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PROCEEDINGS OF THE XXV ANNUAL GROUP MEETING

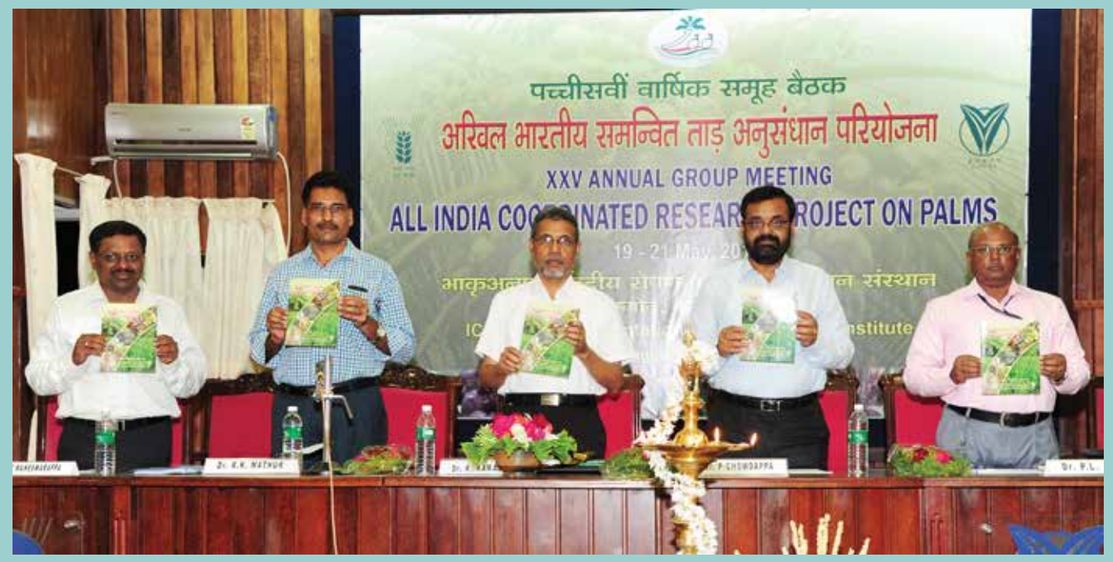
ICAR – ALL INDIA CO-ORDINATED RESEARCH PROJECT ON PALMS
(Including Technical Programme for 2016-17)

Held at

ICAR – CENTRAL PLANTATION CROPS RESEARCH INSTITUTE,
KASARAGOD, KERALA
19th to 21st May, 2016

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

Release of publication by DDG (HS)



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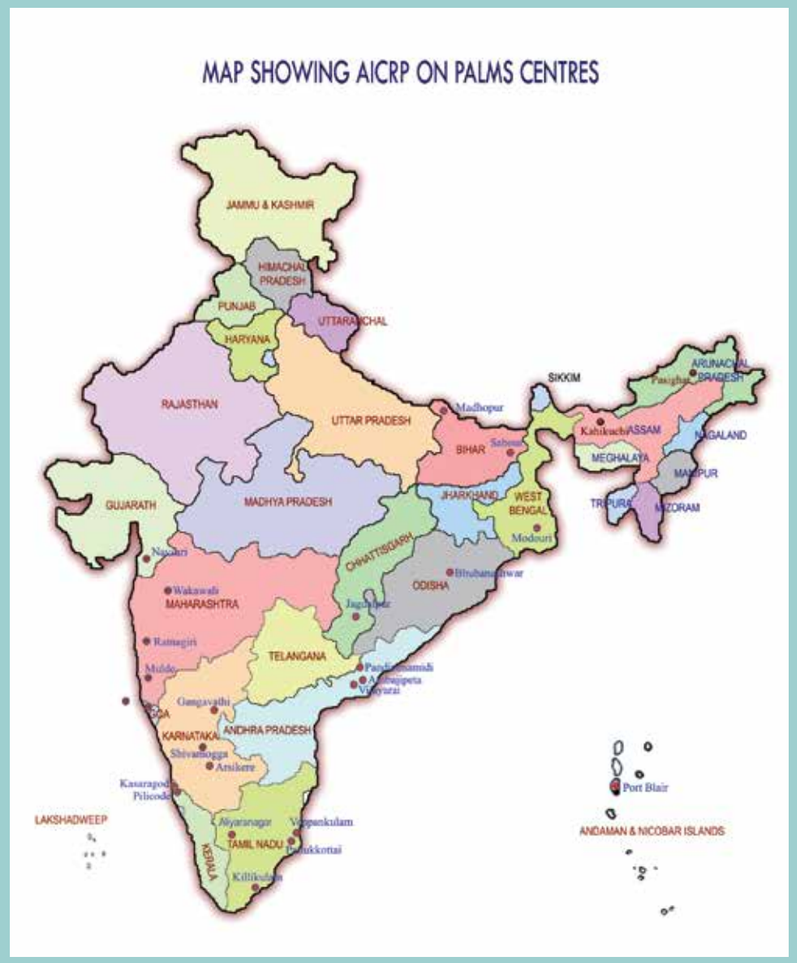

Best AICRP centre award to Aliyarnagar

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AICRP on Palms. 2016.
Proceedings of the XXV Annual Group Meeting of AICRP on Palms with Technical Programme for 2016-17. (Eds. Maheswarappa H. P. & S. Sumitha) . CPCRI, Kasaragod. 103 p.

Published by:

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Compiled and Edited by

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Miss. S. Sumitha

July 2016

Printed at

PrinExPress, Cochin

CONTENTS...

1. Preface

The XXV Annual Group Meeting of AICRP on Palms was held at ICAR-Central Plantation Crops Research Institute, Kasaragod during 19-21 May, 2016. I place my sincere gratitude to Dr. T. Mohapatra, DG (ICAR), Dr. S. Ayyappan, Former DG (ICAR), Dr. N.K. Krishna Kumar, Deputy Director General (Hort. Science) for their critical guidance and encouragement provided for AICRP on Palms. I would like to express my special thanks to DDG (HS) for making it convenient to participate in the meeting and his constant and meticulous guidance offered during the meeting helped us in formulating the technical programme for the year 2016-17. I am thankful to Dr. T. Janakiram, Asst. Director General (HS-I), and staff of Horticultural Scince, SMD, ICAR for their valuable guidance and encouragement for all the activities and also for providing the required support for ensuring the smooth conduct of the Group Meeting.

I am especially indebted to Dr. P. Chowdappa, Director, ICAR-CPCRI, Kasaragod, Dr. R.K. Mathur, Director, ICAR-IIOPR, Pedavegi, Dr. P.L. Saroj, Director, ICAR-DCR, Puttur and Dr. Puttasamy, Retd. Professor of Entomology, UAS, Bengaluru , who graced the occasion and serving as chairman of different technical sessions.

I acknowledge my sincere thanks to Dr. V. Krishnakumar, Dr. K.S. Ananda, Dr. Anitha Karun, Dr. C. Thamban, Dr. Ravi Bhat, Dr. K.B. Hebbar, Dr. V. Niral, Mr. S. Jayasekhar, Dr. P. Subramanian, Dr.Chandrika Mohan, Dr. B.A.Jerard, Dr. Josephrajkumar, Dr. Elain Apshara, Dr. C.T. Jose, Dr. Merin Babu, Dr. Rajkumar and Dr. V.H. Prathibha of ICAR-CPCRI and Dr. B.N. Rao of ICAR-IIOPR, Pedavegi for their guidance in the project. I take this opportunity to express my sincere thanks to scientists of AICRP on Palms centres especially Dr. T.B. Basavaraju, Dr. A. Subramanian, Dr. NBV Chalapathi Rao, Dr. T. Srinivasan, Dr. A. Snehalatharani and Dr. Sanjeevraddi G. Reddi for their help in compilation of this report. Miss. Sumitha. S, Scientist, Mrs. K. Narayani, Private Secretary; Mr. Narayana Naik P, UDC of AICRP Cell have contributed a lot in compiling the Technical Report and also offering the required help in conducting the Group Meeting as well as in the preparation of Proceedings of the Group Meeting is appreciated and gratefully acknowledged.

July 2016,

(**Dr. H. P. Maheswarappa)**
Project Coordinator (Palms)

2. Programme

XXV Annual Group Meeting

ICAR – ALL INDIA CO-ORDINATED RESEARCH PROJECT ON PALMS

Venue	**ICAR-CPCRI, Kasaragod**	
Period	**May 19-21, 2016**	
19.05.2016		
9.30 – 11.30 AM	**INAUGURAL SESSION**	
	Welcome	Dr. P. Chowdappa
	Coordinator's Report	Dr. H. P. Maheswarappa
	Chief guest	Dr. K. Ramaswamy
	Guests of honour	Dr. P. L. Saroj
		Dr. R. K. Mathur
	Release of publications	
	Best AICRP Centre Award	
	Vote of Thanks	Miss. S. Sumitha
11.30 -12.30 PM	**Action taken report**	
	Chairman	Dr. P. Chowdappa
	Co-chairman	Dr. P. L. Saroj
	Convener	Miss. S. Sumitha
		Dr. Ajit Arun Waman
12.30 - 1.30 PM		
Technical session-I	**Variety release proposals**	
	Chairman	Dr. P. Chowdappa
	Co-chairman	Dr. R. K. Mathur
		Dr. Anitha Karun
	Convener	Dr. B. A. Jerard
		Dr. Elain Apshara
2.30 -8.00 PM		
Technical session-II	**Genetic Resources and Crop Improvement**	
	Chairman	Dr. R. K. Mathur
	Co-chairman	Dr. K. S. Ananda
		Dr. Anitha Karun
	Convener	Dr. V. Niral
		Dr. A. Subramanian

20.05.2016		
9:30 -10:30 AM		
Guest lecture	Tissue irrigation	Prof. Mukund Joshi
10.30 -1.00 PM		
Technical session-III	**Crop Production**	
	Chairman	Dr. S. Bhaskar
	Co-chairman	Dr. V. Krishnakumar
		Dr. Ravi Bhat
	Convener	Dr. B. N. Rao
		Dr. T. B. Basavaraju
5.00 -7.00 PM		
Technical session-IV	**Disease Management**	
	Chairman	Dr. P. Chowdappa
	Convener	Dr. V. H. Prathibha
		Dr. A. Snehalatha Rani
7.00 -8.30 PM		
Technical session-V	**Post harvest technology in Palmyrah and TOT**	
	Chairman	Dr. K. B. Hebbar
	Co-chairman	Dr. C. Thamban
	Convener	Er. P. C. Vengaiah
		Dr. T. Prabhu
21.05.2016		
10.30 -1.30 PM		
Technical session-VI	**Pest Management**	
	Chairman	Dr. Puttaswamy
	Co-chairman	Dr. Chandrika Mohan
	Convener	Dr. A. Joseph Rajkumar
		Dr. T. Srinivasan
2.30 -5.00 PM		
PLENARY SESSION		
	Chairman	Dr. N. K. Krishna Kumar
	Co-chairman	Dr. P. Chowdappa
	Convener	Dr. N. B. V. Chalapathi Rao
		Dr. Manjunath Hubballi
Release of publications		
Presentations		
	Vote of Thanks	**Dr. H. P. Maheswarappa**

3. Excerpts of inaugural session

The XXV Annual General Meeting of ICAR-All India Coordinated Research Project on Palms was inaugurated on May 19th 2016 at ICAR- Central Plantation Crops Research Institute, Kasaragod. The inaugural meeting was graced by the presence of Dr. K. Ramasamy, Vice Chancellor, Tamil Nadu Agricultural University, Coimbatore, Dr. P. Chowdappa, Director, ICAR- CPCRI, Kasaragod, Dr. R.K. Mathur, Director, ICAR- Indian Institute of Oil Palm Research, Pedavegi, Dr. P.L. Saroj, Director, Directorate of Cashew Research, Puttur, scientists working in various centres of the project and scientists from various research stations of ICAR- CPCRI, Kasaragod. At the outset, house paid homage to the departed soul of Dr. Y.R. Sharma, Former Director of ICAR- Indian Institute of Spices Research, Kozhikode. Meeting began with welcome to all the delegates, followed by the Swachhata Pledge by the participants of meeting.

Dr. H.P. Maheshwarappa, Project Coordinator, presented a brief report highlighting the activities carried out during last year in various centres of the project. He informed the house that AICRP on Palms was bagged the Chaudhary Devi Lal Best AICRP for 2014 amongst 72 AICRPs operating in the country during 87th Foundation Day of ICAR, held at Patna this year. He further informed that the project was initiated during 1972 for addressing location specific needs of the farmers in the mandate crops and is being implemented in 29 centres spread across 13 states and one Union Territory of the country. During this period, T×T coconut hybrid was recommended for release and promising high yielding oil palm hybrids have been evaluated, which could help in release of the first hybrid of the country in coming years. In crop production, coconut based cropping systems with organic nutrient management was successfully demonstrated at various centres and incorporation of flower crops as intercrops was found to be a profitable option at different centres. Black headed caterpillar was found to be a growing concern in the states of Tamil Nadu and Karnataka. However, successful management of the pest through mass multiplication of the bio-control agents was demonstrated at various centres. Slug caterpillar incidence was reported in Andhra Pradesh and Karnataka, and its successful management was demonstrated using light traps. A number of activities including demonstrations, trainings and diagnostic field visits were carried out during the year for the benefits of the stakeholders.

Dr. P.L. Saroj, during his address, appreciated the work being carried out at various centres of the AICRP on Palms and by the institute for a century. He emphasized that considering the changing scenarios; improved varieties should be developed for multiple traits including those for various purposes and locations. Package of practices need to be developed or modified considering the existing varieties, local climate and resource availability. Multispecies cropping systems are known to increase the profitability of the farmers and hence suitable intercrops should be identified, which could additionally help in maintenance of soil health. Development of technologies for value addition and dissemination of technologies through mobile phones need to be promoted. At the end he appreciated honouring best performing centre to improve the quality of work being carried out.

Dr. R.K. Mathur appreciated 100 years of service of the institute and congratulated the scientists working in various AICRP centres for bagging best AICRP award at national level. He opined that

as the challenges of price fluctuation are growing, intercropping has become the need of the hour. Integrated nutrient management is highly relevant in the present context as it reduces the dependence on inorganic fertilizers, reduces production cost and improves soil health. He critically suggested that the experiments should be designed to improve the basic understanding of the subject, as it could help in solving the problems effectively apart from assisting in publishing the findings as research articles.

Dr. K. Ramasamy, while addressing the gathering suggested that, research works are being carried out in isolation and hence coordinated research is required to be emphasized. He opined that the resources are scarce, so their utilization should be done in efficient way. In order to reduce the dependence on the imports, efforts should be made to promote and market the local produce with minimum support price. He opined that value addition of coconut with diversified products could help in improving the profitability of the farmers. He emphasized the importance of skill development and identification of potential markets for tapping the potential of value added products.

Four publications released from the AICRP centres during the inaugural session. The performance of AICRP centres is being evaluated every year and during 2015-16, AICRP centre, Aliyarnagar has been judged as the best performing centre. Miss. S. Sumitha, Scientist (SPMA) ICAR- CPCRI, Kasaragod , proposed the vote of thanks.

4. Action taken report on the recommendations of the 24th Annual Group Meeting held at CCARI, Goa during 26-29 May, 2015

S. No.	Recommendation	Action taken
Crop Improvement		
1	Under MLTs, common set of combinations are to be evaluated in identified centres.	• In Gen. 1 Expt.3 trial initiated during 2015, common set of germplasm lines are being evaluated in identified centres. • Common cocoa clones/hybrids are being evaluated in different centres.
2	It was recommended during the session that the collection of germplasm accessions should be done purely based on the specific traits which are different from the already existing germplasm (All the coconut and palmyrah centres).	• This is being followed in the collection of germplasm and accordingly only trait specific accessions were made. • Two local germplasms have been identified in Bhamara kothi, Katihar District with less incidence of winter injury. • In Palmyrah , five accessions with distinct characters of dwarfness were collected form Midnapur Dt. of West Bengal and conserved in palmyrah centres.
3	Dr. R.K. Mathur, PS, IIOPR, Pedavegi can visit different centres for monitoring and guiding the improvement trials	Dr. R.K. Mathur, Director of IIOPR has visited oil palm centres (Pattukkotai, Gangavathi, Vijayarai, Pasighat) and reviewed the programmes.
Crop production		
1	Rationalization of cost of production in the cropping system is to be made for working out B: C ratio	Training was imparted for scientist of the centres on 05.04.2016 at CPCRI, Kasaragod and accordingly economic analysis is being reported. Economic tools such as Net present value (NPV), Benefit-cost ratio (BCR) and Internal Rate of returns (IRR) were described for the projects and same will be reported.
Pest Management		
1	The invasive species viz., *Brontispa longissima*, *Aspidiotus rigidus*, *Wallacea* sp. (nursery) enlisted by Dr. Joseph Rajkumar are to be looked for while surveying in the coconut gardens (Aliyarnagar, Ambajipeta, Arsikere and Ratnagiri centres).	The invasive species are looked for during surveys as suggested and not found in the region.

2	The possibility of utilizing pheromone technology for coconut black-headed caterpillar may be attempted by CPCRI (HoD, Crop Protection, CPCRI).	The pheromone technology of coconut black headed caterpillar developed by PCI Pvt. Ltd., Bengaluru, India was field evaluated at Aliyarnagar, Ambajipeta and Arsikere centres and results will be discussed in the Insect pest session. Lure catches were recorded at 15 days interval and the data at the end of one month revealed a total of 196 moths / 4 traps in the sticky traps (with pheromone lures) as against a total of 127 moths/ 4 traps in sticky traps without lures (Aliyarnagar).
3	Due to increased incidence of slug caterpillar in Karnataka and Andhra Pradesh, continuous monitoring for this pest is essential (Arsikere & Ambajipeta centres).	• Slug incidence was recorded in Tiptur Taluk (Karnataka) and monitoring of the pest was done by installing light traps and spraying of *Bt* formulation was attempted for the management of slug. • Sporadic incidence of slug caterpillar was also observed in various mandals of East and West Godavari districts in Andhra Pradesh during February 2016 and continuous monitoring of the pest was done by installing of light traps.
4	The quantum of insecticide usage may be reduced in coconut (Aliyarnagar, Ambajipeta, Arsikere and Ratnagiri centres).	Non-chemical methods *viz*., biological control, use of pheromone lures, field sanitation are promoted for the management of black headed caterpillar, rhinoceros beetle and red palm weevil. Further the usage of red labelled insecticide monocrotophos is discouraged and shifting to safer green label bio-pesticide like Bt formulation is being promoted if at all the usage of insecticide is necessitated in coconut.
5	Action may be taken by CPCRI to commercialize the pheromone lures for use by the coconut farmers (HoD, Crop Protection, CPCRI).	The process of commercialization of pheromone lures (especially the delivery techniques) for rhinoceros beetle and red palm weevil is under progress. Slippage of beetles infesting palms around the traps is closely monitored in all experiments.
6	CPCRI can attempt a modified trap design to trap more number of adults while simultaneously avoiding escape of attracted adults (HoD, Crop Protection, CPCRI).	Trap design of red palm weevil pheromone delivery technology is suitably modified for sustained release of pheromone, enhanced durability and avoiding escapes. The modified trap will be evaluated subsequently.

