806342

AICRP ON CASHEW
CASHEW RESEARCH STATION, MADAKKATHARA

REPORT TO QUINQUENNIAL REVIEW TEAM (2002-2006)

A. EXPERIMENTAL INFORMATION REQUIRED (2002-2006)

1. Year of inception of the project

The center was originally started at Cashew Research Station, Anakkayam during 1972 and has been subsequently shifted to Cashew Research Station, Madakkathara during 1973.

2. Climatic conditions- meteorological data for the last five years

Meteorological data for the year 2002

Month	Temperature (°C)		Relative Humidity (%)		Rainfall (mm)	No. of rainy days
	Maximum	Minimum	7.30 AM	2.30 PM		
January 02	32.8	22.7	79	45	0	0
Feb 02	34.3	22.4	21	38	0	0
Mar. 02	36.2	24.1	85	40	16.2	2
April 02	35.0	24.8	86	55	50.8	4
May 02	32.6	24.5	88	67	308.4	12
June 02	30.0	23.3	93	78	533.5	22
July 02	29.8	23.1	94	74	354.2	21
Aug. 02	28.9	22.9	94	78	506.6	19
Sep. 02	31.1	23.0	92	62	124.0	8
Oct. 02	30.8	23.2	92	74	387.2	19
Nov. 02	31.8	23.4	82	60	22.1	3
Dec. 02	32.3	22.1	72	45	0	0

Meteorological data for the year 2003

Month	Temperature (°C)		Relative Humidity %		Rainfall (mm)	No. of rainy days
	Maximum	Minimum	7.30 AM	2.30 PM		
January 03	33.2	22.9	66	34	0.0	0
Feb 03	34.7	23.6	83	43	162.0	5
Mar. 03	34.6	24.1	86	47	94.8	4
April 03	34.6	25.0	86	58	23.8	3
May 03	34.0	25.0	88	56	40.3	3
June 03	30.9	23.8	91	68	570.6	19
July 03	29.5	22.2	93	74	492.6	22
Aug. 03	30.6	23.4	93	73	490.6	19
Sep. 03	31.0	22.7	91	66	490.1	7
Oct. 03	30.8	23.1	89	73	53.7	14
Nov. 03	31.5	23.9	74	58	276.6	1
Dec. 03	32.2	21.9	74	47	18.20	0

Meteorological data for the year 2004

Month & Year	Temperature (^{0}C)		Relative Humidity (%)		Rainfall (mm)	No. of rainy days
	Maximum	Minimum	7.30 AM	2.30 PM		
Jan.04	33.4	22.3	72	43	0.0	0
Feb.04	35.2	22.5	67	32	0.0	0
Mar.04	36.5	24.2	83	39	8.6	1
Apr. 04	34.8	25.2	84	54	60.2	6
May 04	30.4	23.6	92	75	578.7	21
June 04	29.6	23.1	93	76	786.0	24
July 04	29.3	23.0	94	75	369.6	24
Aug 04	29.5	23.1	92	73	386.9	14
Sept 04	30.8	23.6	91	69	208.8	10
Oct 04	31.4	23.4	85	65	424.7	9
Nov 04	31.1	23.6	74	57	71.7	3
Dec. 04	32.1	22.6	68	43	0.0	0

Meteorological data for the year 2005

Month & Year	Temperature (^{0}C)		Relative Humidity (%)		Rainfall (mm)	No. of rainy days
	Maximum	Minimum	7.30 AM	2.30 AM		
Jan. 05	33.2	22.6	71	46	7.6	1
Feb. 05	35.1	22.3	71	34	0.0	0
Mar 05	35.7	24.6	84	42	0.0	0
Apr 05	33.7	24.8	88	60	171.4	10
May 05	33.6	25.0	86	58	89.2	5
June 05	30.0	23.5	94	78	711.4	23
July 05	28.7	23.0	94	82	727.5	28
Aug 05	29.9	23.3	92	72	346.5	16
Sept 05	29.4	23.3	92	78	416.1	16
Oct 05	31.0	23.2	91	68	178.4	9
Nov 05	30.7	22.9	81	63	11.6	1
Dec 05	31.5	22.1	81	51	3.2	0

Meteorological data for the year 2006

Month & Year	Temperature (^{0}C)		Relative Humidity (%)		Rainfall (mm)	Rainy days (No.)
	Maximum	Minimum	8.30 AM	3.30 PM		
Jan 06	32.5	22.6	94.0	41.0	0.0	0.0
Feb 06	34.3	22.3	71.0	31.0	0.0	0.0
Mar 06	34.8	23.8	86.0	49.0	95.2	4.0
Apr 06	33.6	24.1	73.4	58.6	20.0	0.8
May 06	31.4	24.0	91.5	66.8	173.2	4.0
June 06	29.9	23.4	94.5	74.0	81.7	3.8
July 06	29.4	23.2	94.6	76.2	110.4	6.4
Aug 06	29.9	23.2	92.8	71.0	127.3	3.0
Sept 06	29.0	23.0	92.5	75.5	130.5	4.8
Oct 06	31.2	23.0	88.4	67.0	67.1	2.2
Nov 06	31.6	23.9	81.8	60.5	16.9	1.5
Dec 06	31.5	23.1	67.8	44.3	0.0	0.0

3. Soil

Soil type is laterite and the pH is 5.5. The organic carbon content ranges from 0.72 to 1.01% (medium). The available P_2O_5 ranges from 6 to 12.6 kg/ha (low to medium) and available K_2O ranges from 186 to 280 kg/ha (low to medium).

4. Staff position (including the period of service) during 2002 to 2006

Name of post	Name of personnel & position	Dates of position	Vacant post
Agronomist (Rs. 12000-18300/-)	Dr. P.S. John (Associate Professor & Head)	02.01.2002 to 18.8.04	
	Dr. Jose Mathew (Associate Professor & Head)	18.08.04 to till date	
Jr. Entomologist (Rs12000-18300/-)	Dr. Susannamma Kurien (Assoc. Professor)	From 3.4.1995 to 24-08-04	
	Dr. G K Mahapatro (Asst. Professor)	24-08-04 to 2.1.2007	Vacant since 3.1.2007
Jr. Breeder (Rs. 8000-13500/-)	Dr. V.G. Jayalekshmy (Assistant Professor)	From 3.1.2000 to 19.11.2003	
	Dr. Mareen Abraham (Assistant Professor)	1.1.2004 to 15.6.2006	
	Sri. Gregory Zachariah (Assistant Professor)	28.6.2006 to till date	
Sr. Tech. Asst. (Rs.8000-13500/-)	Smt. Meagle Joseph (Assistant Professor)	1.1.2002 to 12.7.2002	
	Smt. Ancy Joseph (Assistant. Professor)	15.7.2002 to 9.1.2003	
	Dr. Mini.C (Assistant Professor)	1.5.2003 to till date	
Jr. Tech. Asst. (Rs. 1125-1720/-)	Sri. V.V. Suresh (Sr. Research Fellow)	1.3.2002 to 23.5.2002	
	Sri. Manoj T.K.	1.6.2002 to till date	
Grafter (Rs. 3050-5250/-)	Sri. S. Sasi	1.8.97 to 11.9.2003	Vacant since 11.9.2003

5. Farm Area

The total area of the Madakkathara farm is 50.7 ha, out of which cashew plantation alone occupies 38.1 ha. Out of the total cashew area, 18.7 ha are experimental area and 19.4 ha are bulk area. The area under scion bank s 5.4 ha and that under nursery is 1.0 ha. Coconut and pepper occupies 4.8 ha and 0.4 ha, respectively. Buildings and roads occupy one-hectare area. The entire area of the farm is well connected by farm roads. A substantial portion of the farm

boundary is well protected by compound walls. The station has a separate block of two acres of cashew near the KAU School in the main campus.

