows

CPCRI scale			
Per cent damage on nut surface	**Scale**	**Grade Index**	**Intensity**
Nuts with no mite damage	0	0	Nil
< 25 %	1	0.1 – 1.0	Mild
25 – 50%	2	1.1 – 2.0	Moderate
50 – 75%	3	2.1 – 3.0	High
> 75%	4	3.1 – 4.0	Severe

3. Red palm weevil

- Per cent of palms infested (out of total palm (>100) /garden) with typical symptom of RPW
- Symptoms of infested palm (list out and document symptoms observed on infested palm)

4. Black headed caterpillar (from endemic spot)

- Per cent leaf damage (infested leaf/total leaf) (50 palms/garden)
- Record active pest stage (Larvae on 100 leaflets at random/garden)

5. Other pests (slug caterpillar, rodents, scales, mealy bugs, bagworms nut borers, white flies, root grubs, termites etc.)

- Per cent leaf damage: (Infested leaves/ total leaves x 100). To be worked out for slug caterpillar, scales, mealy bugs, bagworms and whiteflies.
- Per cent nut borer damage: (Nuts with borer damage / total nuts x 100). To be worked out for nut borer damage.
- Per cent incidence: (No. of palms with termite infestation in trunk/ total palms x 100). To be worked out for termites.
- Per cent incidence: (No. of palms with fallen nuts / total palms x 100). To be worked out for rodents/ palm civet damage.
- No. of root grubs per square metre: To be recorded at four different spots in 1 acre (in root grub infested gardens).
- Natural enemies, if any, (from the leaflets collected) should be identified and studies to be initiated on mass multiplication.

Coc./Ent. 2. Multi location evaluation trial of the nylon net for the management of rhinoceros beetle in coconut palms

Objective:

- To evaluate the effectiveness of the nylon netting technology for management of rhinoceros beetle in coconut palms

Sl. No.	Name of the centres	Project period	
		From	To
1	Aliyarnagar	2021	Cont.,
2	Ambajipeta	2021	Cont.,
3	Arsikere	2021	Cont.,
4	Ratnagiri	2021	Cont.,

Experimental details

Coconut varieties/ Hybrids – Age between 2 - 6 years

No. of palms: 30 (minimum)

Method of treatment imposition:

1. Wrapping the spear leaf base with 2-3 adjacent leaf base with nylon nets (size – 3.2 x 3.2 cm)
2. When new leaf emerges, nylon net should be loosened and rewrapped suitable to the newly emerged leaf.

Observations to be recorded

1. Before imposing treatment, number of damaged leaves due to beetle attack and total number of leaves per palm should be counted.
2. After imposing treatment, number of beetles entrapped in the net should be counted at weekly intervals.
3. Per cent reduction in damaged leaves should be made after treatment by again counting the number of damaged leaves and total number of leaves per palm.

Coc./ Ent. 4: Production and supply of parasitoids

Sl. No.	Name of the centres	Project period	
		From	To
1	Aliyarnagar	2016	Cont.,
2	Ambajipeta	2016	Cont.,
3	Arsikere	2016	Cont.,
4	Ratnagiri	2016	Cont.,

Year of start: 2016

Technical programme:

- Parasitoids of coconut black headed caterpillar *viz.*, *Bracon brevicornis* and *Goniozus nephantidis* have to be produced in all the AICRP (Palms) centres and distributed in areas where BHC problem is noticed.
- *Goniozus nephantidis* may be recollected from the black headed caterpillar infested gardens (with precise GPS data) and subjected to molecular analysis at ICAR-CPCRI, Kasaragod.

Coc./ Ent. 6: Surveillance, assessment of natural enemies and management of rugose spiralling whitefly in coconut

Centres: Ambajipeta, Arsikere, Ratnagiri and Aliyarnagar centres

Expt. 1: Surveillance and assessment of natural enemies

Methodology

- Observations on RSW incidence shall be made at monthly intervals from three pest infested gardens with varietal details, age of palm and meteorological data
- Five palms shall be selected at random in each garden for observation
- Whitefly infestation should be recorded as:

1) Percentage of leaves infested/palm :

No. of leaves infested by RSW /total leaf per palm x 100

2) Intensity of pest damage from four pest infested leaves per palm from the outer/middle whorl representing four directions (no. of leaflets infested by RSW/ total leaflets per leaf)

3) One leaflet from each observed sample leaf shall be collected and brought to laboratory for assessment of live colonies, pest stages and natural enemies (total of 4 leaflet/palm) (20 leaflets/ plot)

- Information on pest incidence on alternate hosts if any in the garden should also be documented.

Expt. 3: Demonstration of Integrated Pest Management of Rugose Spiralling Whitefly (RSW)

Center : Aliyarnagar, Ambajipeta, Ratnagiri and Arsikere

Objective:

- Demonstration of integrated pest management of Rugose Spiralling Whitefly

Methodology

- One acre coconut garden with Dwarf genotype is to be selected for the demonstration and a separate control with 1 acre palms should be maintained. Palms of the age 5-8 or below only to be selected for the experiment and the following IPM practices to be followed for all the palms.
- Installation of yellow sticky traps in the garden
- Three rounds of neem oil spray 0.5% at 15 days interval
- Three rounds of jet water spray 10 days after spraying neem oil

Observation to be recorded

- Grade pest intensity on palm and detailed observation on pest before treatment and after 10 days of last treatment imposition.

Coc. / Ent. 7: Coconut-based crop-habitat diversification for pest regression.

Center: Ambajipeta, Ratnagiri and Arsikere

Objective :

- To evaluate the effectiveness of ecological engineering (diversification of crop habitat) for pest regression

Activity 2021-22

- Selection and planting of intercrops in coconut garden

5.6 SESSION V - POST HARVEST TECHNOLOGY OF PALMYRAH

Chairman : Dr. K. B. Hebbar, Actg. Head, PB & PHT, ICAR-CPCRI, Kasaragod

Convener : Dr. P. C. Vengaiah, HRS, Pandirimamidi

: Dr. C. Ravindran, TNAU, Killikulam

1. Number of reports presented

Crop	Coconut	Oil palm	Palmyrah	Arecanut
Number of reports	-	-	1	-

2. Centres where work has been done

Crop	Coconut	Oil palm	Palmyrah	Arecanut
Number of centres	-	-	4	-

3. Non reporting centres: NIL

4. Brief description of work done and salient achievements reported

- Jaggery powder prepared form fresh neera (CPCRI method collection) gives good colour and shelf life up to one year, whereas jaggery from traditional method turns into dark colour and spoil within 3 months under room temperature with normal packing.
- Palmyrah tender fruit processing machine developed by CIAE was evaluated and it reduces drudgery and time for endosperm separation. It was also observed that the machine is useful for both skilled and unskilled person at cottage level selling of endosperm.
- Dehydrated tuber and tuber flour was commercialized and through an NGO (ASHA Chinturu, AP) one consignment was sent to UK and income generated to tribal people.

5. Recommendations ready for transfer to extension agency if any-

- NIL

6. Programme proposed for coming years

Crop	**Ongoing experiments**	**Closed experiments**	**New experiments**
Coconut	-	-	-
Oil palm	-	-	-
Palmyrah	6	-	-
Arecanut	-	-	-

7. General guidelines for carrying out the work, recording observations and other aspects connected with the implementation of the programme

Palmy./PHT.1 Standardization and commercialization of inflorescence sap (neera) extraction and inflorescence sap based products (jaggery, palm sugar and candy)

- Alcohol content to be measured in neera collected through herbals
- Energy calculation to be done for neera collection and processing
- Cost economics of neera and neera based products to be analysed
- Discussion with microbiologist for probiotics of neera
- Commercialization of palmyrah products through startups