7	Action may be taken by CPCRI to commercialize the talc based formulation of *H. thompsonii* at the earliest (HoD, Crop Protection, CPCRI).	Commercialization of *Hirsutella thompsonii* will be initiated once the multi-location evaluation experiments are completed in all AICRP centres. Action has been initiated for the generation of biosafety data prior to commercialization.
8	Dr. Chandrika Mohan, PS, ICAR-CPCRI, RS, Kayamkulam can visit all the AICRP (Palms) centres to analyse the cause of non-establishment of *Hirsutella thompsonii* in the trial plots	Dr. Chandrika Mohan has visited Arsikere and Aliyarnagar centre. Nut samples collected from Aliyarnagar after *H. thomposnii* application indicated establishment of the fungus in the field.
Disease management		
1	During surveys, pathology and entomology scientists should accompany each other for recording the problems in coconut gardens (All centres).	Pathology and Entomology Scientists are jointly surveying the coconut growing districts for recording the disease and insect pest in the region.
2	During surveys confirmation of causal organism of the disease needs to be carried out (All centres).	Confirmation of causal organism of the disease during surveys is being carried out.
3	Development of molecular diagnostics for early detection of basal stem rot may be taken up at CPCRI, Kasaragod (HoD, Crop Protection, CPCRI)	PCR and LAMP based protocols for detection of *Ganoderma* spp. have been developed and attempts are being made for early diagnosis of basal stem rot affected coconut palms.
4	Develop sick plots for basal stem rot disease at HRS, Arsikere and HRS, Ambajipeta and screen the coconut varieties supplied by CPCRI, Kasaragod (Ambajipeta and Arsikere centres).	As the screening of different varieties for BSR tolerance/resistance have been carried out at different centres, development of sick plot for the study has been dropped after discussion with Director and HoD of CPCRI.
5	Team comprising Dr. Krishna Kumar, Dr. Joseph Rajkumar, Dr. Jeena Mathew and Dr. Merin Babu should visit Coimbattore, Tirunelveli districts of Tamil Nadu and collect the leaf samples from symptomatic plants for serological studies.	A joint field visit cum survey was undertaken by a team of scientists from CPCRI RS, Kayamkulam *viz.,* Dr. Chandrikamohan, Principal Scientist (Entomology), Dr. Joseph Rajkumar, Principal Scientist (Entomology) and Dr. Merin Babu, Scientist (Plant Pathology) along with the Entomologist and Plant Pathologist working under AICRP (Palms) of CRS, Aliyarnagar on 06.01.2016 and 07.01.2016 to assess the incidence of root (wilt) disease and collect samples from affected palms and for surveying the insect pest complex in Pollachi region. Spindle leaf samples from root (wilt) affected palms were collected from Pollachi (Coimbatore district) and Thenkasi (Tirunelveli district) and serological studies were carried out at ICAR- CPCRI – RS, Kayankulam. All the samples were positive in serology test.

6	Survey for root (wilt) disease in Kanyakumari district of Tamil Nadu to be conducted in June 2015 (Aliyarnagar centre).	Roving survey for root (wilt) disease was conducted at Agastheeswaram and Thirvattaru block in Kanyakumari district of Tamil Nadu. Among the blocks surveyed in Kanyakumari district, maximum disease incidence was recorded in Thiruvattaru block (9.11 per cent) and minimum in Agastheeswaram block (0.16 per cent). Among the villages, more incidence of root (wilt) disease was observed in Villukuruchi village (22.3) followed by Paaraicodu village (20.9%) of Thiruvattaru block.
7	An expert committee may be constituted to reconfirm the causal organism of wilt disease of sulphi palm	Expert committee has been constituted by Vice Chancellor of IGKV university under the chairmanship of HOD of Plant Pathology division of the university to study the wilt disease of sulphi palm.
Post Harvest Technology in Palmyrah		
1	Comparative study on nutrient in coconut and Palmyrah neera to be carried out. Biochemical analysis may be carried out at CPCRI, Kasaragod.	Coconut sap contains high TSS, Total sugars, phenolics and antioxidant activity, but protein and reducing sugars are low as compared with palmyrah sap.
2	Packing of fresh apicolon (tuber) for long transportation may be tried.	Fresh tuber without peeling packed in LDPE covers can be stored up to 10 days at room temperature; peeled tuber can be stored only for two days.
3	Fibre extraction of manual may be compared with machine extraction.	Fiber separation by manually yields only 7- 8 kg per day whereas by using fibre separator machine, yields 45-50 kg per day. Per cent recovery of fibre is 30 with machine and 45 in manual.
4	Sensory evaluation of tender fruit endosperm may take up standard scale in consultation with ICAR-IIHR, Bengaluru. Scientist of Pandirimamidi may visit IIHR to discuss about osmotic dehydration techniques and post harvest aspects.	Er. Vengaiah, interacted with IIHR Scientists for standardizing sensory score evaluation and is being carried out during this season along with osmotic dehydration technique.

5.0 Recommendations & Technical Programmes for 2016-17

5.1 Session I – Variety release proposal

Chairman : **Dr. P. Chowdappa**

Co- chairman : **Dr. R.K. Mathur, Dr. Anitha Karun**

Convener : **Dr. B.A. Jerard , Dr. Elain Apshara**

Proposal was received for release of varieties each from coconut, arecanut and cocoa from ICAR-CPCRI, Kasaragod.

Presentation by

1. **Dr. V. Niral -** Coconut
2. **Dr. K.S. Ananda-** Arecanut
3. **Dr. Elain Apshara**- Cocoa

Recommendations

1. New varieties recommended

Coconut variety - Kalpa Shatabdi

The proposal for release of coconut variety Kalpa Shatabdi was presented by CPCRI Kasaragod combining the performance at CPCRI, Kasaragod and AICRP on Palms Centre, Aliyarnagar. The variety has been developed through selection and inter se mating between the selected palms from the CPCRI accession IND 034, San Ramon Tall introduced during the year 1955 at CPCRI and evaluated. The variety gives high copra out turn of 28.65 kg/palm/year or 5.01 t copra /ha, which is 61.40 % higher than the copra yield of WCT (local control). The variety is characterized by large fruits with average copra content of 272.9 g and higher volume (612 ml/ tender nut) of good quality tender nut water (TSS 6.2^{o} Brix) and gives an average nut yield of 105 nuts/palm/year. Considering the high copra out turn and tender nut quality, the variety Kalpa Shatabdi is recommended by XXV AICRPP Group Meeting held during May 2016 for cultivation in the coconut growing tracts of Kerala, Karanataka and Tamil Nadu.

Arecanut variety - Shata Mangala

The proposal for release of arecanut variety Shata Mangala was presented by CPCRI RS, Vittal combining the performance at CPCRI Regional Station, Vittal and CPCRI Research Centre, Mohitnagar. The variety has been developed through selection and *inter se* mating between the selected palms from the accession Kodinar (VTL146) introduced from Mahuva district of Gujarat during the year 2002 and evaluated. The variety gives an average yield of 3.96 Kg dry kernel/palm/ year and about 4500-5000 kg dry kernel/ ha/year which is 47.76 % higher than local check S K Local and 3.26 kg dry tender processed nuts/palm/year and about 3800-4500 kg dry tender processed nuts/ha/year which is 32.70 % more than S K Local. The variety is characterized by semi tall palms, medium thick stem, shorter internodes, partially drooping crown, homogeneous population, regular bearer, consistent in yield, round shaped uniform nuts and high recovery (26.80 %) of chali from fresh nuts.

Considering the semi tall, high yield, consistent, uniform kernel and suitable for both chali and tender nut processing, the variety Shatamangala is recommended by XXV AICRPP Group Meeting held during May 2016 for cultivation in irrigated areas of Karnataka, North Bengal and Gujarat.

Cocoa variety- Netra Centura

VTLCH 5 (Vittal Cocoa Hybrid 5): This variety is a hybrid between Ia 33 x ICS 89 ((IC 565554 x IC 565559). It is recommended for release as variety. This variety showed early, stable and high yielding potential with medium canopy (16-18 m^2) under arecanut and coconut gardens, as seedlings and clones and under normal (2.7 m x 5.4 m under arecanut) and high density plantings (2.7 m x 2.7 m under arecanut and 2.5 m x 2.5 m under coconut) in two locations. With an average of 66 pods/tree/year, 43 beans/pod, single bean dry weight of 1.11 g it recorded the highest dry bean yield of 3.2 kg/tree/year and the yield per hectare is 1800 kg (600 trees). With 11% shelling percentage, 88% nib recovery and 52% fat content this variety is also found to be suitable for processing industry. It is recommended for Western Ghats hills and plains region of Kerala and Karnataka as well as irrigated arecanut and coconut gardens of Tamil Nadu and Andhra Pradesh for best performance with recommended package of practices.

2. Criteria for release of Arecanut and Cocoa varieties

The criteria to be followed for recommendation and release of new varieties in arecanut and cocoa were discussed and finalised. Accordingly the criteria are as follows.

Arecanut variety:

i) The purpose of the variety is to be clearly defined with breeding objectives/methods.

ii) Pedigree details/source of introduction should be clearly given along with flow chart on the evolution of the candidate variety is to be prepared and given.

iii) Performance data of candidate variety for at least 6 years (after stablilized yield) should be available.

iv) Superiority of candidate variety over local check/already released varieties to be established clearly.

v) To select a variety for dry kernel yield alone, the bench mark shall be 3.20 kg/palm/yr; for processed tendernut purpose alone, the bench mark shall be 2.5kg/palm/year. Generally the candidate variety shall have at least 15% higher values for the targeted traits than the local check/ released variety tested under the experiment.

vi) Reaction to pest and disease including presence of any minor pests also to be reported.

vii) Availability of mother palms and the capacity of breeder seed production are to be clearly mentioned. At least 50 mother palms should be available for breeder's seed/hybrid production to cover an area of 40 ha annually.

viii) Trade off points for the candidate variety also to be figured in the proposal suitably.

ix) DUS traits of the candidate variety along with at least one reference variety is to be given.

x) DNA finger print to be attached.

xi) Clear, glossy, A4 size photos depicting the features of the variety, distinctive DUS traits to be attached.

xii) Package of practices for the candidate variety is to be given with any specific recommendation/ precautions to be followed.

Cocoa variety:

i) The purpose of the variety is to be clearly defined with breeding objectives/ methods and supported with statistically significant data.

ii) Pedigree details should be clearly given along with flow chart on the evolution of the candidate variety is to be prepared and given.

iii) Performance data of candidate variety for atleast 6 years (after stablilized yield) should be available.

iv) Superiority of candidate variety over local check/ any one of the already released varieties to be established clearly.

v) To select a variety,

- Pod yield should be a minimum of 50/ tree/ year with an optimal canopy of 15-20 m^2 (probably in a 10-12 year old tree),
- pod weight should be >350 g with 1 cm husk thickness (smooth and shallow furrows preferable),
- no. of beans should be >35/ pod and the fermented single dry bean weight should be 1 to >1 g, shelling 10-15%, nib recovery >85% and fat content >50%
- dry bean yield should be >1.5 kg/ tree

vi) Reaction to major pests and diseases.

vii) Availability of mother trees and the capacity of breeder seed production are to be clearly mentioned. At least 12 mother trees should be available for breeders' seed/ hybrid production/ as scion bank to cover an area of 5 ha annually.

viii) DNA finger print to be attached

ix) Clear, glossy, A4 size photos depicting the features of the variety.

x) Package of practices for the candidate variety is to be given with any specific recommendation/ precautions to be followed.

These proposals may be submitted to Central Sub-committee on Crop Standards, Development and Release of Varieties of Horticultural crops for release and notification.

5.2 SESSION II- Genetic Resources and Crop Improvement

Chairman : **Dr. R.K. Mathur**

Co- chairman : **Dr. K.S. Ananda, Dr. Anitha Karun**

Convener : **Dr.V.Niral, Dr. A. Subramanian**

1. Number of reports presented

Crop	Coconut	Oil Palm	Palmyrah	Sulphi palm	Arecanut
Number of reports	10	9	1	1	2

2. Centres where work has been done

Crop	Coconut	Oil Palm	Palmyrah	Sulphi palm	Arecanut
Number of centres	14	7	2	1	4

3. Non reporting centre:

Jagdalpur, Madhopur

4. Brief description of work done and salient achievements reported

A. COCONUT

The evaluation of fourteen cross combination of Tall x Tall hybrids at Veppankulam centre resulted in identification of a superior high yielding cross combination, LCOT x CCNT. This hybrid was recommended for release as VPM - 5 during the 24thAnnual Group Meeting of AICRP on Palms at the ICAR- Central Coastal Agricultural Research Institute, Goa. The mean nut yield of the hybrid during the stabilized bearing period was 161 nuts/palm/year, which is 62.6 and 43.8 and higher than ECT and VHC 1 respectively.

Collection, conservation and evaluation of local ecotypes, evaluation of germplasm and hybrids in different agro climatic regions, demonstration of released varieties and production of quality planting material were undertaken by different AICRP (P) centres.

B. OIL PALM

Among the ten hybrids planted during 2006 at Pattukottai (Tamil Nadu) and evaluated for growth and yield performance, the hybrid NRCOP-17 recorded significantly higher FFB yield (163.34 kg / palm & 23.35t/ha) during 2015-16 (at 9th year of planting). Under comparative performance of different hybrid combinations planted during 2007, at Vijayarai centre (A.P), the hybrid NRCOP- 4 recorded significantly higher FFB yield (24.9 t/ha) followed by NRCOP- 5 (19.86t/ha).

C. PALMYRAH

Germplasm survey conducted at Midnapur Dt. of West Bengal by AICRP, Killikulam and Pandrimamidi centres, and a total of five accessions with distinct characters were collected for conservations.

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

- LCT x CCNT, a superior Tall x Tall hybrid, identified for released based on its higher yield at AICRP on palms centre, Veppankulam. It recorded a mean nut yield of 161 nuts palm^{-1} yr^{-1}.

6. Programme proposed for coming years

Crop	On going Experiments	Revised Experiments	New Experiments
Coconut	12	-	-
Oil palm	8	-	-
Palmyrah	1	-	-
Sulphi palm	1	-	-
Arecanut	2	-	-

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

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

Expt. 1: Evaluation of conserved germplasm

- In centres where palms are more than 20 years old, they may be maintained with recommended package of practices and observations on yield parameters may be recorded and submitted every year along with yields of previous four years.
- Set-wise information on cumulative performance of the accessions at each centre may be provided by December. This information may also be provided to CPCRI for information and utilisation in crop improvement programme.
- At Ambajipeta centre, the old germplasm palms which are showing good performance may be multiplied for conservation at the centre.

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

- Modalities for collection and presentation of juvenile growth parameters to be streamlined in consultation with experts.
- Possibility of having local check in trial plots may be explored.

Expt. 3: Evaluation of selection from germplasm

- Title of the experiment may be changed as "Evaluation of elite germplasm".
- Old palms in the under planted trials are to be removed at Ambajipeta centre.

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

Expt. 1: Production and evaluation of new cross combinations in coconut

- The trials at Arisikere and Ambajipeta centres to be closed. Only Bhubaneshwar centre to continue.

Expt. 3: Evaluation of released varieties in coconut

- Yield parameters may be recorded and submitted every year along with average yield of previous four years.

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

- The hybrids may be evaluated for tender nut yield. Number of female flowers and setting percentage also to be recorded.
- Tender nut parameters to be evaluated every year (at sixth and seventh months of maturity).

OILPALM

Gen. 8: Studies on comparative performance of different hybrid combinations of oil palm

- Palm- wise bunch analysis may be taken from this year.

Gen. 8D: Evaluation of new progeny cross combinations in oil palm

- The trials may be closed in Gangavathi centre.

Gen. 8E: Improvement of Dura type

- Set I trial is to be discontinued at Pattukottai. Palms may be removed and area to be used for new planting with material to be provided from IIOPR.

PALMYRAH

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

- Further collection of local germplasm may be restricted to specific traits.
- Minimum descriptors for palmyrah may be prepared for characterisation and documentation of conserved palmyrah germplasm.

SULPHI PALM

Gen. 17: Collection, conservation and evaluation of sulphi germplasm

- As decided in earlier group meeting, further collection of sulphi germplasm may be restricted to specific traits.
- Attempts may be made to prepare minimum descriptor for sulphi palm.

ARECANUT

Gen. 4: Activity 1: Evaluation of varieties and establishment of mother blocks and production of quality planting material in arecanut

- Additional seedlings of Hirehalli Dwarf to be provided by ICAR - CPCRI (RS), Vittal to Shivamoga centre for establishment of mother blocks.

8. RECOMMENDATIONS (General)

- Uniform nomenclature to be adopted for germplasm / hybrids / parental lines under evaluation and yield data of last four years may be presented
- Performance over different centres with respect to common / key parameters should be consolidated and presented during Annual Group Meets along with the year of planting in each location
- Scientists from ICAR - IIOPR, Pedavegi along with PC (Palms) may visit Madhopur centre and assess the outcome of the centre and decide upon the continuation of the centre.

9. Technical Programme (Project wise)

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

Sl. No.	Trials	Code No.	Centre allotted	No. of centres
9	Evaluation of location specific Tall x Tall coconut hybrids	Gen. 2 Expt.5	Ambajipeta, Ratnagiri and Veppankulam	3
10	Evaluation of Dwarf x Dwarf coconut hybrids in different agro climatic conditions	Gen. 2 Expt.6	Ambajipeta, Mondouri, Ratnagiri, Veppankulam and Pilicode	5
Gen. 3: Establishment of mother blocks and production of quality planting material in coconut				
11	Demonstration of released coconut varieties in different agro-climatic regions	Gen. 3 Expt.1	Aliyarnagar, Ambajipeta, Arsikere, Bhubaneshwar, Jagdalpur,Kahikuchi, Mondouri,Navsari, Ratnagiri, Sabour and Veppankulam	11
12	Nucleus seed gardens for released varieties	Gen. 3 Expt. 2	Aliyarnagar, Ambajipeta, Arsikere, Jagdalpur, Kahikuchi, Mondouri, Ratnagiri Veppankulam and Port Blair	9
OIL PALM				
1	Studies on comparative performance of different hybrid combinations of oil palm	Gen. 8	Pattukkottai	1
2	Development and evaluation of D x D crosses by utilizing African germplasm	Gen. 8B Expt. I	Gangavati and Mulde	2
3	Development and evaluation of D x P crosses by utilizing African germplasm	Gen. 8B Expt. II	Gangavati and Mulde	2
4	Evaluation of new cross combinations in oil palm	Gen. 8 C	Madhopur , Mulde, Pattukkottai, Vijayarai	4
5	Evaluation of new cross combinations in North East regions(Pasighat)	Gen. 8 C (I)	Pasighat	1
6	Evaluation of new progency cross combinations in oil palm	Gen. 8D(I)	Madhopur , Mulde, Pasighat, Pattukkottai, Vijayarai	5
7	Evaluation of D x P hybrids for dwarfness and yield in oil palm	Gen. 8D(II)	Vijayarai	1
8	Improvement of Dura Types	Gen. 8 E	Pattukkottai	1
PALMYRAH				
1	Survey and collection of palmyrah germplasm and evaluation	Gen. 9	Killikulam and Pandirimamidi	2

Sl. No.	Trials	Code No.	Centre allotted	No. of centres
SULPHI PALM				
1	Collection, conservation and evaluation of sulphi (*Caryota urens*) germplasm	Gen.17	Jagdalpur	1
ARECANUT				
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	Gen. 4 Activity I	Wakawali and Shivamogga	2
2	Nucleus seed gardens for varieties	Gen. 4 Activity II	Goa, Port Blair, Shivamogga and Wakawali	4

10. Technical Programme (Centre Wise)

Crop : Coconut

Centre	Project Number	Number of Experiments / Activities	Centre	Project Number	Number of Experiments / Activities
Coconut			**Oil Palm**		
Aliyarnagar	Gen.1	3	Gangavathi	Gen. 8B	2
	Gen.2	2	Mulde	Gen. 8B	1
	Gen.3	2		Gen. 8 C	1
Ambajipeta	Gen.1	2		Gen. 8D(I)	1
	Gen.2	5	Madhopur	Gen. 8 C	1
	Gen.3	2		Gen. 8D(I)	1
Arsikere	Gen.1	2	Pasighat	Gen. 8 C (I)	1
	Gen.2	2	Pattukottai	Gen. 8	1
	Gen.3	2		Gen. 8 C	1
Bhubaneshwar	Gen.1	3		Gen. 8 E	1
	Gen.2	4	Vijayarai	Gen. 8 C	1
	Gen.3	1		Gen. 8D(I)	1
Jagdalpur	Gen.1	1		Gen. 8D(II)	1
	Gen.3	2	**Palmyrah**		
Kahikuchi	Gen.1	1	Killikulam	Gen. 9	1
	Gen.2	2	Pandirimamidi	Gen. 9	1
	Gen.3	2	**Arecanut**		
Mondouri	Gen.1	1	Wakawali	Gen. 4	2

	Gen.2	2	Shivamogga	Gen. 4	2
	Gen.3	2	Goa,	Gen. 4	1
Navsari	Gen.1	2	Port Blair	Gen. 4	1
	Gen.2	1	**Sulphi Palm**		
	Gen.3	1	Jagdalpur	Gen.17	1
Pilicode	Gen.1	1			
	Gen.2	1			
Ratnagiri	Gen.1	3			
	Gen.2	4			
	Gen.3	2			
Sabour	Gen.1	2			
	Gen.3	1			
Veppankulam	Gen.1	2			
	Gen.2	4			
	Gen.3	2			
Port Blair	Gen.3	1			

11. b. Detailed Technical Program (2016 – 17)

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

Expt.1: Evaluation of conserved germplasm

S.No	Name of the Centres	Project period	
		From	To
1	Bhubaneshwar	2004	Cont.,
2	Navsari	2011	Cont.,
3	Sabour	2011	Cont.,

Objectives: (i). Conservation and Multi-location testing of the coconut germplasm.