6. Physical infrastructure available at Research Station since inception of the project (other than equipments)

The main building houses the office, training hall and laboratories and has a plinth area of 204 m^2. The farm office (83 m^2) and two farm stores (50 m^2 and 26 m^2) meet the housing needs of the farm section. A drying yard of 50 m^2 is used for drying cashew nut. A building is set apart for the use of laborers for resting. The commercial cashew nursery of the station has two sites (A and B) with all the facilities to produce one lakh grafts per annum. It has three potting sheds, three shade houses, six mist chambers and two shade structures. The station has one each of open well, open pond and bore well. It has a well laid out microsprinkler irrigation system to irrigate the nurseries.

7. Budget provision and expenditure statement, audit utilization certificate

Year	Pay & allowances	TA	Recurring contingency	Non-recurring contingency	Grand total	ICAR share	State share
2002-03							
Actual expenditure	13.52	0.15		1.02	14.69	11.02	3.67
2003-04							
Sanctioned	12.40	0.20	1.20	-	13.80	10.35	3.45
Actual expenditure	13.52	0.15	1.02	-	14.69	11.02	3.67
2004-05							
Sanctioned	13.30	0.30	2.40	2.67	18.67	14.00	4.67
Actual expenditure	13.71	0.25	2.33	2.67	18.96	14.22	4.74
2005-06							
Sanctioned	12.00	0.45	2.40	1.2	16.05	12.04	4.01
Actual expenditure	13.73	0.09	2.14	1.19	17.15	12.86	4.29
2006-07							
Sanctioned	11.85	0.40	2.40	0.00	14.65	10.99	3.66
Actual expenditure	14.96	0.33	2.39	0.00	17.68	13.26	4.42

8. Equipments purchased during last 5 years (2002-2006)

Using the AICRP fund, a tractor mounted power sprayer, a laminar flow unit, pH system and soil thermometers has been purchased.

Plate 1 (a to b). Infrastructural facilities developed under AICRP on Cashew at Madakkathara

a. Tractor mounted power sprayer

b. Farm Store

A semi-automatic liquid packaging machine and mini pulper has been procured for the cashew apple processing laboratory using revolving fund.

9. Works undertaken during the last 5 years (2002-2006)

1. Crop improvement

1.1. Gen. 1. Germplasm collection, conservation, evaluation, characterization and Cataloguing in cashew

The objective of the experiment is to collect, evaluate, characterize and catalogue cashew germplasm. A total of 148 accessions, collected till 2007, have been planted for evaluation in the clonal germplasm block. The accessions, which recorded the highest yield in different years, were BPP-2, Ulikkal-6, V-1 and A. microcarpa during 2002, 2003, 2004, 2005 and 2006 respectively.

1.2. Gen.3. Expt. 3. Multi Locational Trial II (MLT 1992) in cashew

The objective of the experiment was to evaluate the performance of high yielding varieties evolved at research stations all over India. The trial was laid out during 1992 with 13 varieties using Dhana as local check. Varieties M 15/4, Hy 303, Hy 320 and T3/28 recorded the highest annual yields during 2002-03, 2003-04, 2004-05 and 2005-06, respectively. The highest cumulative yield for the period from 1998 to 2006 was recorded by the test varieties M 15/4 (20.75 kg/tree) Hy 320 (19.9 kg/tree) Hy 303 (19.03 kg/tree) and T3/28 (16.6 kg/tree).

1.3. Gen.3. Expt.4. Multi Locational Trial III (MLT 2002) in cashew

The objective of the trial was to evaluate the performance of TMB tolerant accessions and promising hybrids from different states, at Madakkathara. The trial was laid out during 2003 planting season with 11 varieties (10 test varieties and Dhana as local check). The trees have not started yielding.

1.4. Gen.3. Expt.5. Multi Locational Trial V (MLT 2006) in cashew

The objective of the experiment is to evaluate the performance of all the promising high yielding varieties released from different states of India. The trial was laid out during October 2006 with 29 varieties using Dhana as local check. The trees have not started yielding.

1.5. Ge.4. Hybridization and selection of cashew

The objective of the experiment is to incorporate TMB tolerant characters in high yielding varieties with better nut size. A total of 1547 hybrids has been planted and are being evaluated in the field during 1993-2006. Three hybrids H7 (18.4 kg and 76.44 kg annual and cumulative yield during 2002-06 per tree respectively), H-17 (17.8 and 71.35 (2002-06) kg) and H21 (10.5 and 47.7 (2002-06) kg) have been found to be promising. Three varieties evolved under this project have been released during the reporting period. Of these, Raghav and Damodar were released during 2002 and Poornima during 2006.

2. Crop management

2.1. Agr.1. NPK fertilizer experiment in cashew

The main objective of the experiment is to find out the optimum fertilizer requirement of graft-raised cashew. The treatments consisted of three levels each of nitrogen (0, 500 and 100 g N/tree/year), phosphorous (0, 125 and 250 g P_2O_5) and potassium (0, 125 and 250 g K_2O), laid out in confounded factorial experiment. The data on the annual yield of nuts during different years as well as cumulative yield for six years did not show significant response to graded levels of N, P or K or their 2- way or 3- way interactions, except that the annual yield during 2003-04 was significantly influenced by N levels wherein the highest yield was recorded by 1000 g N/ tree/ year.

2.2. Agr.1. On farm fertilizer trial in cashew

The objective of the experiment is to assess the effect of fertilizer doses on graft- raised cashew in farmers' fields. The trial consisted of five fertilizer levels i.e. 100, 150 and 200 per cent of national recommendation, KAU recommendation and a fully organic treatment, laid out in two locations at Pazhayannur and Kadavallur Panchayaths of Thrissur district. The experiment was started during 2004-05. At Pazhayannur, POP dose of KAU recorded the highest yield, while at Kadavallur the yield variation was insignificant.

2.3. Agr.2. Fertiliser application in high density cashew plantation

The objective of the experiment is to standardize an optimum combination of tree population and fertilizer dose for obtaining high productivity in cashew. Combinations of three level each of fertilizers (75: 25: 25, 150: 50: 50 and 225:75:75 kg NPK/ha) and tree densities (200, 400 and 500 plants/ ha) constituted the treatments. The growth characters and the yield during the first and second years of yielding did not show significant variations due to tree densities or fertilizer levels except that no yield could be obtained during the second year due to severe infestation of TMB in spite of timely plant protection measures.

2.4. Agr.4. Expt.2. High density planting observational trial in cashew

The main objective of the experiment is to compare the growth and yield of cashew under normal (4m x 4m) and high (8m x 8m) density planting systems. The data showed that the per tree yields were comparable both under high and normal density plantings during the ninth year of planting as well as in cumulative yield. However the per hectare yield was appreciably high in high density planting.

2.5. Agr. 6. Intercropping in cashew

The experiment aims to identify suitable intercrops that can be grown in cashew plantations in the early years of establishment. The treatments composed of five intercrops (coleus, colocasia, tapioca, sweet potato and amorphophallus) and a pure crop control. The study showed

that among the different tuber crops raised as intercrops in young cashew plantations, tapioca recorded the highest total return, net profit and B: C ratio.