8. General Recommendations: Nil

9. Technical programme (Project wise): 2021-22

Sl. No.	Trials	Code No.	Centre allotted	Number of centres
PALMYRAH				
1	Standardization and commercialization of Inflorescence sap (Neera) extraction and Inflorescence sap based products (Jaggery, Palm Sugar and Candy)	Palmy./ PHT. 1	Killikulam, Konda Mallepally, Pandirimamidi and Sabour	4
2	Standardization of tuber flour based food products (like Pizza, Bakery items, confectionery, health mix etc.)	Palmy./ PHT. 2	Pandirimamidi	1
3	Utilization of palmyrah plant parts for the extraction of fibre and fuel	Palmy./ PHT. 3	Pandirimamidi	1
4	Standardization of preservation technique for palmyrah tender fruit endosperm (*Nungu*)	Palmy./ PHT. 4	Pandirimamidi	1
5	Popularisation of climbing device	Palmy./ PHT. 5	Killikulam, Konda Mallepally, Pandirimamidi and Sabour	4
6	Evaluation of palmyrah tender fruit processing machine developed by CIAE centre	Palmy./ PHT. 6	Killikulam, Konda Mallepally, Pandirimamidi and Sabour	4

10. Technical Programme (Centre wise): 2021-22

Centre	Project Number	Number of projects
Pandirimamidi	Palmy./PHT. 1	1
	Palmy./PHT. 2	1
	Palmy./PHT. 3	1
	Palmy./PHT. 4	1
	Palmy./PHT.5	1
	Palmy./PHT.6	1
Killikulam	Palmy./PHT. 1	1
	Palmy./PHT.5	1
	Palmy./PHT.6	1
Konda Mallepally	Palmy./PHT. 1	1
	Palmy.PHT.5	1
	Palmy./PHT.6	1
Sabour	Palmy./PHT. 1	1
	Palmy./PHT.5	1
	Palmy./PHT.6	1

11. Technical Programme (2021-22) (Ongoing/Revised/New)

Palmy./PHT. 1: Standardization and Commercialization of Inflorescence sap (Neera) extraction and Inflorescence sap based products (Jaggery, Palm Sugar and Candy)

Sl. No.	Name of the centres	Project period	
		From	To
1.	Killikulam	2013	Cont.,
2.	Pandirimamidi	2009	Cont.,
3.	Konda Mallepally	2018	Cont.,
4.	Sabour	2018	Cont.,

Objective:

- Standardization of process for inflorescence sap based products

Activity I: Shelf life studies of neera

Neera collection methods:

- Traditional method (lime added)

- CPCRI Method

Storage study of neera and neera based beverages

Storage conditions:

- Ambient and
- Refrigerated conditions (10°C)

Process parameters:

- Control
- Sterilization (120°C)
- Carbonated /Sulphited (0.01% KMS)

Parameters to be evaluated (every 10 days interval)

- Chemical constituent (TSS, Acidity, Vitamin C, protein, Total sugars)
- Microbial load and sensory quality

Activity II: Freeze drying of sap and its shelf life studies

Center :Pandirimamidi

- o Independent parameters: Additives (%), Time
- o Dependent parameters: Recovery(%), Solvability, Flowability, Moisture content

Activity III. Mechanization of Neera tapping in male palms

Parameters to be studied

a. Size and shape of the spathe

Factors: Age of the palms

Age of the spathe

b. Development of concept for slicing mechanism

Palmy./PHT. 2: Standardization of tuber and tuber flour based food products (like Pizza, Bakery items, confectionery, health mix etc.)

Sl. No.	Name of the Centres	Project period	
		From	To
1.	Pandirimamidi	2016	Cont.,

Objective:

- Development of value added food products from palmyrah tuber flour

Activity for 2021-22

- Studies on antioxidant and anti nutritional factor of tuber flour and composite flour
- To be analyzed at NABL laboratory

Palmy./PHT. 3: Utilization of palmyrah plant parts for the extraction of fibre and fuel

Sl. No.	Name of the Centres	Project period	
		From	To
1.	Pandirimamidi	2015	Cont.,

Objective: Utilisation of fibres from palmyrah

Activity for 2021-22:

- Survey on different type of fibre from palmyrah and its utilisation
- Evaluation of fibres for Basic properties.

Palmy./PHT. 4: Standardization of preservation technique for Palmyrah tender fruit endosperm (*Nungu*)

Sl. No.	Name of the Centres	Project period	
		From	To
1.	Pandirimamidi	2009	Cont.,

Activity I: Studies on Osmotic dehydration of tender fruit endosperm

Independent parameters:

Pre-treatment, Sugar syrup concentration

Dependent parameters :

Water loss (%), Sugar gain (%), Moisture content (%w.b)

Palmy./PHT. 5: Popularisation of climbing device

Objective: Popularisation of climbing device (Joseph model) among the youths.

Sl. No.	Name of the centres	Project period	
		From	To
1.	Killikulam	2018	Cont.,
2.	Pandirimamidi	2008	Cont.,
3.	Konda Mallepally	2018	Cont.,
4.	Sabour	2018	Cont.,

Activity for 2021-22:

- Training youths for climbing Palmyrah with climbing device

Palmy./PHT. 6: Evaluation of Palmyrah tender fruit processing machine developed by CIAE centre

Objective: Evaluation of palmyrah tender fruit processing machine for its efficiency.

Sl. No.	Name of the centres	Project period	
		From	To
1.	Killikulam	2019	Cont.,
2.	Pandirimamidi	2019	Cont.,
3.	Konda Mallepally	2019	Cont.,
4.	Sabour	2019	Cont.,

Activity for 2021-22:

- Evaluate the machine developed by CIAE for the efficacy of Palmyra tender fruit processing

5.6 SESSION VI – TRANSFER OF TECHNOLOGY

Chairman : Dr. K. Muralidharan, Actg. Head (Social Sciences), ICAR-CPCRI, Kasaragod

Co-chairman : Dr. C. Thamban, Principal Scientist (Agri Extension) ICAR-CPCRI, Kasaragod

Convener : Dr. Jagdeesha, Scientist (Hort.), HRES, ArsikereDr. Rinku M. Phukon, Scientist (Hort.), HRS, Kahikuchi

Technical session VI: List of Presentation

Sl. No.	Centre Name	Presentation personnel
1	Aliyarnagar, Veppankulam and Pattukkottai, Killikulam	Dr. Sudhalakshmi
2	Ambajipeta, Vijayarai and Pandirimamidi, Pedavegi	Dr. Govardhan Rao
3	Arsikere, Shivamogga and Bavikere	Dr. Kirankumar
4	Ratnagiri, Mulde and Wakawali	Dr. S. M. Wankede
5	Jagdalpur, Pasighat and Sabour	Dr. Beena Singh
6	Navsari, Kahikuchi, Bhubaneswar and Mondouri	Dr. Pankaj P. Bhalerao
7	Goa and Port Blair	Dr. Arunachalam

General recommendation

1. Transfer of technology activities are to be reported as per the format in a uniform manner clearly indicating the extension methods
2. Functional linkages with KVK's, Dept. of Agri/Hort and FPOs are to be strengthened
3. Efforts to be made for online TOT programmes

PLENARY SESSION

Chairman : Dr. A.K. Singh, DDG (HS), ICAR, New Delhi

Co-Chairman : Dr. B.K. Pandey, ADG (HS II), New Delhi

Convener : Dr. Ajit Arun Waman, ICAR-CIARI, Port Blair

The Plenary Session of the XXX AGM of AICRP on Palms began with the welcome of the Chairman, Co-Chairman and Directors of the host institutes by Dr. Anitha Karun, Director, ICAR-CPCRI and PC, Palms (I/c.). Considering the limitation of irrigation water in most of the places, drip irrigation was advised to be promoted. While recommending this, economic analysis including yield advantage, water conservation, pesticide and fertilizer use efficiency should be calculated. Use of interactive/ artificial intelligent based systems to address various issues faced by the farmers was the need of an hour considering the country's Digital Agriculture policy. He made special emphasis on validation of "intercropping in oil palm garden to enhance the income" needs to be strengthened and Evaluation of promising cocoa hybrids as intercrop in palms under different regions are to be intensified. India contributes to about 60% of the global arecanut production. However, there are impediments in promotion of this crop. For this, he suggested to take up collaborative interdisciplinary studies including clinical trials to get scientific backup about the facts. Further, he opined that existing literature about the health effects of arecanut consumption needs to be documented and such compilations should be used for creation of awareness among the masses.