(ii). Evaluation of germplasm for their yield, reaction to biotic stresses.

Experimental materials:

AICRP centre	Genotypes to be evaluated
Bhubaneshwar	COD, Sakhigopal, MYD, St.Vincent, SSG, Guam Type I, BSI, Andaman Ordinary, Zanzibar Tall, San Ramon, Benaulim Tall, Gangabondam, WCT, MGD, Tiptur Tall and Java Tall
Navsari	COD, MYD, Gangabondam, CGD, Benaulim, PHOT, Kappadam, Seychelles, Borneo, FMS, LCOT, ADOT, San Ramon, Guam, New Guinea Tall, WCT Spicata, BRR, BGL and BYL
Sabour	LCOT, PHOT, ADOT, Benaulim, 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

Bhubaneshwar and Navsari : 5 palms / genotype

Activity for 2016-17:

- 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

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

Objectives: (i). To collect, conserve and evaluate the local land races of coconut.

(ii). To evaluate for yield and reaction to biotic stresses.

Evaluation materials: 10 - 15 local germplasm collection (CRP series).

Experimental design: 5 local germplasm in RBD, other local germplasm will be maintained as an observational trial.

Activity for 2016-17:

- Trait specific collection of local germplasm (Pilicode and Sabour centres)
- Recording of morphological observations , **as listed in the annexure**, in 5 palms / genotype
- Management of palms with recommended package of practices

Varties	Bhubane-shwar	Ambajipet	Arsikere	Aliyar-nagar	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

(i). Evaluation of coconut elite germplasms for higher copra out turn and tender nut water under different agro ecological conditions.

(ii). Evaluation of coconut elite germplasm selections for reaction to biotic stresses.

Trial details

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

Plot size: 4 palms / genotype / replication

Activity for 2016-17:

- 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

S.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 2016-17:

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

Gen. 2 : Evaluation of coconut hybrids in different agro climatic regions

Expt. 1: Production and evaluation of new cross combinations in coconut

S. No	Name of the Centres	Project period	
		From	To
1	Bhubaneshwar	2005	Cont.,

Genotypes:

Bhubaneshwar	8 [Chandra Laksha , VHC 1, Konkan Bhatye Coconut Hybrid, Gautami Ganga x Kera Chandra , VHC 2 , Laksha Ganga , Kera Sree , Godavari Ganga + I check (ECT)]

Objective: Evaluation of coconut hybrids for yield, quality and reaction to biotic stress.

Experimental design: RBD

Replications: 3

Plot size: 4 palms / genotype / replication

Activity for 2016-17:

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

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

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

Objectives :

(i) 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

Sl. No	Centres	Location specific combinations to be evaluated
3.	Arsikere	Tiptur Tall x PHOT, Tiptur Tall x LCOT, LCOT x MYD, LCOT x MOD, Tiptur Tall x MYD, Tiptur Tall x MOD
4.	Bhubaneshwar	Sakhigopal x COD, MGD x Sakhigopal , Sakhigopal x GBGD, GBGD x IND025, COD x CRP794
5.	Kahikuchi	Assam Green Tall (AGT) x CCNT, AGT x MYD, AGT x PHOT, CRP502 x AGT, CRP501 x PHOT
6.	Mondouri	LCOT x PHOT , PHOT x LCOT , ECT x Java Tall, ECT x Jamica, ECT x Hazari
7.	Ratnagiri	COD x CRP 513, COD x Pratap, COD x CRP 514, CRP 513 x COD, Pratap x COD, CRP 514 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 2016-17:

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

Expt. 3: Evaluation of released varieties in coconut

S.No	Name of the Centres	Project period	
		From	To
1	Ambajipeta	2002	Cont.,
2	Bhubaneshwar	2004	Cont.,

Objectives:

- To evaluate the promising varieties of coconut arising out of experiments at CPCRI and SAUs

Experimental details:

Centres	Combinations to be evaluated
Ambajipeta	Chandra Sankara, Chandra Laksha, VHC1, VHC 2, Kera Ganga, Laksha Ganga, Double Century, Godavari Ganga and Chandra Kalpa
Bhubaneshwar	Kera Sankara, Kera Ganga, Chandra Sankara, Kera Chandra and Chandra Kalpa, Sakhigopal

Experimental design : RBD

No. replications : 3 replications

Plot size : 6 palms / genotype / replication

Activity for 2016-17:

- 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 Tall x Tall coconut hybrids

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

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

Objectives:

(i) To evaluate five T x T 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 2016-17:

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

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

Objectives: (i). To evaluate location specific T x T combinations at different centres

(ii).To evaluate for yield and reaction to biotic stresses.

Evaluation materials: Seven location specific Tall x Tall combinations + 1 Check

Sl.No	Centres	Combinations
1	Ambajipeta	Java Tall x ECT, PHOT x ECT, Fiji Tall x ECT, ECT x PHOT, Laccadive Ordinary x ECT, Cochin China x ECT, ECT x Fiji Tall
2	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, LCOT x Benaulim Green Round Tall
3	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 2016-17:

- Recording of morphological 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

S.No	Name of the Centres	Project period	
		From	To
1	Ambajipeta	2011	Cont.,
2	Mondouri,	2011	Cont.,
3	Ratnagiri	2011	Cont.,
4	Veppankulam	2011	Cont.,
5	Pilicode	2014	Cont.,

Objectives:

(i). To develop short statured hybrids for tender nut.

(ii). To evaluate hybrids for tender nut, yield and quality.

(iii). 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 per genotype per replications: 6

Activity for 2016-17:

- Recording of morphological 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.

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

S.No	Name of the Centres	Project period	
		From	To
1	Aliyarnagar	2011	Cont.,
2	Ambajipeta	2011	Cont.,

3	Arsikere	2009	Cont.,
4	Bhubaneshwar	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: (i). 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 Prathiba, Kalpa Mitra, Kalpa Raksha, Kalpa Dhenu and Local check

No. palms / genotype: 10 palms per genotype.

Activity for 2016-17:

- 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
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: (i). Establishment of nucleus seed garden for released varieties

(ii). Production of quality planting materials

Activity for 2016-17:

- 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

Gen. 8: Studies on the comparative performance of different hybrid combinations of oil palm

Centre: Pattukkottai

S.No	Name of the Centres	Project period	
		From	To
1	Pattukottai	2006	Cont.,

Objective: To evaluate the performance of different hybrids for yield and quality.

Ten hybrid combinations:

49 D x 66 P (NRCOP 11)	25 D x 214 P (NRCOP 12)	25 D x 66 P (NRCOP 13)
68 D x 36 P (NRCOP 14)	21 D x 214 P (NRCOP 15)	131 D x 66 P (NRCOP 16)
350 D x 66 P (NRCOP 17)	107 D x 214 P (NRCOP 18)	61 D x 66 P (NRCOP 19)
28 D x 68 P (NRCOP 20)		

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 2016-17:

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

Gen. 8 B. Expt.1: Development and evaluation of D x D crosses by utilizing African germplasm

Centres : Gangavati and Mulde

S.No	Name of the Centres	Project period	
		From	To
1	Gangavathi	2013	Cont.,
2	Mulde	2013	Cont.,

Objectives:

- Development of mother palms by utilizing drought tolerant palms
- Development of D x D crosses.
- Evaluation of new crosses for yield.

Gangavati:

Activity for 2016-17:

Crossing Programme for Gangavati centre				
Development of Dura x Dura crosses				
Female/ Male	**2 (ZS-1-R-3-2)**	**3 (ZS-6-R-2-2)**	**4 (ZS-3-R-2-6)**	**5 (TS-5-R-3-3)**
1 (ZS-3-R-3-3)	*	*	*	*
2 (ZS-1-R-3-2)		*	*	*
3 (ZS-6-R-2-2)			*	*
4 (ZS-3-R-2-6)				*

Mulde:

Crossing Programme for Mulde centre				
Development of Dura x Dura crosses				
Female/ Male	**2 (ZS-8-R-2-5)**	**3 (TS-2-R-2-2)**	**4 (TS-11-R-2-3)**	**5 (TS-11-R-2-6)**
1 (ZS-2-R-3-3)	*	*	*	*
2 (ZS-8-R-2-5)		*	*	*
3 (TS-2-R-2-2)			*	*
4 (TS-11-R-2-3)				*

- Collection of pollens and
- Development of D x D crosses
- Collection of sprouts from ICAR-IIOPR for further evaluation
- Management of palms with recommended package of practices.

Expt. 2: Development and evaluation of D x P crosses by utilizing promising African Dura germplasm

Centre : Gangavati and Mulde

Objectives: (i). Development of D x P crosses.

(ii). Evaluation of these new cross combinations for yield and other parameters

(iii). Development of hybrids for commercial exploitation

Gangavati:

Development of Dura x Pisifera crosses		
1 (ZS-3-R-3-3)	**x**	**P1**
2 (ZS-1-R-3-2)	**x**	**P1**
3 (ZS-6-R-2-2)	**x**	**P1**
4 (ZS-3-R-2-6)	**x**	**P1**
5 (TS-5-R-3-3)	**x**	**P1**
1 (ZS-3-R-3-3)	**x**	**P2**
2 (ZS-1-R-3-2)	**x**	**P2**
3 (ZS-6-R-2-2)	**x**	**P2**
4 (ZS-3-R-2-6)	**x**	**P2**
5 (TS-5-R-3-3)	**x**	**P2**

Mulde:

1 (ZS-2-R-3-3)	**x**	**P1**
2 (ZS-8-R-2-5)	**x**	**P1**
3 (TS-2-R-2-2)	**x**	**P1**
4 (TS-11-R-2-3)	**x**	**P1**
5 (TS-11-R-2-6)	**x**	**P1**
1 (ZS-2-R-3-3)	**x**	**P2**
2 (ZS-8-R-2-5)	**x**	**P2**
3 (TS-2-R-2-2)	**x**	**P2**
4 (TS-11-R-2-3)	**x**	**P2**
5 (TS-11-R-2-6)	**x**	**P2**

Activity for 2016-17:

1) Development of D x P crosses

2) Collection of sprouts from ICAR-IIOPR for further evaluation

3) Management of palms with recommended package of practices.

Gen. 8 C: Evaluation of new cross combinations in oil palm

Centres : Gangavati, Madhopur , Mulde, Pattukkottai, Vijayarai

S.No	Name of the Centres	Project period	
		From	To
1	Gangavathi	2007	Cont.,
2	Madhopur	2011	Cont.
3	Mulde	2007	Cont.
4	Pattukottai	2007	Cont.,
5	Vijayarai	2007	Cont.,

Objectives:

- Multi-location trials on the performance of new oil palm hybrids

Experimental Details:

Treatments : 10 Hybrid Combinations

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

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

Activity for 2016-17:

- Recording observations on growth and yield parameters, **as listed in the annexure.**
- Palm- wise bunch analysis may be undertaken during this year.

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

Centre: Pasighat

Treatments : 10 Hybrid Combinations

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

Activity for 2016-17:

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

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

Centres : Madhopur, Mulde, Pasighat, Pattukkottai, Vijayarai

S.No	Name of the Centres	Project period	
		From	To
1	Madhopur	2013	Cont.,
2	Mulde	2011	Cont.
3	Pasighat	2013	Cont.
4	Pattukottai	2013	Cont.,
5	Vijayarai	2011	Cont.,

Objectives: Evaluation of Oil palm hybrids for oil yield

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 2016-17:

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

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

Centre : Vijayarai

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

Treatment details:

Activity for 2016-17:

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

PALMYRAH

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

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

Objectives:

(i) To collect and conserve dwarf and high yielding palms from different parts of the country.

(ii) Evaluation of the germplasm for growth and yield.

Activity for 2016-17:

- Management of palms with recommended package of practices.
- The germplasm of palmyrah collected will be evaluated for various biometrical and yield related characters.

SULPHI PALM

Gen. 17: Collection, conservation and evaluation of Sulphi (*Caryota urens*) germplasm Year of start: 2009

Objectives:

- To collect, conserve and evaluate the sulphi germplasm
- To document the variability in sulphi palms
- To establish and assemble the diversity among sulphi population

Activity for 2016-17:

- Maintainance of germplasm
- Recording growth observations

ARECANUT

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: 8, Design: RBD, No. of palms / treatment: 6,

Year of start July: 2015

Centre: Shivamogga

Varieties:

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

Replications: 3, Varieties: 6, Design: RBD, No. of palms/treatment: 6

Year of start August: 2015

Activity for 2016-17:

- Planting as per the experimental design
- Adopting package of practices
- Taking observations on growth characters.

Activity II: Establishment of nucleus seed garden of arecanut

Centres: Wakawali, Shivamogga, Port Blair and Goa

Wakawali:

- Shriwardhan- 500 plants
- Hirehalli Dwarf – 25 plants

Shivamogga:

- Hirehalli Dwarf – 25 plants

Port Blair:

- Andaman Dwarf – 25 plants

Goa:

- Hirehalli Dwarf – 25 plants

Activity for 2016-17:

- Management of palms with recommended package of practices.
- Collection of seed nuts/seedlings and planting.
- Recording observations on growth characters.

5.3 SESSION III- Crop Production

Chairman : **Dr. S. Bhaskar**

Co- chairman : **Dr. V. Krishnakumar , Dr. Ravi Bhat**

Convener : **Dr. B.N. Rao, Dr. T.B. Basavaraju**

1. Number of reports presented

Crop	Coconut	Oil Palm	Palmyrah	Arecanut	Total
Number of reports	14	6	1	3	24

2. Centres where work has been done

Crop	Coconut	Oil Palm	Palmyrah	Arecanut	Total
Number of centres	14	5	2	2	23

3 Non reporting centres: 2 (Madhopur, Jagdalpur)

4. Brief description of work done and salient achievements reported

A. Coconut

1. Coconut based high density multi species cropping system

The coconut based cropping systems under integrated nutrient management developed at different AICRP Centres showed higher productivity and income than monocrop of coconut.

Sl.No.	AICRP Centre's	Cropping system
1	Aliyarnagar	Coconut + cocoa + banana + pineapple cropping system with integrated nutrient management of 75% of recommended NPK coupled with organic recycling with vermicompost (Rs. 329600/ha).
2	Arsikere	Coconut + cocoa + lime + drumstick + banana cropping system with fully organic nutrient management (Rs. 259595/ha)
3	Ambajipet	Coconut + cocoa + banana + pineapple + elephant foot yam (K) - tomato (R) + heliconia cropping system with integrated nutrient management of 75% of recommended NPK coupled with organic recycling with vermicompost (Rs. 193183/ha).
4	Bhubaneshwar	Coconut + guava + banana + pineapple + colocasia cropping system with integrated nutrient management of 75% of recommended NPK coupled with organic recycling with vermicompost (Rs. 143687/ha).
5	Kahikuchi	Coconut + pineapple + cowpea + Assam lemon + banana + black pepper cropping system with nutrient management of 50% of recommended NPK + organic recycling with vermicompost + vermi wash application + biofertilizer application and *in situ* green manuring (Rs. 317715/ha)
6	Mondouri	Coconut+ black pepper + banana + lemon + onion + potato cropping system with integrated nutrient management of 75% of recommended NPK coupled with organic recycling with vermicompost (Rs. 394341/ ha).

Sl.No.	AICRP Centre's	Cropping system
7	Ratnagiri	Coconut + black pepper + nutmeg + cinnamon + banana + pineapple cropping system with nutrient management of 50% of recommended NPK + organic recycling with vermicompost + vermi wash application + biofertilizer application and *in situ* green manuring (Rs. 1112629/ha).
8	Veppankulam	Coconut + black pepper + banana + cocoa cropping system with nutrient management of 50% of recommended NPK + organic recycling with vermicompost + vermi wash application + biofertilizer application and *in situ* green manuring (Rs. 352180/ha).

2. Intercropping of flower crops in coconut garden

Growing of flower crops in coconut garden is highly productive and remunerative than monocropping of coconut. The following flower crops were found suitable for intercropping in coconut gardens in different agro climatic regions of the country.

Sl.No.	AICRP centre's	Flower crops identified
1	Aliyarnagar	Marigold, gomphrena and chrysanthemum
2	Arsikere	Chrysanthemum and crossandra and jasmine (*Jasminum multiforum*)
3	Kahikuchi	Gerbera, tuberose and gladiolus
4	Mondouri	Gladiolus, tuberose and gerbera
5	Ratnagiri	Lily, jasmine (*Jasminum multiforum*) and heliconia

OIL PALM

1. Intercropping in young oil palm gardens

Growing of vegetables and fruit crops in young oil palm gardens provide additional income to the farmers. At Gangavati Centre, intercropping of vegetable crops like okra, brinjal and tomato provide an additional income of Rs. 16000 to Rs. 50000 per ha. Similarly at Mulde Centre, intercropping of banana and elephant foot yam provide an additional income of Rs. 61000 to Rs. 123000 per ha.

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

1. Suitable flower crops for intercropping in coconut gardens

Growing of flower crops in coconut garden is highly productive and remunerative than monocropping of coconut. The following flower crops are recommended for intercropping in coconut gardens in different regions of the country.

2. Suitable vegetable crops for intercropping in young oil palm gardens

Sl.No.	AICRP centre	Flower crops identified
1	Aliyarnagar (Tamil Nadu)	Marigold, gomphrena and chrysanthemum
2	Arsikere (Karnataka)	Chrysanthemum and crossandra and jasmine (*Jasminum multiforum*)
3	Kahikuchi (Assam)	Gerbera, tuberose and gladiolus
4	Mondouri (West Bengal)	Gladiolus, tuberose and gerbera
5	Ratnagiri (Maharashtra)	Lily, jasmine (*Jasminum multiforum*) and heliconia

The vegetable crops- okra, brinjal and tomato are suitable for intercropping in young oil palm gardens as they help farmers to earn additional income during the juvenile phase of oil palm.

6. Programmes proposed for coming years

Crop	Ongoing Experiments	Revised Experiments	New Experiments	Total
Coconut	15	-	-	15
Oil palm	7	-	-	7
Palmyrah	1	-	-	1
Sulphi palm		-		
Arecanut	3	-	-	3
Total	**26**	**-**		**26**

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

Agron. 5A: Studies on fertilizer application through micro irrigation technique in coconut

- Increase the number of splits from 6 to 8 at monthly interval for application of fertilizers through micro-irrigation.

Agron.10: Development of coconut based cropping systems for different agro climatic regions

- Banana should be avoided in the cropping system in the areas of water scarcity.
- Use improved varieties of crops for intercropping.
- Land equivalent ratio may be worked out for the cropping system
- Energy balance of the cropping system should be worked out
- Data should be analysed statistically.
- Data on coconut equivalent yield of intercrops should also be presented.
- Record data on pest and disease incidence in the cropping system.
- Compiled presentation of results of Centres may be made for common observations.
- System productivity may be calculated.
- Maintain uniformity in recording observations and presenting data and proper interpretation of the results should be made.
- Title may be changed as **Evaluation of nutrient management under coconut based cropping systems for different agro climatic regions**

Agron. 10A: Development of coconut based farming systems

- Output from animals should be quantified and integration should be established.
- Impact of continuous grazing may be studied.
- Nutrient budgeting and energy balance may be worked out.
- The data on beneficial microbes as well as enzymatic activity may be recorded. The guidelines for microbial analysis will be provided to all the Centres by Project Coordinator (Palms).

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

Expt. 1: Performance of flower crops in coconut garden

Presented the pooled data of flower and coconut yield for three years from 2012-13 to 2014-15 along with the economics, soil nutrient status and leaf nutrient status of coconut. Considering the performance of flower crops in coconut garden and returns that could be realized from flower crops, the following flower crops have been identified for different regions:

- Aliyarnagar Centre: Marigold, gomphrena and chrysanthemum
- Arsikere centre: Chrysanthemum, crossandra and jasmine (*Jasminum multiforum*)
- Kahikuchi Centre: Gerbera, tuberose and gladiolus
- Mondouri Centre: Gladiolus, tuberose and gerbera,
- Ratnagiri Centre: Lily, jasmine (*Jasminum multiforum*) and heliconia.