3. Crop protection

3.1. Ent.1. Expt.3. Evaluation of insecticides for control of tea mosquito bug and other insect pests of cashew

The objective is to find out the efficacy of insecticides for the management of TMB and other pests of cashew. The replicated field trial consisted of six treatments (POP, chlorphyriphos, triazophos, lambda cyhalothrin, profonophos and control). Among the different spraying schedules, lambda cyhalothrin was found most effective and profitable during 2003-04 and 2005-06, over application of chlorpyriphos, triazophos and profenophos and also POP recommendation, while POP recommendation (3 round spray schedule with monocrotophos 0.2%, quinalphos 0.1% and carbaryl 0.1% at flushing, flowering and nut initiation stages respectively) was effective during 2004-05.

3.2. Ent. 2. Control of cashew stem and root borers

3.2.1. Prophylactic trial

To evaluate different pest control measures (Swabbing with neem oil 5 % twice, thrice or four times a year, swabbing with mudslurry-carbaryl (0.2 %) twice, thrice or four times +lindane 0.2 % a year and application of entomopathogenic fungal bio-pesticides *Metarrhizium anisopliae* and *Beauveria bassiana* (each 250 g/ tree + 500 g neem cake), a trial was conducted in a graft plantation. The result obtained was inconsistent. The mean pest free duration during 2005-06 in the treatments varied between 53 to 110 days. During 2002-03 and 2003-04, swabbing of mud slurry + carbaryl (0.2%) four times with lindane (0.2%), with pest free duration of 75 days, was found to be effective.

3.2.2. Curative trial

With the objective of assessing the efficacy of different curative chemical treatments (carbaryl 1%, chlophriphos, monocrotophos and lindane all at 0.2%), along with the treated (POP) and untreated check, this experiment was carried out. The result showed no concrete trend. However monocrotophos 0.2% was found to be effective during 2002-04 and chlorpyriphos 0.2% during 2004-06.

3.3. Ent.3. Bio ecology of pests of regional importance and survey of pest complex and natural enemies in cashew

Twenty-three pests were reported to be infesting cashew at Madakkathara, including the two reported during 2003-05 i.e. spiraling white fly and mango leaf webber. An attempt was made during 2005-06 to categorize the cashew pests into regular, major, minor and rare pests. Positive correlation was established between ant and spider population dynamics. Absence of antagonism between them suggests suitability of ant- technology in the management of TMB.

3.4 Ent.4. Screening of cashew germplasm to locate tolerant/ resistant types for major pests of the region

To identify germplasm accessions tolerant/ resistant to the pests of regional importance, 275 cashew accessions were screened during 2002-03 to 2005-06. TMB damage score of more than 50% was observed in young trees while old trees recorded damage score of less than 24%.

Associated ICAR funded programmes

1. Forewarning of Tea Mosquito Bug in cashew

The main objective of the project conducted during 2003-06 was to develop forewarning models for predicting tea mosquito population build up and suggest the timing of pesticide application for cost effective management. Monitoring of tea mosquito bug population at Madakkathara revealed that the peak population of TMB was during the last two weeks of December and the third week of January, irrespective of the varieties belonging to different flowering characteristics. The prediction model developed from the study revealed the influence of more than one weather parameter in the population build up of TMB.

2. ICAR Ad- hoc scheme on "Soil test based and productivity linked approach for cashew nutrition"

The research project was undertaken with main centre at Madakkathara and five other sub centres to rationalize the fertilizer recommendation for cashew.

Integrating the models developed in this project, a programme namely Quantitative Estimation of the Fertilizer requirement of Cashew (QUEFC) was developed using MS excel to estimate the fertilizer N, P and K requirement for cashew for different soil environments and yield levels. The models are as follows.

1. Model for Estimating N:

FN =258.62725835306+(94.7643266900028*X2)-(1.435526675154*X1)-(0.0658097529438436*X1*X2)+(0.0013424386970878*X1*X1)-(1.599422799423*X2*X2)

FN = Fertilizer Nitrogen (g/tree); X1 = Soil N (kg/ha); X2 = Nut yield (kg/tree); $R^2 = 0.941$; R^2 Adjusted = 0.939

2. Model for Estimating P_2O_5: FP = 52.296Ln(x) + 101.83 (R2= 0.9739)

3.Model for Estimating K_2O: FK = 70.973Ln(x)+138.19 (R2= 0.973)

10. Action taken on recommendation of National Group Meeting held at NRC Cashew in 2004 and at KAU, Thrissur in 2005

10. *i. Action taken on recommendations of National Group Meeting held at NRC, Cashew in 2004*

1. Molecular characterization of cashew varieties is being continued under a KSCSTE-funded project entitled " Cataloguing of cashew germplasm of Kerala with molecular markers and digitizing the morphological data" with Dr. Jayalekshmy, V.G, College of Agriculture, Vellayani as Principal Investigator.

2. The promising variety P-7 from Madakkathara is further evaluated at the centre.

3. To make the breeding programme more compact, five cross combinations were identified to meet the specific objectives.

4. Canopy spread is presented for both NS and EW directions.

5. Under On- farm trial, present recommended doses of fertilizers were included.

6. Pruning is done as a management practice in the high density trial.

7. In the intercropping trial, sole crop yields of intercrops has been recorded.

8. Cost of cultivation and benefit: cost ratio has been presented in the report in respect of intercropping trial.

9. The insecticide lambda cyhalothrin has been included in Ent.1. Expt. 3

10. General orchard management practices have been included as one of the basic components in Entomology trials.

11. Monitoring of biotic and abiotic factors and crop phenology has been recommended in Entomology trials.

12. Pesticide residues has been analyzed and reported for all the insecticides used in the pest management trials.

13. Economics has been worked out for all the pest management trials.

ii. Action taken on recommendation of National Group Meeting held at KAU, Thrissur in 2005

1. Promising hybrids have been multiplied for planting in replicated station trials.
2. It is ensured that germplasm screening is done continuously for four years.
3. MLT V (2006) was planted during 2006.

4. An isolated field for the layout of the new experiment on "Organic farming in cashew" was identified. Sanction is awaited from the University to dispose of the old cashew trees and plant the new experiment in the identified location.
5. Pruning is done as a regular farm operation in the crop management trials.
6. Prophylatic trial against CSRB was discontinued.
7. TMB incidence was recorded on 0-4 scale
8. The team of scientists constituted by Director of Research, Kerala Agricultural University visited cashew plantations of Plantation Corporation of Kerala at Mannarghat and suggested remedial measure
9. Proposals have been submitted to DCCD, Kochi for funding to take up evaluation of all released varieties for their performance in major cashew growing tracts of Kerala to facilitate recommendations of region specific cashew varieties. However it was not approved by DCCD and hence could not be proceeded further, in the absence of alternate funding.

11. Salient achievements

11.1. Technologies generated

Crop improvement

1. Release of Cashew Hybrid "Raghav"

Raghav (H-1610), released during 2002, is a high yielding cashew hybrid obtained by the cross between ALGD-1-1 x K-30-1. The mean yield of the variety is 14.6 kg/tree/year. The nuts are bold with a mean weight of 9.2g. The export grade is W 210. Kernel weight is 2.27g and shelling percentage is 26.6. The apple is golden yellow with 68% juice. It flowers during January- February and hence classified as a mid season flowering variety.