Following technologies were released for the farming community

- Site Specific Nutrient Management with secondary ($CaSO_4$. $2H_2O$ – 1 kg and $MgSO_4$ – 500 g per palm per year) + Micronutrient mixture ($FeSO_4$, $MnSO_4$, $CuSO_4$, $ZnSO_4$, Borax and ammonoium molybdate) @ 1 kg per palm per year + Coconut frond mulching + *Azospirillum* – 100 g + *Phosphobacteria* -100 g + VAM -100 g per palm per year enhanced productivity by 32 % over farmers' practice in tender nut variety Chowghat Orange Dwarf. Net Returns and Benefit cost ratio were Rs. 4.38 lakhs per ha and 2.99 in INM package as against Rs. 3.10 lakhs per ha and 2.66 in farmer's practice respectively.
- Burmese coriander is a popular herb grown in the Andaman and Nicobar Islands. The herb was grown as an intercrop in bearing arecanut palms of variety Samrudhi to study the profitability of this herb as an intercrops in the warm humid tropical conditions of South Andaman Island. Results suggested that introduction of Burmese coriander in the interspaces could give higher net returns of Rs. 13,03,065/- as against Rs. 9,59,600/- in the arecanut sole crop. The B:C ratio of this treatment was found to be 3.19 and hence, it could be recommended for the island farmers.
- Root feeding with propiconozole @ 5 ml in 100 ml of water at three months intervals during Jan, April, July and October reduced the leaf blight incidence by 27.0 per cent after 36 months of treatment. This treatment also recorded the highest nut yield of 138 nuts/ palm/year and the B:C ratio of 3.7 as against 97 nuts/ palm/year in the untreated control.
- The plenary session ended with the vote of thanks by Dr. Ravi Bhat, PC Cell, ICAR-AICRP on Palms.

4. Project Coordinator's Report

The All India Coordinated Research Project on Palms of Indian Council of Agricultural Research (ICAR) under National Agricultural Research System (NARS) started functioning from 1972 is a unique mechanism for testing location-specific and need-based innovations in different agro-climatic conditions of the country. At present the project has coconut, oil palm, arecanut, palmyrah and cocoa as mandate crops and it is implemented in 28 centres. Its headquarters is at ICAR-CPCRI, Kasaragod and 15 centres are conducting research on coconut, six on oil palm, four on arecanut, four on palmyrah and seven on cocoa. The coordinating centres are located in 14 states and one union territory covering 13 SAUs/SHUs, one CAU and four ICAR institutes.

The budget for the year 2020- 21 was Rs. 575.64 lakhs and the scheme is implemented through the respective state Agricultural/Horticultural Universities on 75:25 basis, with 75% ICAR share, 25% share from State Agricultural Universities and with 100% ICAR funding in the case of Central Agricultural Universities and ICAR Institutes.

(Rs. in lakhs)

Sl. No.	Head	Expenditure
1.	Pay and allowances	420.04
2.	T.A.	0.50
3.	RC	113.10
4.	TSP	12.00
5.	SCSP	30.00
	Total	**575.64**

Events Conducted:

29th Annual Group meeting of AICRP on Palms

The ICAR-Central Plantation Crops Research Institute, Kasaragod, Kerala organized the *"Virtual 29th Annual Group Meeting of All India Coordinated Research Project on Palms"* from 10th to 11th August, 2020. Dr. A. K. Singh, Deputy Director General (Hort. Sci.) was the chief guest of the function and Dr. B. K. Pandey, Assistant Director General (Hort. Sci-II), ICAR; New Delhi was the guest of honour. Dr. Anitha Karun, Director, ICAR-CPCRI, Kasaragod welcomed the dignitaries and delegates in which she applauded the positive concern of the Deputy Director General over the health of the palm scientists across the nation. She also highlighted the long standing relation of the Assistant Director General with CPCRI. The Director was concerned about the increasing pests and disease attack on coconut and called upon the palm scientists to join hands to restore the glory of the palm. Dr. H. P. Maheswarappa, Project Co-ordinator, AICRP (Palms), briefed about the activities of project dealing with the mandate crops such as coconut, oil palm, palmyrah, arecanut and cocoa distributed across 28 AICRP centres of 14 states and one Union Territory with collaboration of 13 SAUs, four

ICAR institutes and one CAU. He added that total budget outflow during last year was 543.60 lakhs. Twenty three research papers, 62 popular articles, 6 extension folders and 2 technical bulletins were published during 2019 -20. He informed that impact assessment of cyclone hit areas in the Western ghats of the country, management of the debilitating pests of coconut - Rugose Spiraling Whitefly employing the parasitoid *Encarsia guadeloupe* and development of Multi-tier and Integrated Farming System models are the noteworthy contributions of AICRP (Palms). Effective Transfer of Technology from lab to land through diverse tools and modes remain the major strength of this AICRP programme. He also highlighted that AICRP (Palms) has contributed for release of three technologies which are recommended to the farming community. The Assistant Director General highlighted that all the research programme of AICRP (Palms) needs to be tailored to go in tandem with the present extraordinary situation.

In his inaugural address, the honorable Deputy Director General gave a bird's eye view of the overall growth of horticultural sector and its significant contribution to GDP and nutritional security of the nation with special emphasis on oil palm. He hinted that carbon sequestration potential of palms may be explored, to take over research forward in the era of climatic vagaries. He underlined the need for developing high yielding varieties, user friendly technologies for the betterment of the farm front and to connect ourselves with the farmers with benefitting technological outputs. He portrayed that adoption of remunerative location specific intercrops and integration of animal enterprises in coconut ecosystem through IFS approaches can help farmers to realize better income than sole cropping. He noted the fluent financial grants of Government of India for agricultural sector, with gratitude. In the backdrop of COVID pandemic, he inspired the palm scientists and invited them to explore every possibility to reach the pinnacle of success in palm research by advocating the farmers on diverse avenues for revenue generation with technological platform.

Dr. R. K. Mathur, Director, IIOPR, Pedavegi suggested that high yielding traditional varieties of oil palm be conserved for scaling up its production. Dr. Maheswarappa, H. P., The Project Co-ordinator proposed the vote of thanks. The crop experts also provided their valuable suggestions / recommendations for further improving the efficacy of the AICRP on Palms. The detailed progress made during 2019-20 was presented and the technical programmes for ensuing next year were finalized during the Webinar. A total of 70 participants from various parts of the country participated in the Virtual Meeting including scientists from AICRP centres and ICAR institutes. The inaugural session was followed by technical sessions on genetic resources and crop improvement, crop production, crop protection and post harvest technology.

Following technologies have been recommended to farming community:

- **Intercropping of Panniyur-1:** Based on evaluation, black pepper variety Panniyur-1 recorded significantly higher number of spikes, spike length, number of berries per spike and dry yield compared to other varieties/hybrid. Hence, Panniyur-1 is recommended for intercropping under coconut gardens in the Assam and West Bengal region.
- **Integrated management of Eriophyid mite**: Integrated Nutrient Management as well as Integrated Pest Management packages involving application of recommended dose of fertilizers with 20 kg vermicompost and 5 kg neem cake, growing of green manuring with Cowpea / sunnhemp in the

inter rows, application of Keraprobio (100 g/palm) and root feeding with fenpyroximate 5% EC @ 10 ml (March) and spraying of palm oil-sulphur emulsion (December) is recommended as it was effective in reducing infestation of Eriophyid mite in coconut.

- **Integrated management of slug caterpillar**: The IPM packages comprising mechanical removal and destruction of larval and pupal stages, installation of light traps @ 5/ha, application of recommended dose of fertilizers, spraying of insecticide chlorantraniliprole 18.5 % SC @ 0.3 ml/ litre and release of potential parasitoid *Pediobius imbreus* @ 60/palm is recommended in order to effectively manage the incidence of slug caterpillar in coconut.
- **Management of rugose spiralling whitefly**: Installation of yellow sticky traps in coconut garden is recommended for effective attraction of RSW in coconut in order to mitigate their incidence.