The experiment is concluded and the final report may be submitted to Project Coordinator (Palms).

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

- This is a new programme being implemented at Bhubanewar, Ratnagiri and Kasaragod Centres.
- The Trichoderma population may be recorded along with other microbes.
- Nutrient budgeting may be done.
- Biocomposts having higher K content may be included to supplement K in the organic management wherever K requirement is there.

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

- Quality parameters like total sugar and reducing sugar may be recorded in tender nuts.

Expt. 2: Nutrient management through organics in coconut plantation under Island conditions

- The soil pH should be corrected before imposition of treatments as the soils are acidic.

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

- Follow uniform time for indexing the disease- particular month of the year.

Oil Palm

Agron. 6A: Studies on fertigation through micro-irrigation technique in oil palm

(Madhopur Centre)

- The Scientist of the Madhopur Centre has not attended the meeting. Hence the progress of the experiment could not be discussed.

Agron. 12. Development of water and nutrient management model for oil palm cultivation in North East Region (Pasighat Centre)

- The experiment is not conducted so far. IIOPR Scientists suggested to propose a new experiment in place of existing experiment as the plot is not suitable for fertigation studies.

Agron.13: Demonstration on oil palm production potential in Eastern and North East Regions of India (Pasighat and Madhopur Centres)

- Presented the progress of demonstration carried out at Pasighat Centre.

Agron.15: Intercropping in young oil palm garden

(Gangavathi, Mulde and Vijayarai Centres)

- The experiment at Gangavati Centre is concluded and the recommendation is made:

Okra, tomato and brinjal are the suitable vegetables for intercropping in juvenile oil palm plantation (up to 3 years).

- The experiment will be continued at Mulde and Vijayarai Centres.
- Elephant foot yam is to be grown by maintaining only one stem.

Expt.1: Studies on plant geometry and optimization of nutrients in oil palm

(Pedavegi Centre)

- In sub plot treatments, soil application of RDF may be included.

Palmyrah

Expt. 6: Composting technology of palmyrah pith

- As the decomposition of palmyrah pith was not complete with the existing treatments, the treatments needs to be modified in consultation with Scientists of CPCRI

8. RECOMMENDATIONS (General)

- Observations on change in microbial and nutrient level in soil over years should be recorded.
- Treatment effects over years should also be presented.

9. Technical programme (Project wise)

Sl. No.	Trials	Code No.	Centre allotted	Number of centres
COCONUT				
1	Studies on fertilizer application through micro-irrigation technique in coconut	Agron. 5	Sabour	1
2	Evaluation of nutrient management under coconut based cropping system for different agro-climatic regions.	Agron. 10	Aliyarnagar, Ambajipeta, Arsikere, Bhubaneshwar, Jagdalpur, Kahikuchi, Mandouri, Navsari, Ratnagiri, Sabour, Veppankulam	11
3	**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
4	**Agron.11: Coconut based cropping systems for different agro-climatic regions**			
i)	Performance of cocoa varieties/ hybrids as intercrop in coconut garden	Expt. 2	Ambajipeta, Kasaragod, Navsari, Veppankulam	4
ii)	Multilocation trial (MLT) of cocoa clones under palms	Expt. 3	Aliyarnagar, Arsikere, Kahikuchi, Ratnagiri, Vijayarai	5

Sl. No.	Trials	Code No.	Centre allotted	Number of centres
iii)	Screening of black pepper varieties for their performance as intercrop in coconut gardens	Expt. 4	Kahikuchi, Mondouri	2
iv)	Evaluation of coconut based cropping system models	Expt. 5	Goa, Port Blair	2
v)	Performance of different tuber crops and spices in coconut based cropping system	Expt. 6	Mondouri	1
vi)	Coconut based multispecies cropping systems under coastal littoral sandy soil	Expt. 7	Bhubaneshwar, Kasaragod, Ratnagiri	3
5	**Agron. 14: Soil and nutrient management in coconut**			
i)	Integrated nutrient management technologies to enhance the productivity and quality of tender nut in dwarf coconut.	Expt. 1	Aliyarnagar	1
ii)	Nutrient management through organics in coconut plantation under Island conditions	Expt. 2	Port Blair	1
iii)	Network project on "Organic farming in coconut based farming system"	Expt. 3	Aliyarnagar, Ambajipeta, Arsikere	3
iv)	Management of Root (wilt) disease in coconut (Farmer's garden)	Expt. 4	Aliyarnagar	1
OIL PALM				
1.	Studies on fertigation through micro-irrigation technique in oil palm	Agron. 6A	Madhopur	1
2	Development of water and nutrient management model for oil palm cultivation in North –East Region.	Agron .12	Pasighat	1
3.	Demonstration on oil palm production potential in North East Region	Agron. 13	Madhopur and Pasighat	2
4.	Intercropping in young oil palm garden	Agron. 15	Mulde and Vijayarai	2
5.	**Agron. 21: Plant geometry and optimization of nutrients in oil palm**			
i)	Studies on plant geometry and optimization of nutrients in oil palm	Expt. 1	Pedavegi	1
ii)	Optimization of fertilizer dose for oil palm plantation	Expt. 2	Bavikere	1
iii)	Plant geometry studies in oil palm	Expt. 3	Bavikere	1

PALMYRAH				
1.	Studies on use of growth inhibiting substances for induction of early flowering in palmyrah	Agron. 16 Expt. 1	Killikulam and Pandirimamidi	2
2.	Composting technology of palmyrah pith	Expt. 2	Killikulam and Pandirimamidi	2
ARECANUT				
1.	Development of arecanut based cropping systems for different agro climatic regions Expt. 1. Evaluation of arecanut based cropping system models	Agron.18 Expt. 1	Port Blair	1
2.	Studies on crown chocking disorders in arecanut	Agron. 20	Shivamogga	1

10. Technical programme (Centre wise)

Centre	Project Number	Number of projects
Coconut		
Aliyarnagar	Agron. 10, Agron. 10A, Agron. 11, Agron. 14	4
Ambajipeta	Agron. 10, Agron. 11, Agron. 14	3
Arsikere	Agron. 10, Agron. 10A, Agron. 11, Agron. 14	4
Bhubaneshwar	Agron. 10, Agron. 11, Agron. 14	3
Jagdalpur	Agron. 10	1
Kahikuchi	Agron. 10, Agron. 11	2
Mondouri	Agron. 10, Agron. 11	2
Navsari	Agron. 10, Agron. 11	2
Ratnagiri	Agron. 10, Agron. 11, Agron. 14	3
Sabour	Agron. 5, Agron. 10	2
Veppankulam	Agron. 10, Agron. 10A, Agron. 11	3
Vijayarai	Agron. 11	1
Goa	Agron. 11	1
Port Blair	Agron. 11, Agron. 14	2
Kasaragod	Agron. 11, Agron. 14	2
Oil palm		
Mulde	Agron. 15	1
Madhopur	Agron. 6 A, Agron. 13	2
Pasighat	Agron. 12, Agron. 13	2
Vijayarai	Agron.15	1

10. Technical programme (Centre wise)		
Centre	**Project Number**	**Number of projects**
Coconut		
Pedavegi	Agron. 21	1
Bavikere	Agron. 21	2
Palmyrah		
Killikulam	Agron. 16	2
Pandirimamidi	Agron. 16	2
Arecanut		
Port Blair	Agron. 18	1
Shivamogga	Agron. 20	1

11. Technical Programme 2016-17 (Ongoing/Revised/New)

ONGOING

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

S.No	Name of the Centres	Project period	
		From	To
	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; Replication: 4; Year of start: 2012-13

Date of planting of coconut: 2009; Number of palms/treatment: 6

- Quantity of water : 66 % of open pan evaporation with mulching using available sources within the farm
- Source of nutrients : Urea for Nitrogen

Diammonium Phosphate for Nitrogen and Phosphorus

Muriate of Potash for Potassium

- Recommended dose of organic manure to be applied for all the palms

Activity for 2016-17:

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

Agron.10: Evaluation of nutrient management under coconut based cropping systems for different agro-climatic regions

Centers: Aliyarnagar, Ambajipeta, Arsikere, Bhubaneshwar, Jagdalpur, Kahikuchi, Mondouri, Navsari, Ratnagiri, Sabour, Veppankulam

S.No	Name of the Centres	Project period	
		From	To
	Aliyarnagar	Year of planting of intercrops: 2008-09 and Year of modifying the treatments: 2012-13 Year of planting of the intercrops in Navsari (2013-14)	Cont.,
	Ambajipeta		
	Arsikere		
	Bhubaneshwar		
	Jagdalpur		
	Kahikuchi		
	Mondouri		
	Navsari		
	Ratnagiri		
	Sabour		
	Veppankulam		

Objectives:

- To develop location specific coconut based cropping system models for different agro-climatic regions
- To assess the effect of the cropping system model on the productivity of coconut
- To elucidate the effect of soil moisture conservation practices on the growth and yield of coconut and intercrops.
- To assess the impact of integrated nutrient management technology (with major emphasis on organic wastes recycling process) on soil fertility status and plant nutrient content in coconut.
- To workout the economics of the cropping system model

Treatment details:

T_1 – 75 % of Recommended NPK + organic recycling with vermicompost

T_2 - 50 % of RDF + organic recycling with vermicompost + vermiwash application + biofertilizer application and in situ green manuring.

T_3 - Fully organic: organic recycling with vermicompost + vermiwash application + biofertilizer

application and in situ green manuring and green leaf manuring (glyricidia leaves) + composted coir pith, husk burial and mulching with coconut leaves.

T_4 – Control (Monocrop of coconut with recommended NPK and organic manure)

Crop combinations:

i) Aliyarnagar : Coconut + Cocoa + Banana + Pineapple

ii) Ambajipeta : Coconut + Cocoa + Banana + Pine apple + Tomato + Heliconia

iii) Arsikere : Coconut + Banana + Drumstick + Cocoa+ Lime

iv) Bhubaneshwar : Coconut + Guava + Banana + Pine apple + Colocasia

v) Jagdalpur : Coconut + Guava + Cinnomon + Banana + Colocasia + Bottle gourd (Summer) + Mango ginger + Cowpea (Summer) + Elephant foot yam

vi) Kahikuchi : Coconut + Black Pepper + Turmeric + Banana + Assam Lemon + Pine apple + Elephant foot yam

vii) Mondouri : Coconut + Black Pepper + Lime + Banana + Onion + Potato

viii) Navsari : Coconut + Cinnamon + Turmeric + Banana + EFY + Tannia

ix) Ratnagiri : Coconut + Black pepper + Nutmeg + Cinnamon + Banana + Pineapple

x) Sabour : Coconut + Guava + Banana + Turmeric + Cowpea

xi) Veppankulam : Coconut + Black Pepper + Cocoa + Banana

Activity for 2016-17:

- Management of cropping system as per the schedule.
- Recording of observations **as listed in the annexure.**

Agron.10 A: Development of coconut based farming systems

Centres: Arsikere, Aliyarnagar, Veppankulam

S.No	Name of the Centres	Project period	
		From	To
	Arsikere	2013	Cont.,
	Aliyarnagar	2015	Cont.,
	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 farming system

Centre: Arsikere

S.No	Name of the Centre	Year of Start	
		From	To
1	Arsikere	2013	Cont.,

Treatment details:

T1: Coconut + Fodder crops – Cows

T2: Monocrop of coconut

Design: 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 fodder is 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 2016-17:

- Recording of observations **as listed in the annexure.**
- Management of the system with package of practice.

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

Centre: Arsikere

S.No	Name of the Centre	Year of Start	
		From	To
1.	Arsikere	2014	Cont.,

Treatment details:

T1: Coconut + Pasture crops – Sheep

T2: Monocrop of coconut

Design: 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 2016-17:

- Recording of observations **as listed in the annexure.**
- Management of the system with package of practice.

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

Centres: Aliyarnagar, Veppankulam

S.No	Name of the Centres	Year of Start	
		From	To
1.	Aliyarnagar	2015	Cont.,
2.	Veppankulam	2015	Cont.,

Treatment details:

T1: Coconut + Fodder trees + Pasture crops – Goat

T2: Monocrop of coconut

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

Area for each treatment: 0.40 ha. Year of start: 2015-16

Goat : Telicherry 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 2016-17:

- Management of the system with package of practice.
- Recording of observations **as listed in the annexure**.

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

Expt. 2: Performance of cocoa varieties/ hybrids as an intercrop in coconut garden

Centres: Ambajipeta, Kasaragod, Navsari, Veppankulam

S.No	Name of the Centres	Year of Start	
		From	To
1	Ambajipeta	2008	Cont.,
2	Kasaragod	2008	Cont.,
3	Navsari	2009	Cont.,
4	Veppankulam	2008	Cont.,

Experimental details:

Ambajipeta, Navsari 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); 2009-10 (Navsari)

Kasaragod Centre

Cocoa variety/ hybrid: 13: VTLCH-1, VTLCH-2, VTLCH-3, VTLCH-4, VTLCC-1, VTLC-61, VTLC-66, VTLC-11, VTLC-5, VTLC-19A, VTLC-30A, VTLC-1A and MH-1

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; Year of start: 2007-08.

Activity for 2016-17

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

Expt. 3: Multilocation trial (MLT) of cocoa clones under palms

Centres: Aliyarnagar, Arsikere, Kahikuchi, Ratnagiri, Vijayarai

S.No	Name of the Centres	Year of Start	
		From	To
1	Aliyarnagar	2013	Cont.,
2	Arsikere	2012	Cont.,
3	Kahikuchi	2015	Cont.,
4	Ratnagiri	2013	Cont.,
5	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

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).

Arsikere: 15 Cocoa clones/ hybrids

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

Ratnagiri: 21 Cocoa clones

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.

Vijayarai: 14 Cocoa clones/ hybrids

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 (Arsikere and Vijayarai), 2013-14 (Aliyarnagar and Ratnagiri) and 2015-16 (Kahikuchi)

Activity for 2016-17

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

Expt. 4: Screening of black pepper varieties for their performance as intercrop in coconut gardens

Centres: Kahikuchi and Mondouri

S.No	Name of the Centres	Project period	
		From	To
	Kahikuchi	2008	Cont.,
	Mondouri	2008	Cont.,

Objective: To find out the best pepper variety/varieties as mixed crop in coconut garden

Experimental Details:

Black Pepper varieties- 5: IISR Thevam, IISR Sakthi, Sreekara, IISR Malabar Excel, Panniyur 1

Design: RBD; Replication: 4; Year of start: 2009-10 (Kahikuchi); 2010-11(Mondouri)

Activity for 2016-17

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

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

Experimental details: Port Blair

Treatments

T_1: Coconut monocrop (control)

T_2: Coconut + black pepper + banana + ginger

T_3: Coconut + black pepper + pineapple + ginger

T_4: Coconut + black pepper + elephant foot yam

Design: RBD; Replications: 5; Plot size: 4 palms per treatment; Year of start: 2015-16

Activity for 2016-17:

- Establishment of cropping system and management of the systems as per the package of practices.
- Recording of observations as listed in the annexure.

Expt. 6: Performance of different tuber crops and spices in coconut based cropping system

S.No	Name of the Centre	Project period	
		From	To
1	Mondouri	2015	Cont.,

Mondouri

Objectives:

1. To develop location specific coconut based cropping systems with tuber crops and spices
2. To assess the effect of the cropping system model on the productivity of coconut
3. To work out the economics of the model

Experiment details

Treatments: 7

T_1 : Coconut+ Black Pepper + Onion+ Sweet Potato

T_2 : Coconut + Black Pepper + Turmeric + Elephant Foot Yam

T_3 : Coconut + Black Pepper + Ginger + Colocasia

T_4 : Coconut + Black Pepper + Coriander + Sweet Potato

T_5 : Coconut + Black Pepper + Chilli + Sweet Potato

T_6 : Coconut + Black Pepper + Onion + Potato

T_7 : Coconut Monocrop

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

Activity for 2016-17:

- Establishment of cropping system and management with package of practices.
- Recording of observations **as listed in the annexure**.

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

Centre: Bhubaneshwar, Kasaragod and Ratnagiri

S.No	Name of the Centre	Project period	
		From	To
1	Bhubaneshwar	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

Experiment details:

Treatments:

Main plot –3: Cropping systems

Bhubaneshwar & Kasaragod	Ratnagiri
C1: Coconut + Sapota + Vegetable (Rainy season)	C1 : Coconut + *Garcinia indica* + Vegetable Crops (Rainy season)
C2: Coconut + Sapota + Pineapple	C2 : Coconut + *Garcinia indica* + Pineapple
C3: Monocrop of coconut	C3 : Monocrop of coconut

Sub plot – 3: Nutrient management practices

N1: Green manuring + biofertilizers + organic recycling + FYM (as per POP)

N2: Green manuring + biofertilizers + organic recycling + Soil test based nutrient (chemical fertilizers) application

N3: 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 2016-17:

- Growing of intercrops

- Imposition of nutrient management treatments
- Recording of observations **as listed in the annexure**

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

Objectives:

S.No	Name of the Centre	Project period	
		From	To
	Aliyarnagar	2014	Cont.,

(i). To study the effect of INM on soil health, yield and quality of tender nut in dwarf coconut

(ii). To work out the economics of INM technologies

Treatments:

T_1- Recommended practice (500:320:1200 g NPK/palm + FYM- 50 kg/palm + TNAU Micronutrient Mixture -1 kg/palm + Neem cake -5 kg/palm)

T_2- Biomanures and Biofertilizers (Green leaf manuring-10 kg with Glyricidia loppings + organic recycling of coconut waste through Vermicompost -10 kg + coconut frond mulching + Azospirillum 100 g + Phosphobacteria 100 g + VAM 100 g) + Green manuring with sunhemp twice a year

T_3- T_2 + Soil test based NPK and micronutrient application

Coconut variety: Chowghat Orange Dwarf (COD); Age of palms: 25 years;

No. of palms per treatment- 6; Design – RBD; Replications – 7; Year of start: 2014-15

Activity for 2016-17:

- Imposition of INM treatments
- Recording of observations **as listed in the annexure**

Expt. 2: Nutrient management through organics in coconut plantation under Island conditions

Centre: Port Blair

S.No	Name of the Centre	Project period	
		From	To
1	Port Blair	2015	Cont.,

Objectives:

i). To evaluate the effect of organic nutrient management on soil health and yield of coconut

ii). To work out the economics of organic nutrient management in coconut

Experimental details:

Coconut varieties- 3: Green, yellow and orange Andaman dwarf

Nutrient management- 5

T_1: Control (20 kg FYM, 500:320:1500 g NPK/ palm/ year)

T_2: Biofertilizer (Kera Probio 50 g, twice per year) + *In situ* green manure (Cowpea) + Recycling of biomass (VC, 2 kg through external application)

T_3: Biofertilizer (Kera Probio 50 g, twice per year) + *In situ* green manure (Cowpea) + Recycling of biomass (VC, 2 kg through external application) + FYM (15 kg)

T_4: Biofertilizer (Kera Probio 50 g, twice per year) + *In situ* green manure (Cowpea) + Recycling of biomass (VC, 2 kg through external application) + Poultry manure (8 kg)

T_5: Biofertilizer (Kera Probio 50 g, twice per year) + *In situ* green manure (Cowpea)+ Recycling of biomass (VC, 2 kg through external application) + FYM (8 kg) + Poultry manure (4 kg)

Treatments: 5; Design: Factorial RBD; Replications: 5; Year of start: 2015-16

Activity for 2016-17:

- Imposition of treatments
- Recording of observations as **listed in the annexure**

Expt. 3: Network project on "Organic farming in coconut based cropping system"

Centres: Aliyarnagar, Ambajipeta, Arsikere

S.No	Name of the Centres	Project period	
		From	To
	Aliyarnagar	2015	Cont.,
	Ambajipeta	2015	Cont.
	Arsikere	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 + Cocoa + Lime + Drumstick

Activity for 2016-17

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

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

Centre: Aliyarnagar

S.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

i). Kanakkapillaivalasai village of Tirunelveli District

ii). Manakkadavu village of Coimbatore District

iii). Melagudalur village of Theni district

Year of start: 2015-16

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.
- ❖ Addition of 50 g Zinc sulphate per palm

Activity for 2016-17

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

OIL PALM

Agron. 6 A: Studies on the fertigation through micro-irrigation technique in oil palm

S.No	Name of the Centres	Project period	
		From	To
1	Madhopur	2009	Cont.,

Objectives:

i) To compare efficiency of soil application of fertilizers and fertigation in Oil Palm

ii) To study the effect of fertigation on the productivity of Oil Palm

iii) To work out the economic viability of fertigation over soil application Fertilizer

Source: Urea for nitrogen, Diammonium Phosphate for nitrogen and phosphorus and Muriate of potash for potassium. Fertigation is to be given in 6 splits.