2. Release of Cashew Hybrid "Damodar"

Damodar (H-1600) is a high yielding cashew hybrid released during 2002. This hybrid is developed from the cross between Anakkayam-1 (BLA 139-1) and H-3-13. The variety showed very good adaptability in multi-location trials conducted for 14 years in the East coast, West coast and *Maidan* tracts of Karnataka. The average yield of the variety is13.65 kg/tree/year. The nuts are bold, with a mean nut weight of 8.2g and kernel weight of 2.0g. Damodar is rated as a mid season flowering variety with cent percent flowering during Nov- Dec. Flowering duration is 68 days and harvests can be completed by March- April. The variety has a high shelling percentage of 27.3 %. It has an export grade of W 210. The apple is light red in colour with 69.3 % juice. The hybrid is apparently tolerant to tea mosquito bug.

3. Release of Cashew Hybrid "Poornima"

The variety Poornima (H-1593) was released during 2006 and has been evolved from the cross between BLA 139-1 and K-30-1. It is a high yielding (14.1 kg/tree/year), mid season (Dec-Jan), cashew hybrid with high shelling percentage (31), kernel weight (2.6g) and good export grade (W 210). The nut weight of the variety is 7.8 g. It's upright and compact canopy with intensive branching make it suitable for high density planting. Its high yield and bold nut size, high shelling percentage and good export grade make it preferred by all the stakeholders in the cashew cultivation and industry i.e. farmers, processors and exporters.

4. Promising cashew hybrids in the pipeline

Three promising hybrids H-7, H-17 and H-21 are in the pipeline for release. H -7 is a cross between BLA 139 -4 and P3-2. The yield is 18.4 kg / tree/ year with a nut weight of 8.25 g. H -17 is a cross between BLA 39 -4 and P3-2 with a mean yield of 17.8 kg/ tree/ year. The nut weight is 6.5 g. H 21 is a cross between BLA - 39/ 4 and P3-2 with a mean yield of 10.5 kg / tree/ year. The nut weight is 8.67g.

Crop management

5. A programme named "Quantitative Estimation of the Fertilizer Requirement of Cashew (QUEFC)" was developed integrating three models to estimate the fertiliser N, P and K requirement for cashew for different soil environments and yield levels.

6. The system of high density planting can enhance the nut yield of young cashew crop four - fold on plantation level as compared to normal density planting.

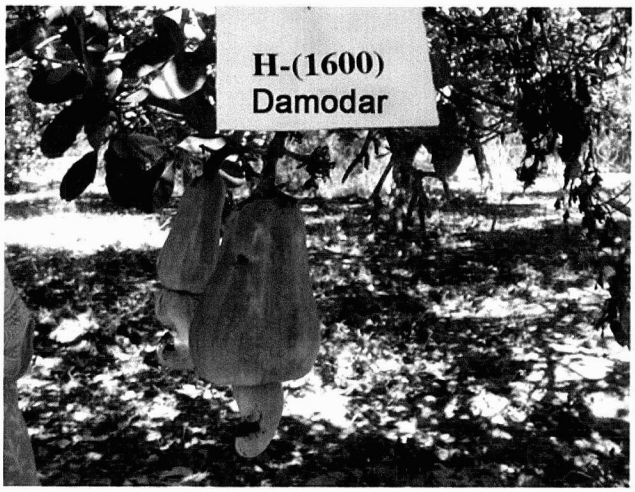
7. Tapioca is the most profitable tuber crop for intercropping in young cashew plantations in terms of net profit and C: B ratio, provided the cultivation is undertaken with due consideration for soil conservation.

Crop protection

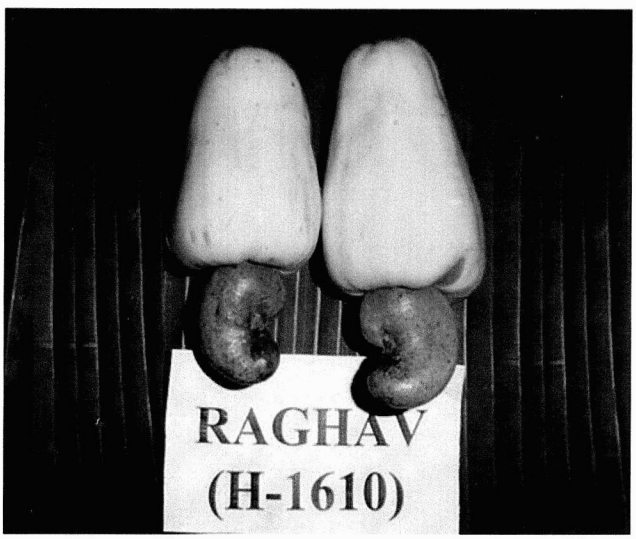
8. The following pesticide application schedule for the control of anthracnose- tea mosquito bug complex in endemic areas has been incorporated in the Package of Practices Recommendations for crops of Kerala

Chemical	Concentration	Time/ stage
Monocrotophos 0.05%	1.5 ml/l (36 EC)	Flushing
+		
Copper oxychloride 0.2%	2g/l	
Quinalphos 0.05%	2ml/l (25 EC)	Flushing
+		
Mancozeb 0.2%	2g/l	
Carbaryl 0.1%	2g/l (50 WP)	Nut initiation

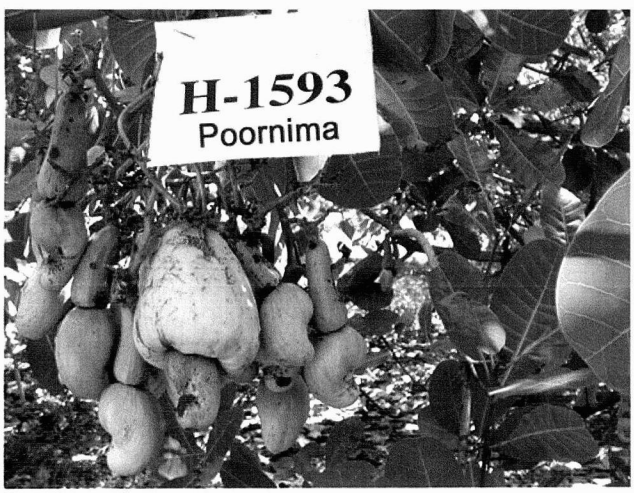
Plate 2 (a to c). Cashew hybrids released by Madakkathara Centre during 2002-2006



a. Damodar



b. Raghav



c. Poornima

Plate 3 (a to c). Promising cashew hybrids in the pipeline evolved by Madakkathara Centre During 2002-2006

a. H 7

b. H 17

c. H 21

Plate 4 (a to b). Development of crop management technologies in cashew by Madakkathara Centre

a. Intercropping

b. High density planting

9. The following prophylatic treatment for the control of cashew stem and root borer has been incorporated in the Package of Practices Recommendations for crops of Kerala

Swab the trunk region (up to 1.0 m height from the ground level) and exposed roots with 5% neem oil twice a year during March- April and November- December along with soil application of sevidol 4 G @ 75 g/tree.

10. Application of lamda cyhalothrin (0.003%) was found most effective and profitable for the control of Tea Mosquito Bug, as compared to the application of common insecticides and present POP recommendation.

11. Post- extraction prophylaxis with chlorpyriphos (0.2%) was found effective to reduce the re-infestation of Cashew Stem and Root Borer (CSRB) as a curative treatment.