Monitoring Reviews

Due to rampant COVID-19 pandemic situation in all around the country, the project coordinator has made review meetings to monitor the technical programmes, budget utilization and progress of the projects of all the centres as per the need through virtual mode. Time to time advice and direction was given for proper implementation of the technical programmes through emails, personal contact and over direct contact via phone as and when required. Monthly progress report and budget utilization information were obtained from centres regularly and the same were reviewed critically. During the review meetings, discussions were held with concerned scientists of ICAR-AICRP on Palms for the smooth functioning of the research programmes. During review meeting, PC has given guidelines for proper utilization of budget, publications and improving the technical programmes.

Linkage and Collaborative programmes:

ICAR-AICRP on palms has linkage and collaboration with following bodies is being undergoing in different centres.

a) Coconut Development Board

b) State department of agriculture/ horticulture

c) ICAR Institutes

d) AICRPs (Fruits, Spices, Mushroom etc...)

e) Coconut produces companies

Publications:

During the reported period the scientists have published 13 research articles in national and international journals besides the papers presented in national conferences, workshops (14 No's). Most of the centres could bring out, technical bulletins (2 No's), books (2 No's), and popular articles (30 No's) in the regional languages.

Transfer of Technology

Centres were imparting training to extension officers, farmers, end-users and extension workers as and when needed. Various diagnostic field visits were made by the scientists of the centres to resolve the field level problems of farmers. The centres were participated in other activities such as demonstration of technologies in farmer's field and participated in social media (TV, Radio) programmes for effective dissemination of the eco-friendly technologies to the farming community.

Research Achievements during 2020-21

COCONUT

CROP IMPROVEMENT

- At Ambajipeta centre, among the varieties/hybrids evaluated for a period of 2014-2020 Godavari Ganga recorded significantly higher yield/palm/year (144nuts) followed by VHC-2 (135 nuts) and Kera Ganga (133 nuts) with the highest fruit weight (1393 g).
- Among the Dwarf x Dwarf combinations planted during 2011 at Ratnagiri, hybrid GBGD x MOD is a promising cross for the earliness. The hybrid COD x MYD recorded the highest tender nut yield (76.7 nuts) followed by the hybrid GBGD x MOD (68.3 nuts) among the entire Dwarf x Dwarf coconut hybrids. The hybrid COD x MYD recorded maximum volume of tender nut water (602.7 ml/nut) whereas, the hybrid GBGD x MOD recorded maximum TSS with a score of 5.7 ^{0} Brix**.**

CROP PRODUCTION

- Evaluation of Coconut based multispecies cropping systems under coastal littoral sandy soil indicated maximum nut yield in Coconut + *Garcinia indica* + Pineapple cropping system with recommended nutrient application. The vegetable (snake guard) yield was maximum in Coconut + *Garcinia indica* + Vegetable crops cropping system with Green manuring + biofertilizers + organic recycling +100% RDF. The maximum pineapple (Kew) yield was recorded in Coconut + *Garcinia indica* + pineapple cropping system with Green manuring + biofertilizers + organic recycling + Soil test based nutrient application. Maximum height and girth of *Garcinia indica* was recorded in Coconut + *Garcinia indica* + Vegetable Crops cropping system with Green manuring + biofertilizers + organic recycling +100% RDF.
- Integration of coconut with pasture crops (*Cumbu Napier hybrid* + *Desmanthus*), fodder trees (*Sesbania grandiflora* + *Leucaena leucocephala* + *Glyricidia)* and Tellicherry breed of goats recorded net income of Rs. 2,54,206/- per ha with BC ratio (3.16) as compared to Rs. 1,51,312/- per ha with BC ratio(2.25) in the monocrop of coconut at Aliyarnagar centre.
- Integrated farming system with coconut, fodder and sheep recorded more number of nuts and fodder yield during the period at Arsikere centre. Integrated farming system recorded higher net returns of Rs 3, 27,290 /ha when compared with Rs. 90,150 / ha in coconut monocropping.
- An assessment of economics of pepper cultivation as mixed crop in coconut garden revealed that Panniyur-1 realised the highest net returns (Rs. 2,50,903/- per ha) as well as B:C ratio of 3.73 followed by Sreekara (Rs. 2,21,776/- per ha, B:C = 3.30) and the lowest net returns (Rs. 1,84,846/ ha) and B:C ratio (2.72) was observed in IISR- Malabar Excel at Ratnagiri centre.

CROP PROTECTION

Disease Management

- 13 new systemic fungicides were tested against the growth of *Ganoderma spp.* under *in vitro* condition with three concentrations viz., 100, 250 and 500 ppm. The results revealed that, Hexaconazole 4% + Carbendazim 16% SC, Hexaconazole 5% + validamycin 2.5% SC and Azoxystrobin 11% + Tebuconazole-18.3% SC were superior as compared to other fungicides in terms of per cent inhibition.
- The relation between weather parameters (relative humidity, temperature and rainfall) and vertical and horizontal spread of Basal Stem Rot disease was studied.. While relative humidity (+0.875) and rainfall (+0.41) showed significant positive correlation with the disease, the temperature (-0.877) showed negative correlation.
- Application of *T. harzianum* and *T. reesei* cake formulation completely cured the stem bleeding disease in coconut when compared to the application of copper oxychloride paste. Disease index of 7.96 and 6.95 was brought down to 0.0 within 50 days with application of *Trichoderma harzianum* cake (CPCRI cake) and *Trichoderma reesei* cake formulation at Ambajipeta.

Pest Management

- A total of 6600 numbers of *Bracon hebetor*, 1,77,050 numbers of *G nephantidis*, 17100 numbers of *P. imbrues*, 242 Tricho cards and **32,61,100** number s of *P. astur* eggs were supplied to the farmers of East Godavari, West Godavari, Visakhapatnam and Srikakulam districts of Andhra Pradesh, Bhadradri Kothagudem, Medchal and Khammam districts of Telangana from Ambajipeta centre. Coconut fronds or leaflets containing parasitized puparia were collected from the affected ecosystem and released in newer areas of infestation. At Aliyarnagar centre, a total of 12,561 packets of *Encarsia* parasitoid were distributed to about 4000 farmers.
- The IPM strategies (Installation of yellow sticky traps in the garden, Three rounds of neem oil spray 0.5% at15 days interval and three rounds of jet water spray 10 days after spraying neem oil)for the management of rugose spiralling whitefly was started during the month of November 2018, in the COD palms (Age 15 years old) at Aliyarnagar centre. The results revealed that the application of IPM strategies significantly reduced incidence and intensity of rugose spiralling whitefly from 52.2% to 22.5% and 48.2 % to 20.5% respectively when compared to the natural control where the percent incidence and pest intensity was increased from 45.2 to 56.2% and 50.5% to 58.5% respectively.

OIL PALM

- Among the 10 hybrids evaluated at Pattukkottai for growth and yield parameters, the hybrid NRCOP 4 recorded significantly higher palm height of 5.27 m, while number of leaves produced per year (25.60) was highest in NRCOP 2. The highest bunch weight of 173.25 kg/palm and per ha yield of 24.78 t/ha was recorded in hybrid NRCOP 9.

- Among the evaluated hybrids at Pattukkottai, the hybrid NRCOP -32 recorded significantly higher palm height (5.18 m) and palm girth (3.55 m), while number of leaves produced per year was the highest in NRCOP 39 (24.90). With respect to yield parameters the hybrid NRCOP 38 recorded the highest bunch weight (16.80 kg), FFB yield per palm of 155.40 kg and FFB yield (22.22 t/ha).
- Seven different intercrops were evaluated in oil-palm garden at Mulde. The maximum yield of oil palm was recorded in treatment Oil Palm + Red Ginger + Black pepper with bunch yield of 166.2 kg /palm. The bush pepper recorded maximum yield of 0.726g per plant and maximum yield of dry berries was 1.05 kg/plot.

ARECANUT

- In order to increase the profitability of arecanut farming in the islands, arecanut based cropping systems with herbal spices *viz*. arecanut + Burmese coriander 'CARI Broad Dhaniya 1', arecanut + coriander 'ArkaIsha' and arecanut + mint were established and were highly remunerative to farmers in Andaman and Island regions.
- Population dynamics of biocontrol agents such as *Trichoderma* spp*, Pseudomonas* spp. and *Bacillus* spp. in the rhizosphere soil of demonstration garden of crown chocking management showed considerable increase in their population after imposition of the treatments. However, among the biocontrol agents, *Pseudomonas* spp. *and Bacillus spp*. showed comparatively higher population followed by *Trichoderma* spp.