Treatments	
T_1	300:150:300g NPK through fertigation
T_2	600:300:600g NPK through fertigation
T_3	900:450:900 g NPK through fertigation
T_4	1200:600:1200g NPK through fertigation
T_5	1200:600:1800g NPK through fertigation
T_6	1200:600:2700g NPK through fertigation
T_7	1200:600:2700g NPK through Soil application

Activity for 2016-17

- Recording observations on growth and yield parameters in Oil Palm
- Imposition of treatments as per schedule

Agron. 12: Development of an integrated water and nutrient management model for Oil Palm cultivation in North-East Region

Centre: Pasighat

Treatments:

1. 25% of RDF for irrigated oil palm

2. 50% of RDF for irrigated oil palm

3. 75% of RDF for irrigated oil palm

4. RDF for irrigated oil palm through soil application at four equal splits

Design: RBD Number of Replications: five No. of palms/ treatment (plot): 6

Recommended Dose of Fertilizer (1200:600:2700 g NPK/palm/year) through fertigation at monthly interval.

Note:

As the experiment is not initiated till today, decision is taken to discontinue the trial and new experiment may be initiated.

Agron. 13 : Demonstration on oil palm production potential in North East Region

S.No	Name of the Centres	Project period	
		From	To
1	Pasighat	2006	Cont.,
2	Madhopur	2009	Cont.,

No of palms: Pasighat -29 and Madhopur – 66

Activity for 2016-17

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

Agron. 15. Intercropping in young oil palm garden

S.No	Name of the Centres	Project period	
		From	To
	Mulde	2014	Cont.,
	Vijayarai	2014	Cont.,

Objectives:

1. To identify the suitable intercrops in newly planted progeny evaluation trial
2. To supplement farmers income during pre bearing period under TBP area

Mulde:

A) Banana Variety- Konkan Safed Velchi

B) Pineapple: Variety- Kew and Queen

C) Elephant Foot Yam

Vijayarai:

Intercrops: Vegetables - Bottle gourd, ridge gourd, bitter gourd and cumber

Replication: 5, Plot size: 3x3m, Design: RBD

Activity for 2016-17:

- Recording observations on growth parameters in Oil Palm
- Recording observation on yield and yield attributes in intercrops
- Management of the system with recommended package

Agron. 21: Plant Geometry and Optimization of nutrients in Oil palm

Expt. 1: Studies on Plant Geometry and Optimization of nutrients in Oil palm

Centre: IIOPR, Pedavegi

Objectives:

(i) To standardize the optimum planting density in oil palm

Technical programme:

Design: Split plot design

Planting methods: Main Plots

1. 9x9x9 m Hexagonal method – 143 palms/ha
2. 9x9 m square method - 123 palms/ha
3. 10x10x10 m Hexagonal method – 115 palms/ha
4. 10x10 m square method - 100 palms/ha

Fertigation Dose: Subplots

1. 25% of RDF for irrigated oil palm
2. 50% of RDF for irrigated oil palm
3. 75% of RDF for irrigated oil palm

- Number of Replications: Three

- No. of palms/ treatment (plot): Minimum of 8-10 palms based on the availability of space
- Approximate area required: 4.20ha (approx.)
- Uniform irrigation to all plots as recommended by IIOPR, Pedavegi
- Mg and Boron are to be applied to all palms uniformly as recommended by IIOPR, Pedavegi.
- Recommended fertilizer dose of 1200:600:2700 g NPK/palm/year through fertigation at monthly interval from third year.

Expt. 2: Optimization of fertilizer dose for oil palm

Centre: Bavikere (New Centre, UAHS, Shivamogga)

Objectives:

(i) To standardise the fertiliser requirement for oil palm under irrigated condition. **Treatments:** N, P_2O_5 and K_2O at three levels each

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

P_2O_5: 0, 600 and 1200 g / palm/year

K_2O: 0, 1800 and 3600 g / palm/year

Design: 3^3 Factorial RBD

Replications: Two Plot size: 9 palms Approx. Area: 3.5 ha

- No organic matter is added. Recommended doses of Mg SO_4 and Borax are to be applied at different growth stages uniformly.
- Planting material : Sprouts of single high yielding cross (Tenera) to be obtained from IIOPR, Pedavegi.
- 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)

Treatments:

Planting methods:

1. 9x9x9 m Hexagonal method
2. 9x9 m square method
3. 10x10x10 m Hexagonal method
4. 10x10 m square method

Design: RBD Number of Replications: Five

- 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: 2700 g NPK/ palm/ year) is to be applied in four equal splits in a year.
- No. of palms/ treatment (plot)/replication: 36 palms

Approximate Area required: 5.5 ha

Activities for 2016-17: (Expt. 2 and 3)

1. Land development
2. Raising of primary nursery (Sprouts from IIOPR).
3. Uniformity trial with maize/sorghum/bajra in experiment 2.

PALMYRAH

Agron. 16: Growth and development studies in palmyrah

Expt. 2: Studies on use of growth inhibiting substances for induction of early flowering in Palmyrah

S.No	Name of the Centres	Project period	
		From	To
1	Killikulam	2013	Cont.,
2	Pandirimamidi	2013	Cont.,

Objectives:

- To induce early flowering in palmyrah palms.
- To study the effect of growth inhibiting substances for induction of early flowering in palmyrah palms

Treatments details: Design –RBD, Replications – 2

Treatments:

T_1-Root feeding with Chlormequat chloride 200 ppm

T_2-Root feeding with Chlormequat chloride 400 ppm

T_3-Root feeding with Mepiquat chloride 200 ppm

T_4-Root feeding with Mepiquat chloride 400 ppm

T_5-Root feeding with Triacontanol 200 ppm

T_6-Root feeding with Triacontanol 400 ppm

T_7- Pouring on the crown with Chlormequat chloride 2 ppm

T_8-Pouring on the crown with Chlormequat chloride 4 ppm

T_9- Pouring on the crown with Mepiquat chloride 2 ppm

T_{10}- Pouring on the crown with Mepiquat chloride 4 ppm

T_{11}- Pouring on the crown with Triacontanol 2 ppm

T_{12}- Pouring on the crown with Triacontanol 2 ppm

T_{13}-Control

Root feeding and pouring on the crown has to be done on 6, 8 and 10 year old palms. After two years from the initiation of the project, observations on different growth and yield related parameters will be recorded and presented.

Observations to be recorded:

- Palm height (m)

- Trunk girth at 1 m height (m)
- No. of days for production of one leaf
- No. of leaves per plant
- Earliness in flowering

Expt. 6: Composting technology of palmyrah pith

S.No	Name of the Centres	Project period	
		From	To
1	Killikulam	2013	Cont.,
2	Pandirimamidi	2013	Cont.,

Objectives:

(i). To evaluate different methods of composting of palmyrah pith

(ii). Analysis of composted pith for nutrients and microbial population

Treatmental details (Modified during 2016):

T_1-	Palmyrah pith (100 kg)+ Urea (1 kg)
T_2-	Palmyrah pith (100 kg) + Pleurotus fungus 2 bottles (1 kg)
T_3-	Palmyrah pith (100 kg) + Urea (1 kg) + Pleurotus fungus 2 bottles (1 kg)
T_4-	Palmyrah pith (100 kg) +Urea (1 kg) + *Trichoderma viride* (1 kg) (Palmyrah pith +Urea, turning at 15 days interval up to 45 days. (Application of *Trichoderma viride* on 46th day and again turning at 30 days interval.)
T_5-	Palmyrah pith (100 kg) + Pleurotus fungus 2 bottles (1 kg) + *Trichoderma viride*(1 kg). (turning for 15 days interval up to 45 days. (Application of *Pleurotus* fungus on 16 th day and *Trichoderma viride* on 46th day and again turning at 30 days interval)
T_6	Palmyrah pith (100 kg) + Poultry manure (10 kg) + Urea (1 kg) + *Pleurotus* fungus 2 bottles (1 kg) + *Trichoderma viride* (1 kg). (Palmyrah pith + Poultry manure + Urea (1 kg) and turning for 15 days interval up to 45 days (Application of *Pleurotus* fungus on 16 th day after turning and *Trichoderma viride* on 46th day and again turning at 30 days interval).
T_7	Palmyrah pith (100 kg) + Poultry manure (10 kg) + Urea (1 kg) + *Pleurotus* fungus 2 bottles (1 kg) + Bio mineralizer (0.2kg). (Palmyrah pith + Poultry manure + Urea (1 kg) + and turning for 15 days interval up to 45 days. (Application of *Pleurotus* fungus and Bio mineralizer on 16 th day after turning) again turning at 30 days interval
T_8	Palmyrah pith (100 kg) + Poultry manure (10 kg) + Urea (1 kg) + *Pleurotus* fungus 2 bottles (1 kg) + Ligno Cellulolytic Fungi 2 bottles (1 kg) + *Trichoderma viride* (1 kg). (Palmyrah pith + Poultry manure + Urea (1 kg) - (1 kg) at 15th day and turning up to 45 days (Application *Pleurotus* fungus, Ligno Cellulolytic Fungi and Bio mineralizer on 16 th day after turning and *Trichoderma viride* on 46th day and again turning at 30 days interval).

Note : *Pleurotus fungus* /Ligno Cellulolytic/ Bio mineralizer to be applied 16 days after turning

Observations to be recorded:

- Time taken for composting
- Physico-chemical characteristics of palmyrah pith and composted palmyrah pith (pH, EC,Organic carbon(Major nutrients(NPK), Micronutrients (Fe,Cu,Mn,Zn)

- Recording temperature of composting at different intervals
- Microbial characterization of composted palmyrah pith.

(The above analysis will be carried out initially and finally after compost).

ARECANUT

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

Centre : Port Blair

Expt. 1: Evaluation of Arecanut based cropping system models

Objectives:

- To develop location specific arecanut based cropping system models for different agro-climatic regions
- To assess the effect of the cropping system model on the productivity of arecanut
- To workout the economics of the model
- Year of Start: Jan, 2015

Treatment details:

T_1: Arecanut alone

T_2: Arecanut + black pepper + banana

T_3: Arecanut + black pepper + ginger

T_4: Arecanut + black pepper + elephant foot yam

No. of palms per treatment: 20; No. of replications: 5; Design: RBD

Activity for 2016-17:

- Management of cropping system as per package of practice.
- Recording of observations.

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

Area: 1 acre Spacing: 2.7 x 2.7 m

Technical package

1. Providing better drainage (Depth maintained 15cm below the root zone)
2. Providing water through drip irrigation
3. Improving aeration by application of paddy/areca husk(5kg/plant).
4. 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.
5. Growing intercrops (Such as cocoa and banana) in the arecanut garden.
6. Two sprays of $ZnSo_4$ @0.5% during May-June and Sep-Oct .

7. Application of fertilizers based on soil and leaf analysis.

Note : The above demonstration will be conducted in two areca gardens of one acre each at Kuruva (Honnali Tq.) and 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 rhizosphare 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.

5.4 SESSION IV- Disease Management

Chairman : **Dr. P. Chowdappa**

Convener : **Dr. V. H. Prathibha, Dr. A. Snehalatha Rani**

1. Number of reports presented

Crop	Coconut	Oil Palm	Palmyrah	Sulphi palm	Arecanut
Number of reports	10	--	--	1	1

2. Centres where work has been done

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

3. Non reporting centres: Nil

4. Brief description of work done and salient achievements reported

A. COCONUT

- In the field trial on integrated management of basal stem rot involving fungicides, bioagents and INM, soil application of 125g of *Trichoderma reesei/asperellum* + 125g of *Pseudomonas fluorescens* along with 5kg of neem cake per palm per year reported significantly lowest disease index at HRS, Ambajipeta and HRS, Arsikere whereas soil application of 125g of *Trichoderma viride* + 125g of *Pseudomonas fluorescens* along with 1.25kg of neem cake per palm at quarterly intervals reported significantly lowest disease index at CRS, Veppankulam.
- Fungicides, Tebuconazole, Tetraconazole, Tebuconazole + Trifloxystrobin, Hexaconazole, Propiconazole and Thiram + Carboxin reported complete inhibition of mycelia growth of *Ganoderma lucidum* under *in vitro* conditions at HRS, Ambajipeta, HRS, Ariskere and CRS, Veppankulam.
- Majority of the *Ganoderma* isolates that belonged to Group 1 in RAPD profile showed compatible reaction among themselves (GA, GA2, GL, GL2, GL3, GL4, A2) and with the isolates that belonged to Group 2A (MKW, KLC, NSP, DGM) in somatic compatibility studies. Further, the isolates of Group 1 and Group 2A showed incompatibility with KGP isolate of Group 2B except GW2 and GL6.
- Similarly, isolates of Group 2B showed compatible reaction among themselves and with isolates that showed no grouping in RAPD profile and incompatible reaction with the isolates of Group 1 and Group 2A in somatic compatibility studies.
- Root feeding of Tebuconazole @ 2ml + 100 ml water at quarterly interval reported maximum reduction in disease severity of leaf blight disease under field conditions at Puliyankandi village in Coimbatore district and Gomangalampudur village in Tirupur district of Tamil Nadu.

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

- Soil application of 125g of *Trichoderma reesei/ T. asperellum* + 125g of *Pseudomonas fluorescens* along with 5kg of neem cake per palm per year for the management of basal stem rot disease of coconut.

- Red gram and Bengal gram plants were identified as indicator plants for early detection of basal stem rot disease of coconut.

6 **Programme proposed for coming years**

Crop	On going Experiments	Revised Experiments	New Experiments
Coconut	10	-	-
Oil palm	-	-	-
Palmyrah	-	-	-
Sulphi palm	1	-	-
Arecanut	1	-	-

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

Path 1: Survey and surveillance of diseases of coconut

❖ Soil microbial profile should be analysed in the surveyed gardens.

❖ Disease scenario over the years in surveyed areas to be documented.

❖ Disease scenario of the last ten years to be compiled along with weather data in respective centres.

Path 2: Basal stem rot disease

❖ The name of *Trichoderma viride* should be changed according to results of molecular identification

❖ Cultures of biocontrol agents should be deposited at culture collection centre IMTECH/NBAIM.

❖ Compatibility of *Trichoderma* isolates with *Pseudomonas fluorescens* should be checked.

❖ Residue analysis of effective fungicides needs to be carried out on outsourcing (NRC Grapes, Pune & IIHR, Bengaluru).

❖ Experiment on "Early detection of basal stem rot disease of coconut" is to be closed and compiled report of the same should be submitted.

❖ New coconut accessions at CPCRI that are not screened against BSR should be screened at HRES, Arsikere and CRS, Veppankulam.

Path 3: Stem bleeding and Bud rot diseases

❖ Tebuconazole, propiconazole and difenoconazole were identified as effective chemicals against *Theilaviopsis paradoxa* under *in vitro* conditions. They are to be tested under field conditions.

❖ Combiproduct containing Iprovalicarb and Propineb; Fenamidone and Mancozeb may be tested against bud rot pathogen.

Path 4: Leaf blight disease of coconut

❖ Weather data for epidemiological studies of leaf blight disease may be collected at hourly interval.

❖ Koch postulates for leaf blight disease may be tested by spraying spore suspension on seedlings and covering with polythene cover.

❖ Sequential use of fungicides against leaf blight should be tested as a new trial at three months interval.

Path 6: Studies on sulphi palm wilt disease diagnosis and its management

❖ Reconfirm the causal organism of wilt disease of sulphi palm.

8. RECOMMENDATIONS (General)

General problems identified in Tamil Nadu

❖ Etiology of the unknown disease at Veppankulam and Aliyarnagar should be tested for Phytoplasma by molecular characterization and Electron microscopy (CPCRI – Kayangulam), for basal stem rot disease by Veppankulam scientist and for soil and leaf nutrient status by CPCRI scientists.

9. Technical programme (Project wise)

Sl. No.	Trials	Code No.	Centre allotted	Number of centres
COCONUT				
1	Survey and surveillance of coconut diseases	Path.1	Aliyarnagar, Ambajipeta, Arsikere and Veppankulam	4
2	Characterization and management of basal stem rot disease of coconut	Path. 2 Expt.1	Ambajipeta, Arsikere and Veppankulam	3
3	Studies on minimum inoculum load required for successful infection of basal stem rot disease	Path. 2 Expt.2	Ambajipeta, Arsikere and Veppankulam	3
4	Management of basal stem rot disease in coconut	Path. 2 Expt.3	Ambajipeta, Arsikere and Veppankulam	3
5	Identification of coconut types resistant to Ganoderma wilt disease	Path. 2 Expt.5	Ambajipeta, Arsikere and Veppankulam	3
6	Management of bud rot and stem bleeding disease in coconut	Path. 3 Expt.1	Ambajipeta and Arsikere	2
7	Characterization and epidemiology of leaf blight disease in coconut	Path. 4 Expt.1	Aliyarnagar and Arsikere	2
8	Studies on the management of leaf blight disease in coconut	Path. 4 Expt.2	Aliyarnagar and Arsikere	2
9	Assessing the incidence of root (wilt) disease in Tamil Nadu	Path. 5 Expt.1	Aliyarnagar	1
SULPHI PALM				
1	Management of sulphi wilt disease	Path.6	Jagdalpur	1
ARECANUT				
1	Studies on Integrated management of Koleroga disease of arecanut under field condition	Path.7	Shivamogga	1

10. Technical programme (Centre wise)

Crop: entre	Project Number	Number of projects
Coconut		
Aliyarnagar	Path.1	1
	Path.4	2
	Path. 5	1
Ambajipeta	Path. 1	1
	Path.2	3
	Path. 3	1
Arsikere	Path. 1	2
	Path.2	4
	Path. 3	1
	Path.4	2
Veppankulam	Path.2	4
Sulphi		
Jagdalpur	Path. 6	1
Arecanut		
Shivamogga	Path. 7	1

11. Technical Programme 2016-17 (Ongoing/Revised/New)

COCONUT

Path. 1: Survey and surveillance of coconut diseases

Centres: Aliyarnagar, Ambajipeta, Arsikere, Veppankulam

Milestones:

1. Survey on the incidence and intensity of bud rot, stem bleeding and *Ganoderma* wilt [one Taluk per year @ 3 villages / Taluk]
2. Periodical survey for new and emerging diseases
3. Survey to be conducted in fixed plot also
4. Preparation of disease maps

Path. 2: Basal stem rot disease

Expt. 1: Characterization and management of basal stem rot disease of coconut

Centres: Ambajipeta, Veppankulam and Arsikere

S.No	Name of the Centres	Project period	
		From	To
	Aliyarnagar	2004	Cont.,
	Ambajipeta	2004	Cont.,
	Arsikere	2012	Cont.,
	Veppankulam	2004	Cont.,

Activity I: Collection of *Ganoderma* isolates from various locations to analyze diversity

Milestone:

1. Isolation and collection of various isolates of *Ganoderma* spp from different coconut growing regions of the state.

2. To identify pathogenic virulence of *Ganoderma* isolates to coconut using sterilized soil.

Activity II: Molecular characterization and conservation of *Ganoderma spp.*

Milestones:

1. Microscopic (Scanning electron microscopy) study of *Ganoderma* isolates (Ambajipeta)
2. To study variations among different isolates of *Ganoderma* using molecular techniques (Ambajipeta and Veppankulam)
3. Grouping of *Ganoderma* isolates based on molecular characters, sero types and pathogenic virulances and establishing the relationship between molecular characters and virulence of the pathogen (Ambajipeta).

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

Activity III: Epidemiology and disease forecasting

Centres: Ambajipeta, Veppankulam and Arsikere

Milestones:

1. To study the relationship between survival and spread of disease in coconut in relation to weather and soil parameters and to develop a simple weather based disease forecasting model.
2. To study the impact of other palms and intercrops in coconut on occurrence and spread of disease.