12. The current recommendation against Tea Mosquito Bug (TMB) of three – round spraying at flushing, flowering and nut initiation may not be effective in cashew plantations with multiple varieties due to overlapping pheno-phases.

Cashew apple utilisation

13. The technology for the production of cashew apple syrup was refined by the use of low cost sago for clarification, reducing the production cost and making the product near natural.

14. Standardized the technology for the production of Ready- To- Serve (RTS) beverage from cashew apple which was immediately employed at the station for its commercial production which received increased consumer acceptance.

15. Cashew apple residue after juice extraction and leaf bitter from the orchard could be effectively used for the production of vermi compost in 95 days.

11.2. Linkage with development/ line departments

The centre has good linkage with all the development and line departments working on cashew in the state.

The centre has implemented several developmental activities funded by Directorate of Cashew nut and Cocoa Development (DCCD), Kochi. It includes programmes such as farmer participatory demonstration cum training programme, demonstration on cashew apple processing, organization of cashew day, project on production forecast, evaluation of replanting programme of state owned corporations, evaluation of regional cashew nurseries, preparation of extension publications on cashew and organization of training programme for DCCD staff.

We work with Cashew Export Promotion Council of India (CEPCI) in cashew promotion activities, establishment of cashew museum and analysis of cashew kernels for pesticide residue in their laboratory. The linkage with agricultural department includes conduct of farmers' seminars, training programmes, serving as resource person, supply of graft and mother plants, field visits, exhibition and farmers' visit to the station.

We work with Plantation Corporation of Kerala Ltd., Forest Department and Rehabilitation Plantations of Kerala by giving technical advise for solving their field problems and in general crop management aspects, training their staff, supply of planting materials for progeny orchards and project preparation on cashew apple processing. We also collaborate with NABARD in the supply of data and technical details about cashew crop for preparation of various projects.

We work with National, State and District Horticultural Missions in implementing two of their projects on cashew nursery and cashew apple processing and prepare syllabus and conduct training programmes sponsored by them.

11.3. Extension activities

11.3.a. Books, booklets, technical bulletins and CDs published

1. John, P.S. and Jayalekshmy, V.G. (Eds.). 2004. Recent trends in cashew nut production and processing. Cashew Research Station, Madakkathara, Kerala Agricultural University, Thrissur

2. Jose Mathew, Meera V. Menon and John P.S. (Eds.). 2004. Proc. of ICAR National Symposium on Input use efficiency in agriculture- issues and strategies: Lead papers, 25-27 Nov. 2004, Thrissur, Kerala

3. John, P.S., Meera V. Menon and Jose Mathew (Eds). 2004. Proc. ICAR National Symposium on Input use efficiency in agriculture - issues and strategies: Extended Summaries, 25-27 Nov. 2004, Thrissur, Kerala

4. Latha, A., John P. S. and Jose Mathew (Eds.). 2004. Management of agricultural inputs in humid tropics. Kerala Agricultural University, Thrissur, 99 p.

5. Jose Mathew and Mini, C. (Eds.) 2005. *Scientific Cashew Cultivation* (In Malayalam – *Sastriya Kasumavu Krishi*). CRS, Madakkathara, 92p

6. Jose Mathew and Mareen Abraham (Eds.) 2004. Enhanced profit through cashew apple processing (In Malayalam). CRS, Madakkathara, 62p

7. John, P.S., Mini C., Susanamma K. and Mareen A. 2004.Scientific cultivation of cashew (Leaflet in Malayalam). Cashew Research Station, Madakkathara.

8. Mini C. and Jose Mathew. 2007. Cashew Nursery (Leaflet in Malayalam). Cashew Research Station, Madakkathara.

9. Mini,C., Jose Mathew and Augustine A. 2005. *Technologies for Cashew Apple Processing.* Kerala Agricultural University, Mannuthy, Thrissur, Kerala, 55p.

10. Jose Mathew, Mini C., Mareen A. and Mahapatro, G.K. 2005. *Caring an Uncared Crop - a profile of Cashew Research Station, Madakkathara.* Kerala Agricultural University, Mannuthy, Thrissur, Kerala, 15p.

11. Jose Mathew, Mini C., Mareen A. and Mahapatro, G.K. 2005. *Scientific Cashew Cultivation (in Malayalam).* Kerala Agricultural University, Mannuthy, 62 p.

12. Mareen Abraham and Jose Mathew. 2005. *Improved Cashew Varieties* (Leaflet in Malayalam). Cashew Research Station, Madakkathara.

13. **CD** on "Production and processing technology of cashew" (In English). Cashew Research Station, Madakkathara.

11.3.b. Number of papers published

11.3.b.i. Scientific articles

1. Jayalekshmy, V.G. 2002. Genetics and breeding of cashew. **In:** *Recent trends in cashew nut production and processing.* Cashew Research Station, Madakkathara, pp. 14-22.

2. Jayalekshmy V.G. and Meagle Joseph 2002. Economic analysis of cashew graft production. **In:** *Recent trends in cashew nut production and processing.* Cashew Research Station, Madakkathara, pp. 42-49.

3. Jayalekshmy V.G. 2002. Germplasm cataloguing and varietal wealth of cashew. **In:** *Recent trends in cashew nut production and processing.* Cashew Research Station, Madakkathara, pp. 53-59.

4. Jayalekshmy V.G. 2002. Economic analysis of cashew apple processing. **In:** *Recent trends in cashew nut production and processing.* Cashew Research Station, Madakkathara, pp. 221-225.

5. Jayalekshmy V.G. and Abdul Salam, M.A. 2002. Cost of establishment of a cashew apple processing unit and production cost of cashew apple syrup. *The Cashew* XVI(2)

6. John P.S. 2002. Principles and practices of integrated nutrient management with special reference to cashew. **In:** *Recent trends in cashew nut production and processing.* Cashew Research Station, Madakkathara, pp. 60-78.

7. John, P.S. 2002. High density planting in cashew. **In:** *Recent trends in cashew nut production and processing.* Cashew Research Station, Madakkathara, pp. 87-93.

8. John. P.S. and Ancy Joseph. 2002. Cashew plantation establishment and management. **In:** *Recent trends in cashew nut production and processing.* Cashew Research Station, Madakkathara. pp. 113-128.

9. Susannamma Kurien. 2002. Pest management in cashew. **In:** *Recent trends in cashew nut production and processing.* Cashew Research Station, Madakkathara, pp. 161-173.

10. Mathew, J. 2004. Utilisation of cashew apple. *Times Food Processing Journal* 4 (3): 29-31

11. Kurien, S., Mahapatro, G.K. and Mathew, J. 2004. Managing the cashew stem and root borer: an integrated strategy. *Proc. of National symposium on Input Use Efficiency in agriculture: issues and strategies*, November 25-27, 2004, Thrissur, pp. 124-125

12. Mini, C., John, P.S., and Sushama, P.K. 2004. Vermicompost preparation from organic waste of cashew garden. *Proc. First Indian Horticulture Congress* 2004, 6-9 Nov 2004, New Delhi, pp.263

13. Mahapatro, G.K. and Jose Mathew. 2005. Integrated pest management in cashew: principles and practices. *The Cashew Bulletin* XLIII (7): 5-15

14. Mahapatro, G.K. Pathummal Beevi, S., Jose Mathew and Biju, C.R. 2006. Advancing in ant-technology in India: issues and strategies. *Cashew Bulletin* XLIV (1): 11- 20

15. Mareen, A., Jose Mathew and Mahapatro, G.K. 2006. H-1593 – A promising cashew hybrid. *Cashew Bulletin* XLIV (3): 9-13

16. Mini. C., John, P.S and Jose Mathew. Effect of scion storage on grafting in cashew. *The Cashew* XX (2): 14-19

17. Mini, C. and Jose Mathew 2006. Utilisation of cashew apple- popularizing cashew syrup. *Proc. Golden Jubilee Souvenir of the Karnataka Cashew Manufactures Association*, 22nd April 2006, Mangalore

18. Mini, C., Jose Mathew, Jessy Thomas, K. 2006. Economic potential of cashew apple processing. *Cashew Bulletin*, XLIV (6): 5-8.