COCOA

Based on performance evaluation of cocoa varieties/hybrids as intercrop in coconut garden, the best performing clones were identified under multi location trial. VTLCH-2, VTLCP-16, VTLC- 20, VTLC-17 and VTLCH-4 from Ambajipeta, Aliyarnagar, Kahikuchi, Ratnagiri and Navasari respectively registered the maximum pod weight, single dry bean weight, numbers of beans/pod and dry bean yield/ tree/year.

PALMYRAH

- Jaggery powder prepared form fresh neera (CPCRI method collection) gives good colour and shelf life up to one year, whereas jaggery from traditional method turns into dark colour and spoil within 3 months under room temperature with normal packing.
- Palmyrah tender fruit processing machine developed by CIAE was evaluated and it reduces drudgery and time for endosperm separation. It was also observed that the machine is useful for both skilled and unskilled person at cottage level selling of endosperm.
- Dehydrated tuber and tuber flour was commercialized and through an NGO (ASHA Chinturu, AP) one consignment was sent to UK and income generated to tribal people.

7.2 TEMPLATE DATA SHEET FOR RECORDING OBSERVATIONS

7.2.1 Crop Improvement

1. COCONUT

Age of palms: 1-5 years

Growth attributes

1) Height: Plant height from base of trunk to tip of the second leaf from top (cm)

2) Girth: Girth at base (cm)

3) Leaf parameters:

- Annual Leaf production (number)
- Functional leaves (number)
- Total leaf length (cm)
- Petiole length (cm)

Flowering

- Age at first flowering (months)

Age of palms: 5-8 years

Growth attributes

1) Palm height: from base to the crown region (cm)

2) Girth at base (cm)

3) Leaf parameters:

- Annual Leaf production (number)
- Functional leaves (number)
- Total leaf length (cm)
- Petiole length (cm)

Floral biology parameters

1) Age at first flowering (months)

2) Inflorescence production per annum (number)

3) Average number of spikes (number)

4) Average number of buttons (number)

5) Male phase (number of days)

6) Female phase (number of days)

7) Overlapping phase (number of days)

8) Setting percentage: (number of nuts/number of buttons) *100 observed from a single inflorescence

For parameters from 3-8, Data to be recorded from at least five inflorescences per palm and average to be arrived

Harvest data

1) Number of nuts harvested per annum

Age of palms: from ninth year onwards

Growth parameters

1) Height: Palm height from base of the trunk to the crown region (cm)

2) Girth: Girth measured at 1metre height from the base of the trunk (cm)

3) Crown shape: circular, semi circular or x shape

4) Leaf scars in 1m length of trunk (to be assessed at 1m above the ground)

5) Length of 10 internodes

6) Leaf parameters:

- Leaf production per year (number)
- Functional leaves (number)
- Total leaf length (cm)
- Petiole length (cm)

Harvest parameters (Data to be recorded from individual palms of each genotype and mean data of the genotype to be presented)

1) Number of bunches produced per annum

2) Number of bunches in button stage

3) Number of bunches in fist and nut stage

4) Number of nuts harvested per annum

5) Bearing habit (regular/alternate)

Tender nut parameters

(Observations to be taken from 6-7th month old nuts

Number of nuts per palm to be analysed: 4 nuts)

1) Water content (ml)

2) Weight of husk

3) Sweetness of water: Good, Average, Poor

4) Taste of tender nut endosperm: Good, Average, Poor

Matured nut parameters

- Observations to be taken from 11th or 12th months old nuts
- Number of nuts per palm to be analysed : 4 nuts per palm per harvest
- Number of palms per genotype : 3 palms
- Data to be recorded from all the replications
- In a year at least 5 harvest data should be recorded.

1) Fruit colour

2) Fruit shape

3) Fruit length (cm)

4) Fruit breadth (cm)

5) Fruit weight (cm)

6) Dehusked nut weight (cm)

7) Kernel weight (g)

8) Kernel thickness (cm)

9) Shell thickness (cm)

10) Shell weight (g)

11) Husk thickness (cm)

12) Copra content (g/nut)

13) Copra yield per palm per annum and copra yield per ha

2. OIL PALM

Recording observations in crop improvement trials

1. **Number of leaves**: The number of leaves is recorded on quarterly basis and is expressed as per palm per year. The first opened leaf is identified and marked with paint (say red colour) in the petiole region for easy identification. In next quarter also the first opened leaf is identified and marked with the same colour paint. The number of leaves in between two marked leaves will indicate the number of leaves produced during that quarter. Likewise, the count is recorded in all fours quarter; the total of four observations will give number of leaves produced in a year.

2. **Number of inflorescences**: The petiole of 17th opened leaf of each palm is marked with paint (say yellow colour). In next quarter also 17th leaf is marked with same colour paint. The inflorescences are counted in between two such marked leaves (yellow painted) and are recorded as number of male inflorescence, female inflorescences and/or hermaphrodites. . Likewise, the count is recorded in all fours quarters; the total of four observations will give total number of inflorescences produced in a year.

3. **Sex Ratio**: The sex ratio is computed as follows:

$$\text{Sex ratio} = \frac{\text{Number of female inflorescences}}{\text{Total number of inflorescences}}$$

4. **Plant height**: The palm height is recorded in centimetres/ meters as under:

4.1. Upto 6 years age: The height is recorded from ground level to tip of the first opened leaf

4.2. 6-8 years of age: The height is recorded from ground level to base of 25th leaf

4.3. More than 8 years: The height is recorded from ground level to 41st leaf base

5. **Stem girth:** The stem girth is recorded as circumference at the palm base; care should be taken to avoid the extended leaf base tip and expressed as centimeters/ meters.

6. **Yield Parameters**: The Fresh Fruit Bunch (FFB yield) is recorded as under:

6.1. Number of bunches: The number of bunches are recorded on per palm basis in every harvest basis and expressed on yearly basis as numbers per palm per year.

6.2. Bunch Weight: The bunch weight is recorded on every harvest basis in kilograms and expressed on yearly basis as kg/palm/year.

6.3. Average bunch weight: It is estimated as under; it is expressed in kg:

$$\text{Average bunch weight} = \frac{\text{Bunch weight}}{\text{Total number of bunches}}$$

3. ARECANUT

Seedling growth attributes: (up to 4 yrs)

1) **Collar girth:** measured at collar region seedling (cm).

2) **Number of leaves/seedling:** The number of leaves present in the seedling.

3) **Number of leaves produced in a year and other leaf parameters**

4) **Seedling height:** measured from base of the seedling to the tip of the oldest leaf (cm).

Adult palm growth attributes: (above 4 yrs)

1) **Height:** From base of the palm to the base of crown (m).

2) **Crown shape:** Drooping, partially drooping or erect.

3) **Crown length:** From the base of the crown to the tip of the crown (m).

4) **Girth above fixed mark:** Measured in cm at 1 m height.

5) **Internode length:** Length of the internodes in cm at 1 m height.

6) **Leaf parameters:**

a) **Number of leaves:** Number of leaves present on the crown.

b) **Length:** Length of the oldest leaf from the base of the petiole to the tip of the leaf (cm).

c) **Breadth:** Measured from the tip of the left leaflet to the tip of the right leaflet in the middle portion of the oldest leaf (cm).

d) **Leaf sheath length:** Measured from the base of the leaf sheath to the point of attachment with the leaflets (cm).

e) **Leaf sheath breadth:** Measured at the broadest portion (middle) of the leaf sheath (cm).

f) **Crinkling at the tip of the leaflets:** Crinkling of the leaf at its tip.

g) **Leaflets (number):** Counted on both left and right hand sides.

h) **Midribs (number):** Counted on both left and right hand sides.

7) **Floral biology parameters:**

a) **Initiation of flowering:** The period in months from the date of planting (one year old seedling) to flowering.

b) **Spadix length:** From the base of the inflorescence to the tip (cm).

c) **Spadix breadth:** Broadest portion (middle) of the spadix (cm).

d) **Number of female flowers:** Number of female flowers produced per inflorescence.

e) **Duration of female phase:** Period in days between the opening of the first female flower and opening of the last female flower in an inflorescence.

f) **Intra spadix overlapping of male and female phases:** Period in days between the male phase and female phase of the same inflorescence.