Methodology:

Vertical and horizontal spread of the disease will be recorded at monthly intervals and disease spread will be correlated with weather parameters in a fixed plot survey.

The incidence of basal stem rot disease per unit area (0.4 ha i.e., 75 palms) in coconut as well as in other palms existing in the same coconut garden i.e., palmyrah, oil palm, areca nut, etc. will be recorded at monthly intervals. The incidence of basal stem rot disease in sole coconut and in coconut with intercrops will be recorded at monthly intervals and the disease incidence will be correlated with the weather parameters, soil nutrient status and moisture status.

Expt. 2: Studies on minimum inoculum load required for successful infection of basal stem rot disease

Centres : Ambajipeta, Veppankulam and Arsikere

S.No	Name of the Centres	Project period	
		From	To
1	Ambajipeta	2013	Cont.,
2	Arsikere	2013	Cont.,
3	Veppankulam	2013	Cont.,

100ml of spore solution containing the required spore load of *Ganoderma* species should be mixed with sterilized sand / garden soil.

Treatments

Set I: Moisture stress condition (irrigation before wilting co-efficient)	**Set II: Normal condition**
T1 – 1.5 x 10^3 cfu/ml T2 – 1.5 x 10^5 cfu/ml T3 – 1.5 x 10^7 cfu/ml T4 – control	T1 – 1.5 x 10^3 cfu/ml T2 – 1.5 x 10^5 cfu/ml T3 –1.5 x 10^7 cfu/ml T4 – control

Pot size: cement pots of 60 cm diameter and 49 cm height

Soil: Ensure quantity of soil, type, pH, moisture status and nutrient status should be uniform in all the pots

Replications: 4

Variety: ECT / WCT

Observations to be recorded (pre and post treatment):

Symptom development and rate of mortality in different treatments

Expt. 3: Management of basal stem rot disease in coconut

Centres: Ambajipeta, Arsikere, Veppankulam.

S.No	Name of the Centres	Project period	
		From	To
1	Ambajipeta	2006	Cont.,
2	Arsikere	2012	Cont.,
3	Veppankulam	2006	Cont.,

Activity I: Biological management **–** Collection, conservation and characterization of bioagents from different locations.

Milestone:

1. Isolation and identification of microbial bioagents existing in rhizosphere regions of coconut based cropping systems and to study its antagonistic - PGPR property.
2. Isolation and identification of microbial bioagents present in phylloplane regions of coconut based cropping systems and to study its antagonistic – PGPR property.

Dilution plate technique: Isolate antagonists by dilution plate method on specific media for fungi, bacteria and actinomycetes. Fungi: PDA; Bacteria: Nutrient agar; Actinomycetes: Dextrose nitrate agar.

Activity II: Integrated Management of BSR – involving fungicides, bioagents and INM
Centres: Ambajipeta, Arsikere, Veppankulam

Milestone:

- Field management of BSR using bioagents with following treatments.
- Standardization of dosage frequency and method of application of bioagents (All three centres).

T_1	Soil application of talc based formulation of 125g of *Trichoderma reesei* + 1.25 kg of neem cake per palm at quarterly interval. (In total 500g Tv and 5kg Neem cake per palm per year)
T_2	Soil application of talc based formulation of 125g of *Trichoderma reesei* + 2.5 kg of neem cake per palm at six month interval. (In total 250g Tv and 5kg Neem cake per palm per year)
T_3	Soil application of talc based formulation of 125g of *Trichoderma reesei* + 5 kg of neem cake per palm at yearly interval. (In total 125g Tv and 5 kg Neem cake per palm per year)
T_4	Soil application of talc based formulation of 125g of *Pseudomonas fluorescens* + 1.25 kg of neem cake per palm at quarterly interval. (In total 500g Pf and 5 kg Neem cake per palm per year)
T_5	Soil application of talc based formulation of 125g of *Pseudomonas fluorescens* + 2.5 kg of neem cake per palm at six month interval. (In total 250g Pf and 5 kg Neem cake per palm per year)
T_6	Soil application of talc based formulation of 125g of *Pseudomonas fluorescens* + 5 kg of neem cake per palm at yearly interval. (In total 125g Pf and 5 kg Neem cake per palm per year)
T_7	Soil application of talc based formulation of 125g each of *Trichoderma reesei* and *Pseudomonas fluorescens* + 1.25 kg of neem cake per palm at quarterly interval. (In total 500g Tv + 500g Pf and 5kg Neem cake per palm per year)
T_8	Soil application of talc based formulation of 125g each of *Trichoderma reesei* and *Pseudomonas fluorescens* + 2.5 kg of neem cake per palm at six month interval. (In total 250g Tv + 250g Pf and 5kg Neem cake per palm per year)
T_9	Soil application of talc based formulation of 125g each of *Trichoderma reesei* and *Pseudomonas fluorescens* + 5 kg of neem cake per palm at yearly interval. (In total 125g Tv + 125g Pf and 5kg Neem cake per palm per year)
T_{10}	Root feeding of 1ml of Hexaconazole in 100 ml water thrice in a year
T_{11}	Soil application of talc based formulation of 125g each of *Trichoderma reesei* and *Pseudomonas fluorescens* + 5 kg of neem cake per palm at yearly interval + Root feeding of 1ml of Hexaconazole in 100 ml water thrice in a year + Micro nutrient application @ 1 kg/palm/year.
T_{12}	Control (without fungicide, bioagent, micronutrient mixture)

Note: In the above set of experiments soil samples should be collected and analysed for nutrient status and microbial population. Coconut should be managed based on the soil nutrient status and recommended dose of organic manure and the nutrients should be applied (macro nutrients) along with the aforesaid treatments. Based on the availability of the palms, treatments can be modified in the centres.

Activity III: Screening of new fungicides

Centres: Ambajipeta, Arsikere, Veppankulam

Field evaluation: Field evaluation of identified new fungicides from *in vitro* studies against basal stem rot disease

Treatments	Details
T_1	Root feeding of Tebuconazole @ 2ml + 100 water at quarterly interval
T_2	Root feeding of Tetraconazole @ 2ml + 100 water at quarterly interval
T_3	Root feeding of Propiconazole @ 2ml + 100 water quarterly interval
T_4	Root feeding of 1 ml of Hexaconazole in 100 ml water quarterly interval
T_5	Control

Replications: 4; Design: RBD

Observations: Record percent disease index in all the treatments

Expt. 5: Identification of coconut types resistant to *Ganoderma* wilt disease

Centres: Ambajipeta, Arsikere, Veppankulam

S.No	Name of the Centres	Project period	
		From	To
1	Ambajipeta	1984	Cont.,
2	Arsikere	2012	Cont.,
3	Veppankulam	1984	Cont.,

Activity Milestone:

1. Standardization of petiole dip method for pre selection of coconut varieties/ hybrids for resistance to basal stem rot disease at HRES Arsikere and CRS, Veppankulam.

Path. 3: Stem Bleeding and Bud Rot Diseases

Expt 1: Management of bud rot and stem bleeding disease in coconut

Centres: Ambajipeta, Arsikere

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

Activity I: Biological management

Milestones

1. To develop biocontrol based IDM approach against bud rot and stem bleeding diseases.
2. To develop various formulations (powder & liquid formulations) of biocontrol agents.
3. To develop suitable substrates for mass multiplication and distribution of biocontrol formulations.
4. To understand the mechanism of action of biocontrol agents against bud rot and stem bleeding diseases.

Stem bleeding: Field experiment (Ambajipeta)

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

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

Bud rot: Field experiment (Ambajipeta)

Treatments

T_1 - Talc form application of *Trichoderma reesei* in nursery seedlings.

T_2 - Positive Control (Copper oxychloride @ 3g/litre of water)

T_3 - Control

Observations to be recorded:

Per cent disease incidence in the treated nursery is to be recorded.

Activity II: Chemical Management

Milestone:

Centres: Ambajipeta, Arsikere,

Treatments	Details (Stem Bleeding Management)
T_1	Root feeding of Tebuconazole @ 2ml + 100 ml water at quarterly interval
T_2	Root feeding of Difenoconazole @ 2ml + 100 ml water at quarterly interval
T_3	Root feeding of Propiconazole @ 2ml + 100 ml water at quarterly interval
T_4	Root feeding of 1 ml of Hexaconazole in 100 ml water at quarterly interval
T_5	Control

Field evaluation: Field evaluation of identified new fungicides from *in vitro* studies against stem bleeding disease

Replications: 4; Design: RBD

Observations: Record percent disease index in all the treatments

2. Screening of latest fungicides against bud rot diseases.

Following fungicides have to be screened under *in vitro* condition at recommended concentrations and the effective one at *in vivo* condition.

1	Azoxystrobin	23% SC
2	Kresoxim methyl	44.3% SC
3.	Pyroclostrobin + Metiram	60%WG
4.	Fenamidone + Mancozeb	60% WG
5.	Bordeaux mixture	1%
6.	Copper oxychlolride	50% WP
7.	Mancozeb	75% WP
8.	Metalaxyl + Mancozeb	68% WP
9.	Iprovalicarb + Propineb 6675 WP	5.5% +61.25% w/w
10.	Fenamidone + Mancozeb 60 WG	10 % +50 %

Observations: Measure the radial mycelial growth

Field evaluation:

Treatments	Details (Bud rot management)
T_1	Spindle application of effective chemical at recommended dose one at pre-monsoon, during monsoon and post monsoon period
T_2	Spindle application of effective chemical at recommended dose one at pre-monsoon and one during monsoon period
T_3	Spindle application of effective chemical at recommended dose one at pre-monsoon and two during monsoon period
T_4	State recommendations can be followed for bud rot management Copper oxychloride @ 3g/litre of water
T_5	Control

Observations: Record percent disease index in all the treatments

Path. 4: Leaf blight disease of coconut

Expt. 1: Characterization and epidemiology of leaf blight disease in coconut

Centres: Aliyarnagar and Arsikere

S.No	Name of the Centres	Project period	
		From	To
	Aliyarnagar	2007	Cont.,
	Arsikere	2012	Cont.,

Activity I: Collection of *Lasiodiplodia theobromae* isolates from various locations.

Milestone:

1. Collection of isolates of *Lasiodiplodia theobromae* from different disease endemic areas.
2. Studies on Pathogenic variability of *Lasiodiplodia theobromae* isolates.

Activity II: Conservation and molecular characterization of leaf blight pathogen.

Milestone: Molecular variability among different isolates of *Lasiodiplodia theobromae.*

Activity III: Epidemiology and disease prediction.

Milestone:

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

Observations to be recorded:

1. Disease intensity and the weather data have to be recorded at monthly interval.
2. Impact of other palms and intercrops in coconut on the occurrence and spread of disease.

Expt. 2: Studies on the management of leaf blight disease in coconut

Centre: Aliyarnagar and Arsikere

S.No	Name of the Centres	Project period	
		From	To
1	Aliyarnagar	2005	Cont.,
2	Arsikere	2005	Cont.,

Activity I: Screening of available systemic fungicides against leaf blight pathogen

Field evaluation: Evaluation of identified systemic fungicides from *in vitro* studies against leaf blight disease under field conditions (Aliyarnagar)

Two Locations: (Puliyankandi, Coimbatore district and Gomangalampudur- Tirupur district)

Design: RBD Treatments: 8 Replications: 3

Treatments	Details
T_1	Root feeding of Tebuconazole @ 2ml + 100 ml water at quarterly interval
T_2	Root feeding of Tebuconazole @ 2ml + 100 ml water at half yearly interval
T_3	Root feeding of Tebuconazole @ 2ml + 100 ml water once in a year
T_4	Root feeding of Propiconazole @ 2ml + 100 ml water at quarterly interval
T_5	Root feeding of Propiconazole @ 2ml + 100 ml water at half yearly interval
T_6	Root feeding of Propiconazole @ 2ml + 100 ml water once in a year
T_7	Root feeding of 2 g of Carbendazim in 100 ml water thrice at 3 months interval
T_8	Control

Field evaluation: Field evaluation of identified new fungicides from *in vitro* studies against *Pestalotia* leaf spot disease (Arsikere)

Treatments	Details
T_1	Root feeding of Tebuconazole @ 2ml + 100 ml water at quarterly interval
T_2	Root feeding of Thiophanate methyl @ 2ml + 100 ml water at quarterly interval
T_3	Root feeding of Azoxystrobin @ 2ml + 100 ml water at quarterly interval
T_4	Root feeding of 2 g of Carbendazim in 100 ml water at quarterly interval
T_5	Control

Replications: 4; Design: RBD

Observations: Record per cent disease index and yield parameters in all the treatments

Activity II: Demonstration of integrated disease management on leaf blight

1. Removal and destruction of severely affected fronds
2. Spraying of Bordeaux mixture 0.5% or copper oxychloride 0.3% two times at 45 interval during summer months
3. Root feeding of Carbendazim @ 2 g + 100 ml water thrice at 3 months interval
4. Basal application of *Pseudomonas fluorescens* @ 200g along with 50 kg FYM per year

Treatment details

S.No	Root feeding treatments
T1	Tebuconazole @ 2ml in 100 ml water followed by Propiconazole @ 2ml in 100 ml water at three months interval for one year
T2	Tebuconazole @ 2ml in 100 ml water followed by Carbendazim @ 2g in 100 ml water at three months interval for one year
T3	Propiconazole @ 2ml in 100 ml water followed by Carbendazim @ 2g in 100 ml water at three months interval for one year
T4	Propiconazole @ 2ml in 100 ml water followed by Tebuconazole+ Trifloxystrobin @ 1g in 100 ml water at three months interval for one year
T5	Carbendazim @ 2g in 100 ml water followed by Tebuconazole+ Trifloxystrobin @ 1g in 100 ml water at three months interval for one year
T6	Tebuconazole @ 2ml in 100 ml water followed by Carbendazim @ 2g in 100 ml water followed by Propiconazole @ 2ml in 100 ml water followed by Tebuconazole+ Trifloxystrobin @ 1g in 100 ml water at three months interval for one year
T7	Control

Path. 5: Root (wilt) disease of coconut

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

Centres: Aliyarnagar

S.No	Name of the Centres	Project period	
		From	To
	Aliyarnagar	2003	Cont.,

Activity I: To monitor the spread of root (wilt) disease in Tamil Nadu

Milestone:

1. Survey to be intensified for root (wilt) disease in Coimbatore, Tirupur, Dindigul, Theni, Thirunelveli and Kanyakumari districts in Tamil Nadu.

2. Information on cultural practices followed should also be included.

Observations to be recorded:

- Per cent disease incidence in the surveyed area have to be recorded (Number of palms affected over the area)
- Impart training to the farmers by conducting periodical training/seminar/campaign at specific locations in collaboration with department of agriculture to identify the root wilt affected palms and motivate them for eradication of affected palms.
- Preparation of disease maps.

SULPHI PALM

Path. 6: Management of sulphi wilt disease

Centres: Jagdalpur

S.No	Name of the Centres	Project period	
		From	To
	Jagdalpur	2009	Cont.,

Location of experiment : Farmer's field

Design : RBD, Treatments : 07, Replications: 03

Technical programme

T-1: Captan 50 WP + Carbendazim 50WP, @ 0.2%,

T-2: Propiconazole 25 EC @ 0.2%

T-3: Hexaconazole 5 % @ 0.2 %

T-4: Captan 50 WP + Hexaconazole 5% @ 0.2 %

T-5: *Trichoderma harzianum* (400g)

T-6: *Trichoderma harzianum* (300g)+ *Pseudomonas fleuroscense* (100g)

T-7: Control (without any treatment)

- All the treatment will be imposed on the palms which shows partially wilting symptoms initiation (Start from November 2016) at 30 days intervals - 5 times in a year.
- Fungicides will be applied @ 20 litre solution in water and bio-agents @ mixing with 05 kg organic manure (FYM) per plant (From Nov. to March).

Observations will be recorded:

- cfu of bio-agent pre and post application of treatment.
- Per cent wilt disease severity.
- Progress of symptoms of wilt disease.

ARECANUT

Path. 7: Studies on integrated management of Koleroga disease of Arecanut under field condition

Objective:

- To develop integrated management package for Koleroga disease through bio control agents

Design: RBD; Treatments: 7; Replications: 3;

No. of Palms/Replication=16 (Manchale and Koluru); No. of Palms/Replication=10 (Melige)

Locations: 3 Manchale (Sagar Tq.), Koluru and Melige (Thirthahalli Tq.)

Treatment details:

T_1 - ***Trichoderma harzianum*** **(Shivamogga isolate)** @ 20ml(105x10^7cfu/ml stock soln)/l water + soil application of **microbial consortia (Shivamogga**) @ 50g +*Trichoderma*

harzianum (Shivamogga isolate)@50g +1 kg FYM /palm.

T_2 - ***Pseudomonas fluorescens (Shivamogga isolate)*** @ 20ml (105x10^7cfu/ ml stock soln)/l water+ soil application of microbial consortia (**Shivamogga**) @ 50g + *Trichoderma harzianum* (**Shivamogga isolate**) @ 50g +1 kg FYM /plant.

T_3 - ***Bacillus megaterium*** **(Shivamogga isolate**)@ 20ml((105x10^7cfu/ml stock soln)/l water+ soil application of microbial consortia (Shivamogga)@50g + *Trichoderma harzianum* (Shivamogga isolate) @50g +1 kg FYM /plant.

T_4 - ***Trichoderma harzianum*** **(Shivamogga isolate)** @ 20ml(105x10^7cfu/ml stock soln)/l water+ ***Pseudomonas fluorescens (Shivamogga isolate)*** @ 20ml((105x10^7 cfu/ml stock soln)/l water+ ***Bacillus megaterium*** **(Shivamogga isolate)** @ 20ml((105x10^7cfu/ml stock soln)/l water + soil application of Microbial consortia (*Trichoderma harzianum*+ *Pseudomonas fluorescens* and *Bacillus megaterium* (Shivamogga isolates))@100g/plant along with 10kg of FYM/decomposed compost to the soil per year.

T_5 - Fenamidone 10% +Mancozeb 50% (w/w) (sectin) (@0.3% spray)+Adhesive

T_6 - Application of Bordeaux mixture@ 1% + Adhesive

T_7 - Control

Spray schedule (T_1 to T_4)

I application- Between 15 -25th April

II application- 15 days after first spray/application

III application – 30 days after 2nd spray/application

Spray schedule (T5 to T6)

As per the recommendations

Observations to be recorded:

- Initial microbial population in the crown as well as in the rhizosphere soil before imposition of treatments and every year after imposing the treatments
- Initial mean no. of healthy roots/sq.ft area /plant before imposing treatments and every year after imposing the treatments.
- No. of infected nuts fallen/plant at 15 days interval starting from 15th June to 30th September (every year).
- Nut yield/plant (Fallen nut counts + harvested nuts may be taken into consideration to work out disease severity). Disease incidence will be given based on the number of trees infected.

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 practices.

5.5 SESSION V- Pest Management

Chairman : **Dr. Puttaswamy**

Co- chairman : **Dr. Chandrika Mohan**

Convener : **Dr. A. Joseph Rajkumar, Dr. T. Srinivasan**

1. Number of reports presented

Crop	Coconut	Oil Palm	Palmyrah	Sulphi palm	Arecanut
Number of reports	7	-	-	-	1

2. Centres where work has been done

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

3. Non reporting centre:

4. Brief description of work done and salient achievements reported

A. COCONUT

Black Headed Caterpillar

During the surveys in Andhra Pradesh, outbreak of coconut black headed caterpillar was observed in all the coastal districts and 37 lakh parasitoids were supplied to the affected areas. In Tamil Nadu the black headed caterpillar problem was noticed in several districts like Tiruppur, Namakkal, Dindigul and Coimbatore and parasitoids of *Bracon brevicornis* were mass reared at Biocontrol Lab, Coconut Research Station, Aliyarnagar and a total of 2,08,100 nos. of parasitoids were supplied to farmers for release in an area of 99 acres.

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

6. **Programme proposed for coming years**

Crop	On going Experiments	Revised Experiments	New Experiments
Coconut	7	-	5
Oil palm	-	-	-
Palmyrah	-	-	-
Sulphi palm	-	-	-
Arecanut	1	-	-

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

Ent.3: Survey and monitoring of pest problems in coconut

- Roving survey should reflect the pest incidence in the state cutting across different season (minimum 2 visits/ year).
- Survey time should be invariably uniform for all centres.