19. Jose Mathew, Usha K.P. and Latha, A. 2006. Opportunities for organic nutrition in cashew. Abstracts, National Seminar on "Convergence of technologies for organic horticulture", TNAU, Coimbatore, 20-21 July 2006, pp. 175

20. Mahapatro, G.K., Pathummal Beevi, S., Mareen Abraham and Jose Mathew. 2006. Advancing towards organic technologies for pest management in cashew: a holistic approach. Abstracts, National Seminar on "Convergence of technologies for organic horticulture", TNAU, Coimbatore, 20-21 July 2006, pp. 184-185

21. Jose Mathew and Mini. C. 2006. Improving resource use efficiency in cashew. *Abstracts. Natl. Symp on Improving Input Use Efficiency in Horticulture*. August 9-11, IIHR, Bangalore. pp. 139

22. Mahapatro G.K. and Jose Mathew.2006. Cashew trees harbouring red-ant nests need no spraying. *Abstracts. Nat. Symp. on Improving input use efficiency in Horticulture*, August 9-11, IIHR, Bangalore. pp.186.

23. Mahapatro. G.K. Jose Mathew and Mini. C. 2006. Critical cashew crop-phenophases verses pest management in cashew. *Lead Papers and Abstracts*, National seminar on *Plant Physiology* entitled "Physiological and molecular approaches for the improvement of agricultural, horticultural and forestry Crops", 28-30 November 2006, Kerala Agricultural University, Vellanikkara, pp. 124

24. Mini. C. and Jose Mathew.2006. Priming on seed viability and seedling vigour in cashew. National Seminar on Plant Physiology, 28-30th November 2006, KAU, Vellanikkara, pp. 156

25. Remyamol, K.K, Indira. V, Mini. C and Pushpalatha,P.B.2006. Quality evaluation of blended cashew apple RTS beverages. *Abstracts of papers*, 18th Indian Convention of Food Scientists and Technologists, 16-17 November 2006 (iefost 2006), Hyderabad, pp. 64

26. Mini. C and Jose Mathew. 2006. Uses of cashew apple- popularizing cashew apple syrup (In Hindi). *The Cashew* XX (2): 2-7

11.3.b.ii. Popular articles

1. Jayalekshmy, V.G and Abdul Salam, M.A. 2002. Poshaga Gunameriya Kasumanga (In Malayalam). *Kerala Karshakan* Nov. 10
2. Jose Mathew, Mareen Abraham and Mini. C. 2005. Kasunedan kasumauv (In Malayalam). *Karshakan* 13 (3): 8-9
3. Mini, C. 2005. Kasumanga, kasumanga (In Malayalam). *Karshakan* 13 (3): 12-14
4. Mareen Abraham and Jose Mathew. 2005. High yielding varieties for enhanced income from cashew (In Malayalam). *Karshakan* 13 (3): 15-17
5. Mahapatro, G.K. and Mini, C. 2005. Integrated insect-pest management in cashew (In Malayalam). *Karshakan* 13 (3): 17-18
6. Jose Mathew.2005. Better management for better cashew yields (In Malayalam). *Karshakan* 13 (3): 19-21
7. Jose Mathew and Mini.C.2005. Kasumavu gaveshanathinte kalari (in Malayalam) (Cashew Research in Kerala). *Karshakan* 13 (3): 22 and 69
8. Mahapatro, G.K. and Jose Mathew. 2005. Integrated pest management in cashew: concepts and practices. *Cashew Bulletin* XLIII (7): 5-15.
9. Jose Mathew and Mahapatro,G. K.2005. Organic farming in cashew. *Agrobios Newsletter* 4 (1): 60-64

10. Jose Mathew. 2005. *Cashew - management* (In Malayalam). Kerala Karshakan 51(7): 6-7 & 31
11. Mini, C. and Mahapatro, G.K. 2005. *Cashew- insect and disease management* (In Malayalam). *Kerala Karshakan* 51(7): 10-11
12. Mareen Abraham. 2005. *Cashew- Plenty of varieties* (In Malayalam). *Kerala Karshakan* 51(7): 8-9
13. Mini. C. and Mahapatro, G.K. 2005. *Kasumavu Keeda Roga Chikilsa* (In Malayalam). *Kerala Karshakan*. 51 (7): 10-11
14. Mini. C. and Jose Mathew. 2005. Cashewnut kernel is good for heart (In Malayalam). *Karshakasree* 11(3): 52-54
15. Mini, C. and Jose Mathew. 2005. High density planting for cashew. *The Hindu Daily*, 15 December 2005, pp.17
16. Mini. C. and Jose Mathew. 2005. Bright prospects for cashew. *Kissan World* 32 (12): 56-57
17. Mahapatro, G.K, Pathummal Beevi, S., Jose Mathew and Biju, C.R., 2005. Advancing in ant-technology in India: issues and strategies. Cashew Bulletin XLIV (**1**): 11-20
18. Mareen, A., Jose Mathew and Mahapatro, G.K. 2006. H-1593 – A promising cashew hybrid. *Cashew Bulletin* XLIV (3): 9-13
19. Mini.C., John, P.S and Sushama, P.K. 2005. Vermicompost preparation from the organic wastes of cashew garden. *The Cashew* XIX (4): 15-19
20. Mini. C, Sally K Mathew and Jose Mathew. 2006. Cashew nursery: watch against diseases and insects. *Karshakan* 14(9): 60-61.
21. Mini.C., 2006. Cashew apple in different forms. *Kerala Karshakan*. 52 (4): p 22 and 24
22. Mahapatro G.K. and Jose Mathew 2006. Cashew stem and root borer: management aspects. *Cashew Bulletin*

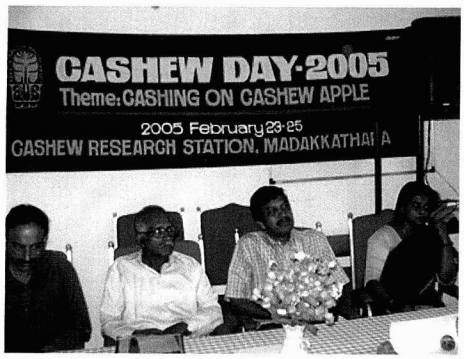
11.3.c. Radio talks

Year	Name of scientist	Topic
2002	Dr. Susannamma Kurien	Control of tea mosquito bug in cashew
	Dr. V.G. Jayalekshmy	Processing of cashew apple
2003	Dr. P.S. John	Prospects of cashew cultivation in Kerala
	Dr. Susannamma Kurien	Pest management in cashew
2004	Dr. Jose Mathew	Recent trends in cashew cultivation
2005	Dr. Mini.C	Preparation of different types of jam and squashes
	Dr. Jose Mathew	Promising cashew varieties and planting
2006	Dr Jose Mathew	*Phosphate solubilizing bacterial bio-fertiliser – A Dialogue*
	Mini.C	Propagation of cashew
	Mini.C	Cashew apple processing