8) **Infructescence parameters:**

a) **Orientation:** Erect, intermediate or drooping.

b) **Arrangement of nuts:** Loose, intermediate or compact.

9) **Fruit parameters:**

a) **Colour:** Yellow, deep yellow, orange or deep orange.

b) **Shape:** Round, oval or oblong.

c) **Fresh weight:** Weighed immediately after the harvest (g).

d) **Length:** Measured in polar zone of the nut (cm).

e) **Breadth:** Measured in equatorial zone of the nut (cm).

f) **Husk thickness:** Measured in the equatorial zone of the split nut (cm).

g) **Dry weight:** Measured after drying in sunlight (g).

h) **Dry weight/palm:** Measured per palm (kg).

i) **Husk weight:** Weighed immediately after dehusking the dried nut (g).

10) **Kernel attributes:**

a) **Length:** Measured at the polar zone of the kernel (cm).

a) **Breadth:** Measured at the equatorial zone of the kernel (cm).

b) **Dry weight:** Weighed after dehusking the nut (g)

c) **Recovery percentage:** Measured as ratio of the weight of the dried kernel to the weight of the fresh nut expressed in percentage.

4. COCOA

Growth parameters: Plant height, girth, height at first branching, no. of branches, canopy spread, canopy volume, pruning weight, growth habit

Pod characteristics: Pod colour, pod surface, No. of pods/tree/year (healthy + diseased), pod weight, no. of beans per pod, husk thickness, husk: bean ratio, single dry bean weight, dry bean yield/tree/year, wet: dry ratio, shelling %, recovery %

4. **Component crops:** Plant height, No. of branches, canopy spread, yield attributing characters & yield
5. **Pasture and Fodder crops:** Yield at different harvests
6. **Cows:** Yield of milk, yield of cow dung and urine
7. **Sheep and Goat:** Lamb production, gain in body weight and yield of droppings.
8. **Soil analysis:** Initial soil analysis for OC, N, P, K and secondary nutrients and then, once in 3 years.
9. **Plant analysis:** For N, P, K content- initial status, then, once in 3 years for coconut
10. **Economic analysis:** Net Present Value (NPV), Internal Rate of Return (IRR), Payback period and B: C ratio will be analyzed in the system in comparison with monocrop.
11. Quantity of FYM, sheep manure, vermin compost produced and used in the system
12. Light interception studies
13. Soil microbial population (Bacteria, fungi, actinomycetes and other beneficial microorganisms)
14. Earthworm population
15. Pests and disease incidence

7.2.2 DISEASE MANAGEMENT

Roving survey of coconut diseases

Format for collecting / recording data

Name & address of farmer : Village : Taluk : District :		
01	GPS Data	
02	Distance from HQ	
03	Date of inspection	
04	Age of Palms	
05	Area/ No. of Palms	
06	Variety/ hybrid grown	Tall Dwarf hybrids Dwarf
07	Nature of Soil	
08	Irrigation sources/ method	
09	Intercrops grown	
10	Management Practices	
11	Yield data from farmer if available	
12	Randomly select 30 palms in a farm and observe for disease (Out of 30 palms)	
	a. BSR	No of palms :
	b. SB	No. of Palms
	c. Bud rot	No. of Palms
	d. Leaf blight	No. of Palms: Disease Score :
	e. Leaf spot	No. of Palms: Disease Scale:
13	New diseases observed if any	

*Follow standard grades /scores (uniformly) for calculating PDI

- Roving survey to be conducted twice in a year (September and February)
- Four districts in each state having maximum coconut area to be selected for surveying of disease incidence/ intensity. Under each district five taluks and three revenue villages per taluk on random basis should be selected during survey. In each village three gardens should be taken for survey. The sample size would be 30 coconut palms per garden.
- The new symptoms/diseases if observed will be documented and sample will be processed for further characterization up to genus level.
- Leaf blight and leaf spot disease index (PDI) to be recorded. For other three major diseases. For other three diseases, Disease incidence (%) to be recorded.

Compilation of Survey data on disease Incidence and Index

District	**Disease incidence (%)**									
	BSR		**SB**		**BR**		**LB (PDI)**		**LS(PDI)**	
	Sept.21	Feb.22	Sept.21	Feb.22	Sept.21	Feb.22	Sept.21	Feb.22	Sept.21	Feb.22
Dist-1										
Dist-2										
Dist-3										
Dist-4										

Compilation of survey data disease wise for each district/state

Name of the disease	Average incidence reported (average of all 4 districts)	Compared to previous year Disease Incidence increased/ decreased/No change	Remarks
1. BSR 2. SB 3. BR 4. LB 5. LS 6. Any new disease minor disease			If there is any drastic increase or reduction in disease incidence , possible reasons may be provided briefly

Fixed plot survey of Coconut diseases

Template for recording data

- The one hectare coconut garden with sole crop where no special management practices for any of diseases are taken will be selected. However, the general packages of practices are followed for management of crop in selected garden.
- The initial disease index/incidence will be documented in fixed plot.
- Further, incidence/index will be documented once in three months for all major diseases.
- The soil microbial population and population of soil borne pathogens of coconut will be assessed once at every three months.
- Further, weather parameters prevailing over the period will also be documented.
- Total number of palms, Number of palms infected, corresponding severity grades/scores to be recorded.
- Each palm in the plot should be observed regularly while recording data.

Month/ Year	Disease Incidence (%) and Disease Index (PDI)									
	BSR		SB		BR		LB		LS	
	DI (%)	PDI	DI (%)	PDI	DI (%)	PDI	DI (%)	PDI	DI (%)	PDI
Apr										
Jul										
Oct										
Jan										

Uniform Disease indexing method to be followed by all centres

7.2.3 Pest management

Pest surveillance in coconut

Name & address of farmer:		
District:		
Taluk:		
Village		
GIS		
1.	Distance from the HQ	
2.	Date of survey	
3.	Age of the palms	
4.	No. of palms/ farmer holding	
5.	Variety	
6.	Management practices (fertilizer, organic manures etc.)	
7.	Irrigation	
8.	Intercrops	
9.	Pest status	
10.	Weather parameters (temperature; RH)	
11.	Pesticide /bioagent usage pattern	

Rhinoceros beetle

Palms to be observed: 25

Palms	Damage on any frond in the palm	No. of V-cut leaves from top 10	Spear leaf damage	No. of Inflorescence damaged
1	Y/N		Y/N	Y/N
2				
25				
Total	a	b	c	d
Per cent	a/25	b/250	c/25	d/25

Red palm weevil

Palms to be observed: 10

Palms	Leaf axil entry	Bole entry	Crown entry	Any entry
1	Y/N	Y/N	Y/N	Y/N
2				
10				
Total	a	b	c	d
Per cent	a/10	b/10	c/10	d/10

Black headed caterpillar

Palms to be observed: 25

Palms	Damage on any leaflets	Total fronds in a palm	No of damaged fronds in a palm	No. of leaflets damaged out of random 100 leaflets in a frond	No of larvae per 10 leaflets	Pest stage
1	Y/N	a	u	m	g	E/L/P
2		b	v	n	h	
25		f	y	s	l	
Total	a	g	z	t	q	
Per cent	a/25		z/g	t/25	q/25	

Coconut eriophyid mite

Palms to be observed 25

Palms	Total nuts	No of mite infested nuts	100 random nuts	0	1-25% nut damage	26-50% nut damage	51-75% nut damage	>75nut damage	Grade index
1									
2									
25									
Total									
Per cent									

Root grub

Palms to be observed: 25

Palms	No of affected palms	No of grubs/30 cm^2
1	y/n	a
2		b
25		f
Total	a	g
Per cent	a/25	g/25

Rugose spiralling whitefly

Palms to be observed: 25

Palm No.	Total fronds	Infested fronds	% incidence	Intensity			No. of live colonies	Grade Index	Natural Enemies (Parasitoid/others)	Percent parasitization
				Total leaf lets	Infested leaf lets	Percent intensity				
1				1						
				2						
				3						
				4						
2				1						
				2						
				3						
				4						
24				1						
				2						
				3						
				4						
25				1						
				2						
				3						
				4						