- Meteorological observations may also be collected pertaining to the areas.
- Survey data need to be statistically analyzed and presented so that a valid message is delivered from all centres. Pooled data from all centres should also be presented with statistical analysis.
- Geo-mapping and seasonal diversity of pests should be presented from all centres highlighting the occurrence of the pest in a location at a particular season.
- Each Power Point slide presented should covey a message interpreted through statistical analysis.
- The experiment may be renamed as Pest surveillance in coconut and methodology may be discussed with CPCRI scientists.

Ent.5: Management of eriophyid mite in coconut gardens

- Monitoring and follow up of completed experiments (to be completed and result to be submitted to PC, Palms before December 2016)

Ent. 11: Evaluation of olfactory conditioned larval parasitoid (*Goniozus nephantidis*) in the field against *O. Arenosella*

- Monitoring and follow up of completed experiments (to be completed and result to be submitted to PC, Palms before December 2016)
- Tabulate the data on olfactory conditioning (centre wise and year wise data) and subject for statistical analysis. The data shall also be subjected to pooled analysis for different years in all centers.

Ent. 14: Validation of integrated pest management technology for *Oryctes rhinoceros* in different regions

- Monitoring and follow up of completed experiments (to be completed and result to be submitted to PC, Palms before December 2016)
- Tabulate the data on pheromone trap experiments (centre wise and year wise data) and subject for statistical analysis. The data shall also be subjected to pooled analysis for different years in all centers.

Ent. 16: Field evaluation of talc formulation of *Hirsutella thompsonii* (CPCRI isolate) against coconut eriophyid mite.

- Monitoring and follow up of completed experiments (to be completed and result to be submitted to PC, Palms before December 2016)
- Tabulate the data on the evaluation of *H. thompsonii* (centre wise and year wise data) and subject for statistical analysis. The data shall also be subjected to pooled analysis for different years in all centers.

Ent. 17: Evaluation of insecticides against the red palm weevil, *Rhynchophorus ferrugineus*

- Monitoring and follow up of completed experiments (to be completed and result to be submitted to PC, Palms before December 2016)

(i) Monitor and record RPW incidence in plots where pheromone traps were set up during 2015-16.

8. RECOMMENDATIONS (General)

Technical programmes of the session needs to be modified as per the need and may be formulated in consultation with Scientists of CPCRI. Group meeting may be convened at CPCRI, RS Kayamkulam

to formulate the programme.

9. Technical Programme (Project wise)

Sl. No.	Trials	Code No.	Centre allotted	No. of centres
COCONUT				
1	Pest surveillance in coconut	Ent. 1	Aliyarnagar, Ambajipeta, Arsikere, Ratnagiri	4
2	Evaluation of botanical cake and paste for the management of rhinoceros beetle infesting juvenile palms	Ent. 2	Aliyarnagar, Ambajipeta, Arsikere, Ratnagiri	4
3	Integrated management of coconut eriophyid mite	Ent. 3	Aliyarnagar, Ambajipeta, Arsikere, Ratnagiri	4
4	Production and supply of parasitoids	Ent. 4	Aliyarnagar, Ambajipeta, Arsikere, Ratnagiri	4
	Integrated management of slug caterpillar	**Ent. 5:**	Amabjipeta & Arsikere centre	2
Arecanut				
	Evaluation of entomopathogenic nematodes (EPN) for the management of areca white grubs.	Ent. 18	Shivamogga	1

10. Technical Programme (Centre Wise)

Centre	Project Number	Number of Experiments/Activities
Crop :Coconut		
Aliyarnagar	Ent. 1	1
	Ent. 2	1
	Ent. 3	1
	Ent. 4	1
Ambajipeta	Ent. 1	1
	Ent. 2	1
	Ent. 3	1
	Ent. 4	1
Arsikere	Ent. 1	1
	Ent. 2	1
	Ent. 3	1
	Ent. 4	1
Ratnagiri	Ent. 1	1
	Ent. 2	1
	Ent. 3	1
	Ent. 4	1
Crop :Arecanut		
Shivamogga	Ent. 18	1

11. Detailed technical programme (2016-17)

Ent. 1: Pest surveillance in coconut

S.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

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.

Detailed pest wise observations

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 usage pattern	

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, mealybugs, 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.

Fixed plot survey

- Two plots – one plot near the Institute & another plot in pest endemic zone), six observations/ year at two months intervals) (June, Aug, Oct, Dec, Feb, April).
- Observation to be recorded for rhinoceros beetle, red palm weevil and eriophyid mite
- If black headed caterpillar is not present in the selected area, select separate pest infested plot for *O. arenosella*. Minimum 100 palms in the garden need to be assessed.
- Observations as per standard protocol for roving survey

Ent. 2: Evaluation of botanical cake and paste for the management of rhinoceros beetle infesting juvenile palms

S.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:

- Juvenile palms 2-3 years should be selected for the experiment
- Cakes and paste will be supplied by ICAR-CPCRI, RS, Kayamkulam. Cakes @ 2-3 per palm and paste @ 15 g/palm are to be placed in the 2-3 innermost leaf axils.
- Five treatments to be replicated four times (5 palms per replication) in a completely randomized block design (100 palms for the experiment).

Treatment details:

T1	Botanical cake (June, Oct & Feb) + paste (Aug, Dec & April)
T2	Neem cake + sand (150 g each) to be filled in the innermost leaf axils – once in 4 months (June, Oct, Feb)
T3	Placement of naphthalene balls in the innermost leaf axils @ 12 g / palm – once in 2 months (June, Aug, Oct, Dec, Feb, April)
T4	Placement of Chlorantraniliprole 0.4%GR (in perforated sachets) in the innermost leaf axils @ 6 g per palm once in 4 months (June, Oct, Feb)
T5	Control

Activity for 2016-17

- Record the spear leaf damage at quarterly intervals and express as percentage (Sept., Dec, March, June).
- Record the variety and other health management treatments given by farmer.

Ent. 3: Integrated management of coconut eriophyid mite

S.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:

Methology

- Experiment to be conducted inside the research station, preferably.

- 50 palms to be selected for incorporating the following package of practices and 50 palms to be maintained as control.

Package of practices

Integrated Nutrient management (Recommended NPK for the region + 20 kg of FYM + 20 kg vermicompost + 5 kg neem cake+ green manuring with cowpea / sunnhemp in the coconut basins + husk incorporation in the inter rows+ micronutrient application+ keraprobio (100g/palm)) in a well irrigated garden + Root feeding with fenpyroximate 5%EC @ 10 ml + 20 ml water during March + spraying palm oil – sulphur emulsion during December.

Note: FYM, VC, Keraprobio to be applied in two splits, May and Sept. months.

NPK, micronutrient (based on soil test result) and Neem cake to be applied in two splits, 15 days after application of organic manures.

- The control plots should be maintained with NPK and organic manures.

Preparation of palm oil sulphur emulsion

- To prepare 1 litre of mixture 200 ml palm oil, 800 ml of water, 5 gram wettable sulphur (80%) and 12 g soap powder are required. Dissolve the soap and sulphur in water and then add palm oil and mix thoroughly. This mixture is to be stirred well and should be used for spraying on the day of preparation itself.

Activity for 2016-17

- Pre-experimental soil and plant nutrient status (Soil *p*H, organic carbon, NPK level and micronutrient analysis).
- Observation on mite population (per 16 mm^2), per cent nut damage, mite grade index, and yield per palm have to be recorded once in six months.
- Growth, yield and yield attributing characters (Annual leaf production, annual inflorescence production, nut yield, copra content, oil content etc.).

(Agronomist / Horticulturist of the centre needs to be associated)

Ent. 4: Production and supply of parasitoids

S.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:

- Parasitioids 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 CPCRI, Kasaragod.

Ent. 5: Integrated management of slug caterpillar

S.No	Name of the Centres	Project period	
		From	To
1	Ambajipeta	2016	Cont.,
2	Arsikere	2016	Cont.,

Year of start: 2016

a) Fifty bearing palms to be selected for the experiment and a separate control with 50 palms should be maintained. Only slug-infested palms to be taken for the experiment.

b) Destruction of 2-3 outer whorls of leaves, spraying Chlorantraniliprole 18.5%SC (0.3ml/litre) during November –December, Bt (5g /litre) (January –February), installation of light trap (5/ ha).

c) Record number of moths trapped /trap.

d) Record the no. of caterpillars in 10 leaflets before and after the treatment.

e) Yield loss analysis for 150 palms to be done in infested gardens in 2-3 locations.

f) Search out for natural enemies and identify them.

g) Record annual leaf production and nut yield.

Arecanut

Ent. 18: Evaluation of entomopathogenic nematodes (EPN) for the management of areca white grubs.

Experimental details:

Design : RBD Treatments: 6 Replication : 4

Palms/replications : 15

Locations : 2, Arakere (Shivamogga Tq.), Koluru (Thirtahalli Tq.)

Technical Programme for 2016-17

Treatment details :

T_1- *Heterorhabditis indica* @ 5g/1 (25 g/ palm) – (commercial formulation)

T_2- *Steinerema carpocapsae* (CPCRI isolate) @ 1.5 billion IJs /ha (1.2 crore IJs /palm)

T_3- Imidacloprid 17.8 SL (2.5ml/5 l water)+*Steinernema carpocapsae* @ 0.75 billion IJs/ha

T4- Metarrhizium commercial formulation (20 g/palm) + *Steinernema carpocapsae* @ 0.75 billion IJs/ ha

T_5- Imidacloprid 17.8 SL @0.0045% (2.5ml/5 lt. water) (Standard check)

T_6- Control

Mode of application

T1: **Two** time application during June- July by dissolving *Heterorhabditis indica* @25g in 5 litre of water and drenching it to root zone - **during June- July and Sept- Oct**

T2: Two time application during June- July and Sept- Oct through drenching in 5 lt.of water (dry soil), if soil moisture is at the field capacity directly inject nematode solution at the depth of 10 – 15

cm in slanting position

T3: Two time application during June- July through drenching insecticide 0.5 ml@2 lt. of water at root zone and followed by directly injecting the nematode to the root zone during Sept- Oct.

T4- Basal application of Metarrhizium -commercial formulation (20 g/palm) during June-July + *Steinernema carpocapsae* @ 0.75 billion IJs/ha by directly injecting the nematode to the root zone during Sept- Oct

T5: One time application during Sept- Oct.

T6: Control

Data collection/observation:

1. Mean number of grubs/palm - Before treatment and followed by 30 DAT, 60 DAT and then induction of Second treatment-Observation after 30 DAT (90 DAT of first application).
2. Growth parameters: a. Internodal length (cm) 30 cm below the lower leaf and
   b. Number of leaves
   c. Yield per palm

5.6 SESSION VI- Post Harvest Technology of Palmyrah

Chairman : **Dr. K B Hebbar**

Co- chairman : **Dr. C Tamban**

Convener : **Dr. P.C. Vengaiah, Dr. T. Prabhu**

1. Number of reports presented

Crop	Coconut	Oil Palm	Palmyrah	Sulphi palm	Arecanut
Number of reports	-	-	7	-	-

2. **Centres where work has been done**

Crop	Coconut	Oil Palm	Palmyrah	Sulphi palm	Arecanut
Number of centres	-	-	2	-	-

3. Non reporting centres: NIL

4. Brief description of work done and salient achievements reported

PALMYRAH

1. Inflorescence Sap Collection through CPCRI Technology successfully implemented for Palmyrah and collected fresh sap and developed Palmyrah syrup and crystal jaggery without adding any preservative.
2. The biochemical analysis of palmyrah sap compared with coconut sap, and found that total sugars was less as compared to coconut sap, but slightly more in protein.
3. Removal of bitterness in Plamyrah Tuber (apicolon) was carried out using cold extraction method *i.e.*, flour is subjected to soak at normal water at room temperature for 6 hour and water is drained and flour dried at low temperature and observed that nutritional losses due to soaking in water is low.
4. Preservation of tender fruit endosperm with 50% brix in multilayer pouch under refrigerated condition gives maximum shelf life(6 months) as compared other condition.

6. Programme proposed for coming years

Crop	On going Experiments	Revised Experiments	New Experiments
Coconut	-	-	-
Oil palm	-	-	-
Palmyrah	4	-	-
Sulphi palm	-	-	-
Arecanut	-	-	-

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

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

- Neera collection and its processing into value added products in Palmyrah using CPCRI method is standardised. This technology can be transferred to potential Entrepreneur or NGOS for further validation
- Jaggery prepared by CPCRI method is found to be better in shelf life. however its Biochemical analysis has to be analysed

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

- The palmyrah fibre separator modified for its better efficiency to be popularised for its patenting after discussion with CTRI-KVK

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

- As there great demand for fresh tender fruit endosperm (Nungu). Proper preservation technique to be developed in consultation with CPCRI and IIHR PHT scientists

8. RECOMMENDATIONS(General)

- Palmyrah Neera collection through CPCRI Method should be promoted like coconut Neera and success story to be highlighted

9. Technical programme (Project wise)

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)	PHT1	Pandirimamidi and Killikulam	2
2	Standardization of tuber and tuber flour based food products (like Pizza, Bakery items, confectionery, health mix etc.)	PHT2	Pandirimamidi	1
3	Utilization of palmyrah plant parts for the extraction of fibre and fuel	PHT3	Killikulam	2
4	Standardization of preservation technique for Palmyrah tender fruit endosperm (*Nungu*)	PHT4	Pandirimamidi and Killikulam	2

10. Technical Programme (Centre Wise)

Centre	Project Number	Number of projects
Pandirimamidi	PHT1	2
	PHT2	1
	PHT3	1
	PHT4	2
Killikulam	PHT1	2
	PHT3	2
	PHT4	2

11. Technical Programme 2016-17 (Ongoing/Revised/New)

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

S.No	Name of the Centres	Project period	
		From	To
1	Killikulam	2013	Cont.,
2	Pandirimamidi	2009	Cont.,

Objective : Standardization of process for inflorescence sap based products

Activity I : Shelf life studies of Neera

Neera collection methods: 1. Traditional method (lime added)

2. CPCRI Method

Storage study of Neera and Neera based beverages

Storage conditions:

Ambient and

Refrigerated conditions (10^{o}C).

Process parameters:

Control,

Sterilization (120^{o}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 : Development of Syrup/ honey from inflorescence sap

Syrup brix: 60^{o}Brix,

65 ^{o}Brix,

70 ^{o}Brix

Storage conditions:

Ambient and

Refrigerated conditions (10^{o}C).

Parameters to be evaluated (every 15 days interval):

Chemical constituent (TSS, Acidity, Vitamin C, protein, Total sugars)

Microbial load and sensory quality

Crystal formation

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

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

Objective: Development of blended health mix from Palmyrah tuber flour

Blend : Palmyrah tuber, banana and tapioca blend

Treatments:

1. Palmyrah tuber
2. Banana
3. Tapioca
4. Palmyrah tuber+Banana, 1:3
5. Palmyrah tuber+Banana, 1:1
6. Palmyrah tuber+Banana, 3:1
7. Palmyrah tuber+Tapioca 1:3
8. Palmyrah tuber+Tapioca, 1:1
9. Palmyrah tuber+Tapioca, 3:1
10. Banana+Tapioca, 1:3
11. Banana+Tapioca, 1:1
12. Banana+Tapioca, 3:1
13. **Palmyrah tuber+Banana+Tapioca, 1:1:1**

Nutritional Parameters to be evaluated:

1. Starch (mg/100mg) and Resistant starch(mg/100mg)
2. Amylose (mg/100mg)
3. Reducingsugar (mg/100g)
4. Sucrose (mg/100g)

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

S.No	Name of the Centres	Project period	
		From	To
	Killikulam	2013	Cont.,
	Pandirimamidi	2015	Cont.,

Objective : Physico-chemical properties of fibres from palmyrah

Physical:

a) Moisture regain (%)
b) Diameter
c) Density (gml
d) Linear Density(den)

Chemical (%):

a) Cellulose
b) Hemi Cellulose

c) Lignin

Mechanical:

a) Modulus (gf/den)

b) Stress (MPa)

c) Strain (%)

d) Tenacity (gf/den)

Activity for 2016-17

1. Ergonomic study with existing machine
2. Comparison of Fiber quality in manual and machine

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

S.No	Name of the Centres	Project period	
		From	To
1	Killikulam	2014	Cont.,
2	Pandirimamidi	2009	Cont.,

Activity I: Modified Atmospheric Packaging of tender fruit endosperm

Material for packing PP (200 gauge), LDPE (300 gauge)

Conditions for storage: Control (refrigerated)

Modified Atmosphere Packaging (MAP) (refrigerated)

MAP (Ambient storage)

Quality indices to be measured at every 4 days

TSS, Acidity, colour, firmness and physiological loss in weight

Gas composition (O_2 % and CO_2 %)

6. Plenary session

Chairman : **Dr. N.K. Krishna Kumar**

Co- chairman : **Dr.P. Chowdappa, Dr. R.K. Mathur**

Convener : **Dr. N. B. V. Chalapathi Rao, Dr. Manjunath Hubballi**

The plenary session was held on 21st May, 2016 under the chairmanship of Dr. N.K. Krishna Kumar, DDG (Hort. Sci.), ICAR, New Delhi and Dr. P. Chowdappa, Director, ICAR-CPCRI and Dr. R.K.Mathur, Director, ICAR- IIOPR, Pedavegi were present on the occasions. Dr. H.P. Maheswarappa, Project Coordinator (Palms), briefed about the group meeting programme held for two days along with recommendations. The performance of AICRP centres is being evaluated every year and during 2015-16, AICRP centre, Aliyarnagar has been judged as the best performing centre. DDG (Horticulture Science) gave away the certificate and memento to Scientists of the centre. Recommendations from the various sessions presented for the approval of the session. In his chairman's remarks, DDG opined upon including cocoa as a mandate crop under AICRP on Palms to address the problems of cocoa crop and renaming the project as AICRP on Palms & Cocoa. During the programme, 10 publications were released for the benefits of the stakeholders. The meeting was attended by 100 participants representing 29 centres spread across 13 States and one Union Territories, apart from the scientists from the ICAR-CPCRI and ICAR-IIOPR.

Following are the suggestion given by DDG (Hort. Sci.,) for further improving the output of the centres.

- Project Coordinator (Palms) and Director, IIOPR should present status report of coconut, arecanut and oil palm every year during Annual group meeting.
- The publications released during AGM may be circulated to Agricultural/Hort. universities, Plant Protection Adviser, Govt. of India, Secretary DARE, Horticulture Commissioner, Govt. of Karnataka, Coconut Development Board, State Department of Agriculture and Horticulture.
- The recommendation of early detection of BSR and management of the BSR should be combined. Further, the recommendation is subjected outcome of compatibility of Trichoderma and Pseudomonas.
- All the germplasm maintained in the CPCRI should be cryopreserved and conserved.
- The cocoa should be included in AICRP in the following centres as intercrops in different states.
- Tamil Nadu, Veppankulam – Cocoa+Coconut
- Karnataka, Shivamogga - Arecanut+ Cocoa
- Kerala – Trichur – Coconut + Cocoa
- AP – Vijayrai – Oilpalm+Cocoa
- Ambajipet – Coconut+ cocoa

Dr. H.P. Maheswarappa, PC (Palms) proposed the vote of thanks.

7. Annexure

7.1. Project Coordinator's Report

The All India Coordinated Research Project on palms was started functioning from 1972 with the objective of conducting location specific research in mandate crops. At present the project has Coconut, Oil Palm, Arecanut and Palmyrah as mandate crops and is implemented in 29 centers with its headquarters at Kasaragod and 15 centers are conducting research on coconut, eight on oil palm, four on arecanut, two on palmyrah and one on sulphi palm. The coordinating centers are located in 13 states and one union territory covering 13 SAU's, one Central Agricultural University and four ICAR institutes.

Budget: The budget for the year 2015-16 was Rs.528.00 lakhs (ICAR Share).

(North East Region: 42.20 lakhs: TSP: 25.00 lakhs).