11.3.d. TV talks

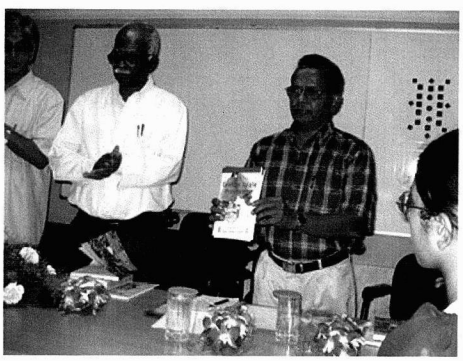
Year	Name of scientist	Topic
2006	Dr. Jose Mathew, Dr. Mareen Abraham, Dr. G.K. Mahapatro and Dr. Mini.C	A programme on "Scientific Cashew cultivation" based on the scripts prepared by the scientists of the station, was telecasted by Doordharshan under "Krishidarshan" programme

Plate 5 (a to e). Extension activities by Madakkathara Centre



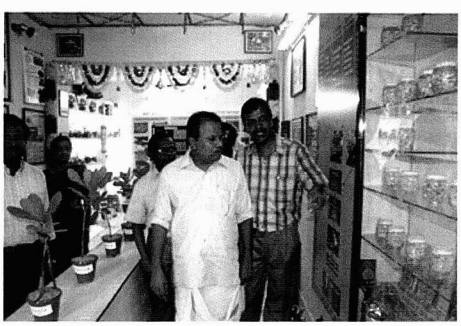
a. Cashew day

b. Training to field staff



c. Extension publication

d. Participation in exhibition



e. Cashew museum

11.3.e. Other extension activities

11.3.e.1. Classes handled in farmers' seminars/staff training

1. Dr Mareen A, Dr Mini C and Dr G.K. Mahapatro handled classes on scientific cashew cultivation, varieties of cashew and plant protection aspects on 20.12.04 at Krishi Bhavan, Pandikkad
2. Dr. Mini.C attended farmers seminar and handled class on Harvest & post-harvest handling of cashew on12.1.05 at Madavour Krishi Bhavan
3. Dr. Mini.C handled class on Cashew apple processing in the farmers' seminar on 11.3.05 at Kannadi Panchayath
4. Dr Jose Mathew, Dr Mareen A., Dr Mini C. & Dr G K Mahapatro handled classes on different aspects of cashew cultivation for the training programme for staff of PCK Ltd during 27th to 29th January 2005 at Cashew Research Station, Madakkathara
5. Dr Jose Mathew, Dr Mareen A., Dr Mini C. & Dr G K Mahapatro handled classes for the training programme for farmers on the theme *Cashing on cashew apple* during 2-4, 15-17 and 23-25 February 2005 at Cashew Research Station, Madakkathara
6. Dr Jose Mathew attended the Farmer-Scientist Interface on Cashew Cultivation on 25.3.05 at KFRI, Peechi

11.3. e.1.Participation in exhibitions

1. Put up a stall in " Thrissur Pooram Exhibition" for display and sale of high yielding varieties of cashew and cashew apple products (Period 13-04-2005 to 23-05-2005)
2. Put up a stall at the State Level Agricultural Exhibition organized by College of Horticulture, Vellanikkara as part of the RAWE programme of final B Sc (Ag) students at Valakkavu during 11-12 December 2005 for display of scientific technologies and sale of products in cashew.
3. Actively participated in the Flower Show 2006 organized at Thrissur during January 20-27, 2006 for sale and display of cashew apple products.
4. Organized a mini-Exhibition during the AICRP Workshop at COF, Vellanikkara on Cashew Products (28-30 Nov 2005)

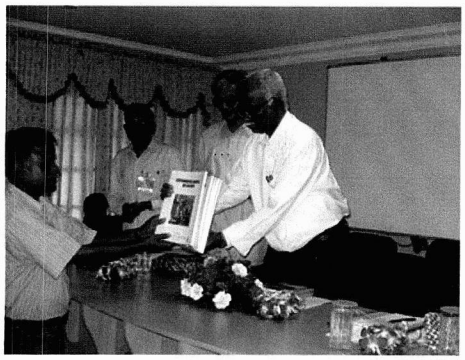
11.4.1.Seminars/symposium conducted

1. Organized the National Symposium funded by ICAR on" Input use efficiency in agriculture-Issues and strategies" by Dr. Jose Mathew at College of Horticulture, Vellanikkara during 25-27 Nov.2004

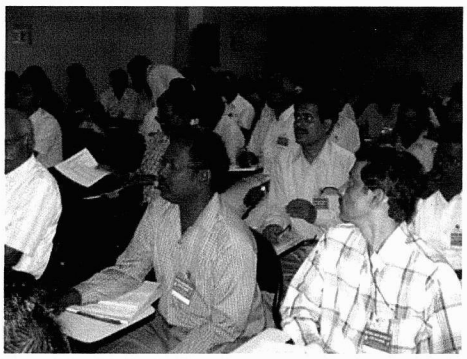
2. The centre organized the Group meeting of scientists of AICRP on Cashew during 28-30 Nov.2005 at Vellanikkara, Thrissur

Plate 6 (a to e). National Group Meeting of scientists of AICRP on Cashew organized by Madakkathara Centre during 28-30, November 2005

a. Project Co-ordinator presents the report



b. Release of "Experimental manual on cashew"



c. Delegates' view

d. Technical session

e. Visits of delegates to Madakkathara Centre

11.4.2. Training programmes conducted

Topic	No. of trainees	Category	Venue	Date	Name of Scientist
Short course on Recent trends in cashew nut production and processing	22	Scientists	Cashew Research Station, Madakkathara	11-21 Nov.2002	Dr. P. S. John
Cashew graft production	20	Farmers	Cashew Research Station, Madakkathara	24th Nov 2004	Dr Mini C
Cashew graft production	20	Farmers		29th Nov 2004	Dr Mini C
Cashew Day (Funded by DCCD)	250	Farmers		25th May 2005	Dr P S John (Trg.Director) Dr Mini (Coordinator)
Recent Advances in Cashew Plantation Management (Funded by PCK)	21	Field Staff of Plantation Corporation of Kerala (PCK)		27-29 January 2005	Dr Jose Mathew (Trg. Director) Dr Mini (Coordinator)
Cashing on Cashew apple (Funded by DCCD)	61 (Three batches)	Farmers, unemployed youth, entrepreneurs and women		2-4,15-17 and 23-25, Feb.2005	Dr Jose Mathew (Trg. Director) Dr Mareen Abraham (Coordinator)
Crop-management, processing, varieties and plant protection	80	Farmers from Orissa	CRS, Madakkathara	6th and 12th June 2006	Jose Mathew, Mini C, Mareen. A and Mahapatro
Cashew graft production	10	Trainees from ARS, Chalakudy	CRS, Madakkathara	10th June 2006	Dr Mini C
Cashew apple processing	2	Scientists from KVK, CPCRI, Kasaragode	CRS, Madakkathara	5th July 2006	Dr Mini C
Cashew insect pests and sprayings		B Sc (Ag) 6th semester	CRS, Madakkathara	28.10.06	Dr. G.K. Mahapatro
Cashew apple processing (DCCD – funded)	50	Farmers	CRS, Madakkathara	19th, 21st, 24th, 26th and 28th 2007	Dr. Mini. C
Cashew apple processing	1	Scientist from NRCC, Puthur	CRS, Madakkathara	6.3.07	Dr. Mini. C
Cashew apple processing	25	Farmers from Ernakulam	CRS, Madakkathara	7.3.07	Dr. Mini. C
Cashew apple processing	10	Women from KVK, Malapm	CRS, Madakkathara	14.3.07	Dr. Mini. C