Other pests

Number of palms to be observed 10

Slug Caterpillar			Nut Borer				Termite	Rodent
Palm No.	Total leaves	Infested leaves	% infestation	Total Nuts	Damaged Nuts	% infestation	% infestation	damage % (fallen nuts/total palms)
1								
2								
10								

7.3 Technical Programmes and Personnel

Scientist	Programmes
Aliyarnagar	
Dr. B. Vinoth kumar	Coc. /Ent. 1; Coc./Ent.4; Coc./Ent.6
Dr. V. Sivakumar	Coc./Gen.1; Coc./Gen. 2; Coc./Gen. 3; Cocoa/Gen. 5
Dr. Sudhalakshmi	Coc./Agron. 10A; Coc. /Agron. 14
Dr. Latha	Coc./Path. 1; Coc./Path. 5; Coc./Path. 6
Ambajipeta	
Dr. B. V. K. Bhagavan	Coc./Gen. 1; Coc./Gen. 2; Coc./Gen. 3 Cocoa./Gen. 5
Dr. Devika Rani	Coc./Ent. 1; Coc./Ent.4; Coc./Ent.6
Dr. Krithi	Coc./Agron. 14
Dr. Govardhan	Coc./ Path. 1; Coc./ Path. 2; Coc./ Path. 3
Arsikere	
Dr. Jagadeesha	Coc./Agron. 10A; Coc./Agron. 14
	Coc./Gen. 1; Coc./Gen. 2; Coc./Gen. 3
Dr. Kiran Kumar K. C.	Coc./ Path. 1; Coc./ Path. 2; Coc./Path. 3; Coc./ Path. 5
Dr. G. S. Chandrashekar	Coc./Ent. 1; Coc./Ent.4; Coc./Ent.6
Bhubaneshwar	
Dr. A. K. Sahoo	Coc./Gen. 1; Coc./Gen. 2; Coc./Gen. 3
Goa	
Dr. V. Arunachalam	Arec./Gen. 4; Coc./Agron. 11
Jagdalpur	
Dr. Beena Singh	Coc./Gen. 1; Coc./Gen. 3
Dr. B. K.Salam	
Kahikuchi	
Dr. J. C. Nath	Coc./Gen. 1; Coc./Gen. 2; Coc./Gen. 3; Cocoa/Gen. 5
Mrs. R. M. Phukon	
Mondouri	
Dr. Dilip K. Ghosh (LKN)	
	Coc./Gen. 1; Coc./Gen. 2; Coc./Gen. 3
Navsari	
Dr. Pankaj P. Bhalerao	Coc./Gen. 1; Coc./Gen. 2; Coc./Gen. 3
Port Blair	

Dr. Ajit Arun Waman	Coc./Gen. 3; Arec./Gen. 4; Coc./; Arec./Agron. 18
Ratnagiri	
Dr. S. L Ghavale	Coc./Gen. 1; Coc./Gen. 2; Coc./Gen. 3; Cocoa/Gen. 5
Dr. S. M. Wankhede	Coc./Ent. 1; Coc./Ent.4; Coc./Ent.6
Dr. V.V. Shinde	Coc./Agron. 10A; Coc./Agron. 11
Sabour	
Dr. Ruby Rani	Coc./Gen. 1; Coc./Gen. 3; Coc./Agron. 5
Dr. Ahmar Aftab	Palmy./Gen. 10; Palmy./ PHT. 1; Palmy./ PHT. 5; Palmy./ PHT. 6; Palmy./ Agron. 23
Veppankulam	
Dr. Surulirajan	Coc./Path. 1; Coc./Path. 2
Dr. Arun kumar	Coc./Gen. 1; Coc./Gen. 2; Coc./Gen. 3; Cocoa/Gen. 5
Dr. Dr. Babu	Coc./Agron. 10A, Cocoa/Gen. 5
Wakawali	
Dr. Prafulla Mali	Arec./Gen. 4, Arec./Agron. 18;
Shivamogga	
Dr. B. Gangadhara Naik	Arec./Gen. 4; Agron. 20; Areca./Path. 8; Areca./Path. 9; Areca./Path. 10
Pattukkottai	
Dr M Tamil Selvan	OP./Gen. 8 C; OP./Gen. 8 D(I); OP./Gen. 9
Mulde	
Dr. Debajae. P. S	OP./Gen. 8 D(I); OP./Gen. 9; Agron. 22
Vijayarai	
Dr. Madhavi Latha	Cocoa/Gen. 5 OP./Gen. 8 D(I); OP./Gen.8 D(II) ; OP./Gen. 9
Killikulam	
Dr. Ravindran	Palmy./Gen. 9; Palmy./PHT.1; Palmy./Agron. 23; Palmy./ PHT. 5; Palmy./ PHT. 6
Pandirimamidi	
Dr. Rajendra prasad	Palmy./Gen. 9; Palmy./Agron. 23
Dr. P. C. Vengaiah	Palmy./PHT.1; Palmy./PHT.2; Palmy./PHT. 4; Palmy./ PHT. 5; Palmy./ PHT. 3; Palmy./ PHT. 6
Pasighat	
Dr. Barun Singh	OP./Gen. 8 C(I); OP./Gen. 8 D(I); OP./Agron. 12; OP./ Agron. 13

RARS, Pilicode	
Smt. Ninitha Nath	Coc./Gen. 1; Coc./Gen. 2; Coc./Gen. 3
CPCRI, Kasaragod	
Dr. P. Subramanian	Cocoa/Gen. 5; Coc./Agron. 14
IIOPR, Pedavegi	
Dr. Ravi Chandran	OP./Gen. 9
Bavikere	
Dr. Nagarajappa Adivarappar	OP./Agron. 21
Konda Mallepally	
Dr. T. Suresh Kumar	Palmy./Gen. 10; Palmy./ PHT. 1; Palmy./ PHT. 5; Palmy./ PHT. 6; Palmy./Agron. 23
Sirsi	
Dr. Sudheesh Kulkarni	Cocoa/Gen. 5
Thrissur	
Dr. Suma	Cocoa/Gen. 5

7.4 List of Delegates attended during virtual meet (22.11.21 to 24.11.2021)

Dr. A. K. Singh Deputy Director General (Hort. Sci.) ICAR, Krishi Anusandhan Bhavan-II, Pusa, New Delhi.	Dr. B. K. Pandey Asst. Director General (Hort. Sci-II) ICAR, Krishi Anusandhan Bhavan-II, Pusa, New Delhi.
Dr. Anitha Karun Director (Actg.)ICAR-CPCRI Kudlu P.O., Kasaragod, Kerala	Dr. R. K. Mathur Director ICAR-IIOPR, Pedavegi, Andhra Pradesh
Dr. E. K. Chakurkar Director, ICAR-CIARI Port Blair	Dr. B. A. Jerard Principal scientist (Hort.) ICAR-CIARI, Port Blair
Dr. Ravi Bhat Actg. Head, Crop Production ICAR-CPCRI, Kudlu P.O., Kasaragod.	Dr. Vinayaka Hegde Actg. Head, Crop Protection ICAR-CPCRI, Kudlu P.O., Kasaragod.
Dr. K.B. Hebbar Actg. Head, PB & PHT ICAR-CPCRI, Kudlu P.O., Kasaragod	Dr. K. Muralidharan Actg. Head, Social Sciences ICAR-CPCRI, Kudlu P.O., Kasaragod.
Dr. V. Niral Principal Scientist (Genetics and Plant Breeding) ICAR-CPCRI, Kudlu P.O., Kasaragod.	Dr. P. Subramanian Principal Scientist (Agronomy) ICAR-CPCRI, Kudlu P.O., Kasaragod.
Dr. C. Thamban Principal Scientist (Agri. Extn.) ICAR-CPCRI, Kudlu P.O., Kasaragod.	Dr. A. Joseph Rajkumar Principal Scientist (Entomology) ICAR-CPCRI, Regional Station, Kayankulam.
Dr. Murali Gopal Principal Scientist (Microbiology) ICAR-CPCRI, Kudlu P.O., Kasaragod	Dr. Chandrika Mohan Principal Scientist (Entomology) (retd.) ICAR-CPCRI, Regional Station, Kayankulam.
Dr. C.T. Jose Actg. Head ICAR-CPCRI, Regional Station, Vittal.	Dr. Kalavathi. S Actg. HeadI CAR-CPCRI, Regional Station, Kayankulam.
Dr. Regi Jacob Thomas, Principal Scientist (Hort.) ICAR-CPCRI, Regional Station, Kayankulam.	Dr. Elain Apshara Principal Scientist (Hort.) ICAR-CPCRI, Regional Station, Vittal.
Dr. R. Sudha Senior Scientist (Fruits) ICAR-CPCRI, Kudlu P.O., Kasaragod	Dr. Merin Babu Scientist (Pathology) ICAR-CPCRI, Regional Station, Kayankulam.