Awards:

Chaudhary Devi Lal outstanding AICRP Award

Chawdhury Devi Lal outstanding AICRP Award for 2014 was honourned to the All India Coordinated Research Project on Palms (ICAR-CPCRI, Kasaragod, Kerala) for its contribution in developing many location-specific technologies in crop improvement, production and plant health management of mandate crops viz., Coconut, Oil palm and Palmyrah. AICRP Centre, Ambajipeta (Dr. YSRHU, AP) has been judged as the best centre. The award was received by Dr. H.P. Maheswarappa, Project Coordinator (Palms) on 25th July, 2015 during the 87th ICAR Foundation and ICAR award ceremony held at Patna (Bihar), which was inaugurated by Hon'ble Prime Minster Shri Narendra Modiji. The award was given by Hon'ble Minister of state for Agriculture Dr. Sanjeev Kumar Balyan and Shri Mohan Bhai Kundariya.

Events conducted:

XXIV Annual Group Meeting

The Annual Group meeting of All India Coordinated Research Project on Palms was organized from 26th to 28th May, 2015 at ICAR-Central Costal Agricultural Research Institute, Goa. The Annual Group Meeting was inaugurated by Mr. Manoj Kumar Sahoo, IAS, Secretary, Agriculture, Govt. of Goa. The inaugural function was presided by Dr. S.K. Sharma, Director, CIAH, Bikaner, Dr. P.L. Saroj, Director, DCR, Puttur and Dr. A.S. Kumaraswamy, Former, Dean of Education (UAHS), Shivamogga graced the occasion. Dr. A.S. Kumaraswamy and Dr. C.A. Viraktamath participated in the group meeting as expert members for the technical sessions of Crop Production and Insect Pest Management. Four publications released from the AICRP centres during the inaugural session namely AICRP on Palms at a Glance, Prospects of mushroom cultivation in coconut garden in Odisha, RCRS, Bhatye Research at a glance (Marathi), Oil palm cultivation (Marathi) from Mulde centre. The plenary session was held on 28th May 2015 under the chairmanship of Dr. N.K. Krishna Kumar, DDG (Hort. Sci.), ICAR, New Delhi and Dr. P. Chowdappa, Director, ICAR-CPCRI and Dr. P. Kalidas, Actg. Director, ICAR- IIOPR, Pedavegi were present on the occasions. Dr. H.P. Maheswarappa, Project Coordinator (Palms), briefed about the group meeting programme held for two days along with recommendations. The performance of AICRP centres is being evaluated every year and during 2014-15, AICRP centre, Mulde has been judged as the best performing centre. Decissions taken in various sessions were presented for the approval of the session. In his chairman's remarks, DDG stated that, AICRP work should be strengthened through and Multi location trails

(MLT) for variety release or any technology development.

Core committee to finalise the technical programme for AICRP on Palms, Oil palm centre, Bavikere (Voluntary Centre)

The core committee consisting of Dr. B.N.Rao, R. K. Mathur and Maheshwarappa H.P met at AHRS, UAHS, Bavikere, Chikamagalur dt. on 12 th August 2015 and visited the farm and identified the blocks suitable for the AICRP trials and finalised the Technical programme.

Regional Workshop on oil palm

Regional workshop on 'Technological strategies for enhancing oil palm production in Western Region of India' at Biotech Lab, Belagavi, Karnataka (covering Karnataka, Maharashtra, Goa, Gujarath and Kerala States) on 28.1.2015. The workshop was attended by State Government officials, oil palm growers and palm oil industrialist. Dr. D.L. Maheswar, VC, UHS, Bagalkot was invited as the Chief Guest and following technical sessions were held Oil palm development in western states, Oil palm Research – Technologies and Way Forward Interface among different oil palm stakeholders. The decisions and recommendations taken during each session were documented for further action.

Regional Workshop on oil palm in North Eastern Region

Regional workshop on Technological strategies for enhancing oil palm production for North Eastern Region was held at Aizawal, Mizoram during 2-3rd February, 2016. about 117 officer of state department of Agriculture / Horticulture, staff of oil palm procuring unit, scientist staff of ICAR, SAU's and KVK from Mizoram, Arunachal Pradesh, Nagaland, Meghalaya, Assam and West Bengal attended the workshop.

One day training for Agronomist of AICRP centres

One day training on "Statistical and economical analysis for plantation crops" was held at the at Extension and statistics section, ICAR-CPCRI, Kasaragod on 5th April, 2016. The project coordinator (Palms) reviewed the technical programme under each projects.

Monitoring Centres:

In order to execute the technical programme in all the centres, the Project Coordinator has monitored the functioning of different AICRP centres by visiting them and keeping constant touch with all the centres through phone and email. Time to time advice and direction was given for proper implementation of the technical programmes. Monthly progress report and budget utilization information were obtained from centres regularly and the same was reviewed critically. During the visit to centres, discussions were held with Vice Chancellor, Director of Research and Head of the Division of the SAUS's of the concerned centre as well as with the scientist of AICRP on Palms for the smooth functioning of the research programmes. After each visit, suggestions were given for implementing the technical programmes. Nodal officers identified from ICAR-CPCRI, ICAR- IIOPR have also visited the centres and monitoring the technical programmes.

Collaborative programmes: Collaboration with AICRP tuber crops, spices, fruits and mushroom is being undergoing in different centres.

Publications: During the period there were 8 research papers published in referred journals apart from papers presented in conferences (13 Nos). Many centres could bring out technical bulletin, extension folder, popular articles in the local languages and participated in TV and Radio programmes to disseminate the technologies.

TOT: Centres have imparting training to officers, extension workers and farmers as and when needed. Diagnostic field visits have been made by scientists of the centres to address the field problems of the farmers. Participated in exhibitions and other activities also. Demonstration of

technologies in farmers field is being implemented in different centres.

TSP programmes: Under the TSP programmes have been implemented in Maharashtra, Gujarath, Chhattisgarh and Odisha states involving tribal families.

NEH programmes: Under the NEH, programmes have been implemented in Assam, and Arunachal Pradesh.

Performance grading of centres: During the period, 2 centres have achieved Very Good category, 13 centres Good category, 4 centres Average category and 3 centre under needs improvement. The very good centre with highest scoring is Aliyarnagar centre (coconut), and will be honoured by the Chief guests.

RESEARCH HIGHLIGHTS (2015-16)

Genetic Resources and Crop Improvement

Coconut

The evaluation of fourteen cross combination of Tall x Tall hybrids at Veppankulam centre resulted in identification of a superior high yielding cross combination, LCOT x CCNT, which is a Tall x Tall combination. This hybrid was recommended for release as VPM - 5 during the 24thAnnual Group Meeting of AICRP on Palms at the ICAR- Central Coastal Agricultural Research Institute, Goa. The mean nut yield of the hybrid during the stabilized bearing period was 161 nuts/palm/year, which is 62.6 and 43.8 and higher than ECT and VHC 1 respectively.

Oil palm

Among the ten hybrids planted during 2006 at Pattukottai (Tamil Nadu) and evaluated for growth and yield performance, the hybrid NRCOP-17 recorded significantly higher FFB yield (163.3 kg / palm & 23.3 t/ha) during 2015-16 (at 9 th year of planting). Under comparative performance of different hybrid combinations planted during 2007, at Vijayarai centre (A.P), the hybrid NRCOP- 4 recorded significantly higher FFB yield (24.9 t/ha) followed by NRCOP- 5 (19.8 t/ha).

Germplasm collection in Palmyrah

Germplasm survey conducted at Midnapur dt. of West Bengal by AICRP, Killikulam and Pandrimamidi centres, and a total of five accessions with distinct characters were collected for conservations.

Crop production

The coconut based cropping systems under integrated nutrient management developed at different AICRP Centres showed higher productivity and income than monocrop of coconut. At Aliyarnagar Centre, the cropping system of coconut + cocoa + banana + pineapple with integrated nutrient management of 75% of recommended NPK coupled with organic recycling with vermicompost recorded higher net income of Rs. 3.77 lakhs per ha followed by fully organic treatment (Rs. 3.46 lakhs/ha). At Arsikere Centre, the cropping system of coconut + cocoa + lime + drumstick recorded higher net returns under fully organic nutrient management (Rs. 2.95 lakhs/ha) followed by 50% of recommended NPK + organic recycling with vermicompost + vermiwash application + biofertilizer application and in situ green manuring (Rs. 2,84,410/ha).

- **Intercropping of flower crops in coconut garden:** Growing of flower crops in coconut garden is highly productive and remunerative than monocropping of coconut. The suitable flower crops identified under coconut are marigold, gamphrena, celosia, zinnia and chrysanthemum at Aliyarnagar Centre, chrysanthemum, crossandra, china aster and marigold at Arsikere Centre, gerbera, tuberose, gladiolus and marigold at Kahikuchi Centre and gladiolus, tuberose and gerbera at Mondouri Centre, lily, heliconia and jasmine at Ratnagiri Centre.

- Six cocoa clones *viz* VTLCC – I, VTLCH – I, VTLCH – 2, VTLCH – 3, VTLCH – 4 and VTLC – 1 were evaluated under screening of cocoa clones for their performance as a mixed crop in coconut gardens at Ambajipeta centre. Among them, the clone VTLCH – 2 gave highest yield of 2.95 kg dry beans per tree.

Intercropping in juvenile oil palm garden

- The vegetable okra intercropped with oil palm recorded higher fruit yield and net returns followed by tomato and brinjal in juvenile oil palm under Tungabhadra command area of Karnataka.

Pest management

Black headed caterpillar

During the surveys in Andhra Pradesh, outbreak of coconut black headed caterpillar was observed in all the coastal districts and 37 lakh parasitoids were supplied to the affected areas. In Tamil Nadu the black headed caterpillar problem was noticed in several districts like Tiruppur, Namakkal, Dindigul and Coimbatore and parasitoids of *Bracon brevicornis* were mass reared at Biocontrol Lab, Coconut Research Station, Aliyarnagar and a total of 2,08,100 nos. of parasitoids were supplied to farmers for release in an area of 99 acres.

Karnataka: The infestation by Coconut black headed caterpillar was noticed in all the 4 major coconut growing districts of Karnataka. A severe incidence (20.84%) was noticed in Tumkur district throughout the year. The other districts where the caterpillar incidence observed include Hassan (12.41%), Mysore (12.33%) and Mandya (4.61%).

Slug caterpillar infestation garden

In AP and Karnataka:

Severe incidence of Slug caterpillar is reported from Uppalagutam, Ravulapalem, Kothapeta, Razole, Sakenetapalli and Mumidivaram mandals of East Godavari and Bhimavaram,Poduru and Yelamanchali mandals of West Godavari district. The incidence was initially observed in February 20th and at present around 400 to 500 acres are affected with the slug caterpillar. adoption of management practices in Kothapeta mandal successful managed the pest. Awareness programmes on management strategies are disseminated to farmers of affected mandals through field visits and training programmes with assistance of Department of Horticulture .

During February, 2016 there was incidence of slug caterpillar was noticed in Ramenahalli near KV Cross, Tipur Tq, Tumkur district. The infestation was found in 23 old gardens affecting 124 palms out of 612 palms.

Disease management

- In the field trial on integrated management of basal stem rot involving fungicides, bioagents and INM, soil application of 125g of *Trichoderma viride* + 125g of *Pseudomonas fluorescens* along with 5kg of neem cake per palm per year reported significantly lowest disease index at HRS, Ambajipeta and HRS, Arsikere whereas soil application of 125g of *Trichoderma viride* + 125g of *Pseudomonas fluorescens* along with 1.25kg of neem cake per palm at quarterly intervals reported significantly lowest disease index at CRS, Veppankulam.
- Fungicides, Tebuconazole, Tetraconazole, Tebuconazole + Trifloxystrobin, Hexaconazole, Propiconazole and Thiram + Carboxin reported complete inhibition of mycelia growth of *Ganoderma lucidum* under *in vitro* conditions at HRS, Ambajipeta, HRS, Ariskere and CRS, Veppankulam.
- Root feeding of Tebuconazole @ 2ml + 100 ml water at quarterly interval reported maximum

reduction in disease severity of leaf blight disease under field conditions at Puliyankandi village in Coimbatore district and Gomangalampudur village in Tirupur district of Tamil Nadu.

Recommendations

- **VHC 4 :** Research programs aimed at development of a coconut hybrid with high nut yield, copra output and oil yield has resulted in identification of a superior high yielding cross combination, LCOT x CCNT, at AICRP – Palms centre, Veppankulam. It is a Tall x Tall combination, under evaluation since 1986. It recorded mean nut yield of 161 nuts/palm/year. This is 62.6 and 43.8 per cent higher than checks ECT and VHC 1 respectively.
- **Intercropping of flower crops in coconut garden:** Growing of flower crops in coconut garden is highly productive and remunerative than monocropping of coconut. The suitable flower crops identified under coconut are marigold, gamphrena, celosia, zinnia and chrysanthemum at Aliyarnagar Centre, chrysanthemum, crossandra, china aster and marigold at Arsikere Centre, gerbera, tuberose, gladiolus and marigold at Kahikuchi Centre and gladiolus, tuberose and gerbera at Mondouri Centre, lily, heliconia and jasmine at Ratnagiri Centre.
- In the studies conducted on the management of eriophyid mite in coconut gardens, it was observed that eriophyid mite damage based on mean damage grade index was found to be the lowest in IPM and INM treated palms with root feeding with azadirachtin 1% (10 ml + 10 ml water) (Mild to moderate -0.1 to 2.0 damage grade index) when compared to the untreated control garden and treatment garden where IPM and INM package with out root feeding of azadirachtin.
- The studies with light traps against the slug caterpillar *Macroplectra nararia* revealed that installation of three traps/ha with 200 W incandescent bulb 1 ½' above + water pan has trapped highest numbers of adult moths. Studies on peak time of slug caterpillar *M. nararia* moth attraction towards the light source revealed that moths got attracted from 19.00 hours onwards and attained peak in between 21.00 to 01.00 hours and gradually decreased to nil at 03.00 hours.
- In the trial on evaluation of various insecticides against the red palm weevil, *Rhynchophorus ferrugineus,* the imidaclorpid treated palms showed hundred per cent recovery from the weevil infestation.
- Soil application of 125g of *Trichoderma viride* + 125g of *Pseudomonas fluorescens* along with 5kg of neem cake per palm per year for the management of basal stem rot disease of coconut.

Intercropping in juvenile oil palm garden

- The vegetable okra intercropped with oil palm recorded higher fruit yield and net returns followed by tomato and brinjal in juvenile oil palm under Tungabhadra command area of Karnataka.

7.2 Proforma for recording observations

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 centi meters/ 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. It is recorded centi meters/ 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. 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

7.3 Technical Programmes and Personnel

Scientist	Programmes
Aliyarnagar	
Dr. T. Srinivasan Assistant Professor (Entomology)	Ent. 1; Ent. 2; Ent.3 ; Ent.4;
Dr. A. Subramanian Assistant Professor (Plant Breeding)	Gen. 1; Gen. 2; Gen. 3
Dr. S. Rani Assistant Professor (Agronomy)	Agron. 10; Agron. 10A; Agron. 11; Agron. 14
Dr. R. Ramjegathesh Assistant Professor (Plant Pathology)	Path. 1; Path. 4; Path. 5
Ambajipeta	
Dr. G. Ramanandam Associate Professor (Horticulture)	Gen. 1; Gen. 2; Gen. 3
Dr. N. B. V. Chalapathi Rao Assistant Professor (Entomology)	Ent. 1; Ent. 2; Ent.3 ; Ent.4; Ent. 5
Mrs. E. Padma Assistant Professor (Horticulture)	Agron. 10; Agron. 11; Agron. 14
Dr. A. Snehalatha Rani Assistant Professor (Pathology)	Path. 1; Path. 2; Path. 3; Path. 4
Arsikere	
Dr. T. B. Basavaraju Professor (Agronomy)	Agron. 10; Agron. 10A; Agron. 11; Agron. 14
Dr. M. Prashanth Associate Professor (GPB)	Gen. 1; Gen. 2; Gen. 3
Manjunath Hubballi Assistant Professor (Plant Pathology)	Path. 1; Path. 2; Path. 3; Path. 4
Dr. G. S. Chandrasekar Assistant Professor (Entomology)	Ent. 1; Ent. 2; Ent.3 ; Ent.4; Ent. 5
Bhubaneshwar	
Dr. S.C. Sahoo Professor (Horticulture)	Gen. 1; Gen. 2; Gen. 3; Agron. 10; Agron. 11
Goa	
Dr. V. Arunachalam Principal Scientist (Horticulture)	Gen. 3; Gen. 4; Agron. 11; Agron. 18
Jagdalpur	
Dr. Beena Singh Assistant Professor (Horticulture)	Gen. 1; Gen. 2; Gen. 3; Gen. 17
Dr. P. K. Salam Assistant Professor (Agronomy)	Agron. 10; Agron. 11; Agron. 17

Scientist	Programmes
Kahikuchi	
Dr. J. C. Nath Professor (Horticulture)	Gen. 1; Gen. 2; Gen. 3
Dr. K. K. Deka Associate Professor (Horticulture)	Agron. 10; Agron. 11
Mondouri	
Dr. Dilip K. Ghosh Associate Professor (Horticulture)	Gen. 1; Gen. 2; Gen. 3
Dr. D. K. Ghosh Assistant Professor (Horticulture)	Agron. 10; Agron. 11
Navsari	
Dr. Pankaj P. Bhalerao Assistant Professor (Fruit Science)	Gen. 1; Gen. 2; Gen. 3; Agron. 10; Agron. 11
Port Blair	
Dr. Ajit Arun Waman Scientist (SPMA)	Gen. 3; Gen. 4; Agron. 11; Agron. 14; Agron. 18
Ratnagiri	
Dr. Shinde V. V. Associate Professor (Horticulture)	Gen. 1; Gen. 2; Gen. 3; Agron. 10; Agron. 11
Mr. S. S. Chavan Assistant Professor (Entomology)	Ent. 1; Ent. 2; Ent.3 ; Ent.4;
Sabour	
Dr. Ruby Rani Assistant Professor (Horticulture)	Gen. 1; Gen. 3; Agron. 5; Agron. 10
Veppankulam	
Dr. S. Thangeswari Assistant Professor (Plant Pathology)	Path. 1; Path. 2
Dr. K. S. Vijay Selvaraj Assistant Professor (Horticulture)	Gen. 1; Gen. 2; Gen. 3
Dr. A. Selva Rani Assistant Professor (Agronomy)	Agron. 10; Agron. 11
Wakawali	
Dr. Rajesh R. Rathod Assistant Professor (Horticulture)	Gen. 4
Shivamogga	
Dr. B. Gangadhara Nayak Assistant Professor (Pathology)	Gen. 4; Agron. 20; Ent.18
Pattukkottai	
Dr. T. Sumathi Assistant Professor (Horticulture)	Gen. 8; Gen. 8 C; Gen. 8 D(I); Gen.8 D(II); Gen. 8 E

Scientist	Programmes
Gangavathi	
Dr. Sanjeevraddi G. Reddi Assistant Professor (Agronomy)	Gen. 8 B; Gen. 8 C; Gen. 8 D; Agron. 15
Mulde	
Mr. V. P. Damodhar Assistant Professor (Horticulture)	Gen. 8 B; Gen. 8 C; Gen. 8 D; Agron. 15
Vijayarai	
Dr. P. Madhavi Latha Assistant Professor (Agronomy)	Gen. 8 C; Gen. 8 D(I); Gen.8 D(II); Agron. 11; Agron. 15
Killikulam	
Dr. T. Prabhu Assistant Professor (Horticulture)	Gen. 9; Agron. 16
Dr. M. Balakrishna Assistant Professor (Food Processing)	PHT. 1; PHT. 3; PHT. 4
Pandirimamidi	
Dr. G. Narasimha Murthy Assistant Professor (Horticulture)	Gen. 9; Agron. 16
Dr. P. C. Vengaiah Asst. Professor (Food Science &Technology)	PHT. 1; PHT. 2; PHT. 4
Madhopur	
Mr. Sathish Chandra Narayan Assistant Professor (Plant Breeding)	Gen. 8 C; Gen. 8 D; Agron. 6 A; Agron. 13
Pasighat	
Dr. Barun Singh Assistant Professor (Horticulture)	Gen. 8 C; Gen. 8 D; Agron. 12; Agron. 13
RARS, Pilicode	
Dr. Vanaja T. Assistant Professor (GPB)	Gen. 1; Gen. 2;
CPCRI, Kasaragod	
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IIOPR, Pedavegi	
Dr. B. N. Rao Principal Scientist (Horticulture)	Agron. 21
Bavikere	
Dr. T. Basavaraj Naik Associate professor (Agronomy)	Agron. 21

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