Dr. N.R. Nagaraj Scientist (Plant Breeding) ICAR-CPCRI, Regional Station, Vittal.	Dr. Thava Prakash Pandian Scientist, (Plant Pathology) ICAR-CPCRI, Regional Station, Vittal
Dr. Shivaji Hausrao Thube Scientist (Entomology) ICAR-CPCRI, Regional Station, Vittal.	Dr. P.S. Pratibha Scientist (Entomology) ICAR-CPCRI, Kudlu P.O., Kasaragod
Dr. Rajkumar Scientist (Nematology) ICAR-CPCRI, Kudlu P.O., Kasaragod.	Dr. Daliya Mol Scientist (Pathology) ICAR-CPCRI, Kudlu P.O., Kasaragod
Dr. Sujithra, M Scientist (Entomology) ICAR-CPCRI, Kudlu P.O., Kasaragod.	Dr. V.H. Prathibha Scientist (Pathology) ICAR-CPCRI, Kudlu P.O., Kasaragod
Dr. S. Sumitha Scientist (SPMA) ICAR-CPCRI, Kudlu P.O., Kasaragod	Dr. Ravichandra Principal Scientist (Seed Technology) ICAR-IIOPR, Pedavegi, Andhra Pradesh
Dr. K. Manorama Principal Scientist (Agronomy) ICAR-IIOPR, Pedavegi, Andhra Pradesh	Dr. Subanna Senior Scientist (Entomology) ICAR-IIOPR, Pedavegi, Andhra Pradesh
Dr. P. Anitha Senior Scientist (Hort.) ICAR-IIOPR, Pedavegi, Andhra Pradesh	Dr. M. Thirupathi Reddy Asst. Professor (Agronomy), HRS, Vijayarai, Andhra Pradesh
Dr. Madhavi Latha. P Asst. Professor (Horticulture) HRS, Vijayarai, Andhra Pradesh	Mrs. Rinku. M. Phukon Assistant Professor (Hort.) HRS, Kahikuchi, Guwahati, Assam.
Dr. J. C. Nath Professor (Horticulture) HRS, Kahikuchi, Guwahati, Assam	Dr. Ruby Rani Asst. Professor (Horticulture)Bihar Agricultural College,Sabour, Bhagalpur, Bihar.
Dr. V. Arunachalam Principal Scientist (Horticulture) ICAR-CCARI, Old Goa	Dr. S. M. Wankhede Asst. Professor (Entomology) Regional Coconut Research Station, Bhatye, Ratnagiri, Maharashtra.
Dr. Pankaj P. Bhalerao Asst. Professor (Fruit Science) Navsari Agricultural University, Navsari, Gujarat	Dr. Prafulla Mali Assoc. Professor (Horticulture) Central Experimental Station, Wakawali, Ratnagiri, Maharashtra.
Dr. S. L Ghavale Asst. Professor (Horticulture) Regional Coconut Research Station, Bhatye, Ratnagiri, Maharashtra.	Dr. Nagarajappa Adivappar Principal Investigator AICRP Palms - Bavikere Centre ZAHRS Navile, Shivamogga

Dr. G.S. Chandrasekhar Asst. Professor (Entomology) Horticultural Research Station, Arsikere, Hassan, Karnataka.	Dr. Sudheesh Kulkarni Scientist (Horticulture) HRES, Sirsi, Uttara Kannada, Karnataka.
Dr. B. Gangadhara Naik Professor (Plant Pathology) COA, Navile, Shivamogga, Karnataka.	Dr. A. K. Sahoo Scientist (Horticulture)Department of Horticulture,OUAT, Bhubaneshwar, Odisha.
Dr. V.V. Shinde Asst. Professor (Agronomy) College of Horticulture, Mulde, Kudal Taluk, Sindhudurga	Dr. Sudhalakshmi. C Asst. Professor (Agronomy), Coconut Research Station, Aliyarnagar, Coimbatore, Tamil Nadu.
Dr. B. Vinoth Kumar Asst. Professor (Entomology) Coconut Research Station, Aliyarnagar, Coimbatore, Tamil Nadu.	Dr. E. Rajeswari Asst. Professor (Pathology), Coconut Research Station, Aliyarnagar, Coimbatore, Tamil Nadu.
Dr. Latha Asst. Professor (Pathology) Coconut Research Station, Aliyarnagar,Coimbatore, Tamilnadu.	Dr. V. Sivakumar Asst. Professor (Horticulture) Coconut Research Station, Aliyarnagar, Coimbatore, Tamil Nadu.
Dr. M. Suruliraj Asst. Professor (Pathology) Coconut Research Station, Veppankulam, Thanjavur, Tamil Nadu	Dr. A. Arun Kumar Asst. Professor (Horticulture) Coconut Research Station, Veppankulam, Thanjavur, Tamil Nadu
Dr. R. Babu Professor and Head (Agronomy) Coconut Research Station, Veppankulam, Thanjavur, Tamil Nadu	Dr. P.C. Vengaiah Asst. Professor (Food Sci.& Technology)HRS, Pandirimamidi, Andhra Pradesh
Dr. T. Suresh Kumar Assoc. Professor (Horticulture) Horticulture Research Station, Konda Mallepally, Telangana.	Dr. Ahmar Aftab Senior Scientist (Horticulture) Bihar Agricultural College, Sabour, Bhagalpur, Bihar.
Dr. Barun Singh Scientist (Horticulture) College of Horticulture and Forestry, CAU, Pasighat, East Siang	Dr. Suma Professor Cocoa Research Centre, Kerala Agriculture University, Vellanikkara, Thrissur
Dr. Beena Singh Scientist (Horticulture) ShaheedGundadhur College of Agriculture and Research Institute, Jagdalpur	Dr. B. V. K. Bhagavan Principal Scientist (Horticulture)HRS, Ambajipeta Andhra Pradesh

Dr. Kirankumar K.C Asst. Professor (Pathology) Horticultural Research Station, Arsikere, Hassan, Karnataka.	Dr. P. K. Salam Scientist (Agronomy) Shaheed Gundadhur College of Agriculture and Research Institute, Jagdalpur
Dr. N. B. V Chalapathi Rao Senior Scientist (Entomology) HRS, Ambajipeta Andhra Pradesh	Dr. Govardhan Scientist (Pathology) HRS, Ambajipeta Andhra Pradesh
Dr. Debaje. P. S Scientist (Horticulture) College of Horticulture, Mulde	Dr. Vanaja. T Professor (PGB) Regional Agricultural Research Station, Pilicode, Kasaragod.
Dr. C. Ravindran Asst. Professor (Horticulture) AC & RI, Killikulam, TNAU	Dr. D. K Ghosh (LNK) Assoc. Professor (Agronomy) Dept. of Plantation Crop, BCKVV, Mondouri
Dr. M Tamil Selvan Asst. Professor (Horticulture) ARS, Pattukkottai, Thanjavur	Dr. Siddappa Asst. Professor (Horticulture) College of MysoreUHS Bagalkot
Dr. Jagadeesha Asst. Professor (Horticulture) Horticultural Research Station, Arsikere, Hassan, Karnataka.	

हर कदम, हर डगर
किसानों का हमसफर

भारतीय कृषि अनुसंधान परिषद

Agrisearch with a human touch