11.5. Seminar and symposium attended by the scientists

1. Dr. V.G. Jayalekshmy attended the Kerala Science Congress from 29.1.02 to 31.1.02 at Cochin University, Kerala
2. Dr. P.S. John and Smt. Meagle Joseph attended the AICVIP workshop on 9th to 12th April 2002 at Vellanikkara.
3. Dr. P.S. John attended the National seminar on "Indian cashew in the new millennium" on 11-12 April 2002 at Visakapattanam.
4. Dr. P.S. John and Smt. Meagle Joseph attended two days workshop on Agriculture organised by Kerala Research Programme on Local Level Development held at Kila, Thrissur on 11- 12 June 2002.
5. Ms. Ancy Joseph attended the short course at IARI, New Delhi on "Molecular marker application in plant breeding" from 26.9.02 to 5.10.02.
6. Dr. Mini.C attended the winter school on "Exploitation of under utilised horticultural crops" from 5- 25November 2003 at Rajasthan College of Agriculture, MPUAT, Udaipur
7. Dr. Mini.C attended the 16th Kerala Science Congress from 29-31 January 2004 at CWRDM, Kozhikode
8. Dr. Mini.C attended the National Conference on 'Seed: a global perspective' during 26-28 March 2004 at National Agriculture Science Centre, New Delhi
9. Dr Jose Mathew attended National Workshop of AICRP on Water Management at Thrissur on 24-27 May 2005
10. Dr Mareen, A and Dr Mini, C. attended Workshop on Biodiversity and Bio-resources Conservation Awareness at IISR, Calicut on 21.1.06
11. Dr. C. Mini attended training on "Packaging for exports in food processing industry" organized by Small Industries Service Institute, Thrissur and Indian Institute of Packaging, Chennai, at Calicut on 2-3 March 2006
12. Dr Jose Mathew attended the NAARM sponsored Brain Storming session on "GATS and Strategic Issues in Higher Agricultural Education" at COH, Vellanikkara on 25-01-2006.
13. Dr G K Mahapatro attended a 21-day training on *Emerging trends in Economic Entomology* at Centre for Advanced Studies (CAS), Dept. of Entomology, CCS Haryana Agricultural University, Hissar during 21 February to March 13, 2006
14. Dr Mini C attended the 21-day training on "Advances in improvement of vegetable crops" at YS Parmar University of Horticulture and Forestry, Solan from 28th March – 17th April 2006.
15. Dr Mareen A and Dr Mini C attended the *National Symposium on Underutilized Horticultural Crops*, IIHR, Bangalore, 8-9 June 2006. The paper was awarded with **Certificate of Merit**.
16. Dr. Jose Mathew attended the group meeting on organic farming in cashew organized by NRCC, Puttur at Puttur on 5th July 2006
17. Dr. Jose Mathew attended the National seminar on "Convergence of technologies for organic horticulture" at TNAU, Coimbatore during 20-21 July 2006
18. Dr. Jose Mathew and Dr G K Mahapatro attended the National seminar on "Improving Input Use Efficiency in Horticulture" at Atria Hotel, Bangalore, during 9-11 Aug 2006. (Awarded the **First Prize** in Poster presentation, Technical session: *Pesticide Use Efficiency*)
19. Dr. Jose Mathew attended the International Buyer-Seller Meet on Cashew organized by CEPCI, Kochi at Kovalam (Trivandrum) during 15-17 Sept 2006.

20. Mr Gregory Zachariah has attended the UGC Refresher Course on 'Biotechnology and Bioinformatics' at Academic Staff College, University of Calicut during 28-09-2006 to 18-10-2006).
21. Dr. Jose Mathew attended the 26th International Rice Research Conference held at New Delhi during 9-13 October 2006 and presented a paper.
22. Dr. Jose Mathew and Mr. Gregory Zachariah attended the 23rd State Seed Sub Committee Meeting on 30.10.06 to present the proposal for the release of cashew hybrid H 1593 as Poornima.
23. Dr Mini C. and Dr. G.K. Mahapatro attended the National seminar on *Plant Physiology* entitled "Physiological and Molecular approaches for the improvement of Agricultural, Horticultural and Forestry Crops". 28-30 November, 2006, held at Kerala Agricultural University, Vellanikkara
24. Dr Jose Mathew attended the National Seminar on "Plantation crops for sustaining ecosystem" (Placrosym XVII) at Cochin during 5-9 Dec 2006 and presented a paper.

11.6. Year- wise and variety wise graft production under Regional Nursery

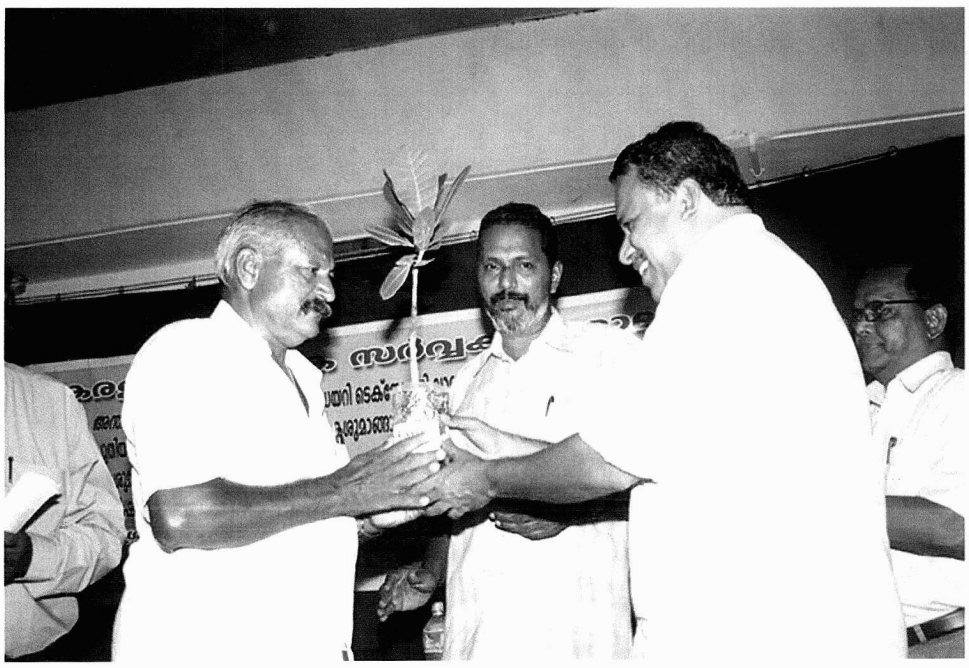
Variety	2002-03	2003-04	2004-05	2005-06	2006-07
Madakkathara-1	69073	40303	18005	10	5040
Priyanka	17228	11351	6500	900	4281
Dhana	33940	5712	3600	1948	1637
Dharasree	19800	3024	3316	335	941
Madakkathara-2	13693	2330	2830	50	120
Anakkayam-1	19819	1210	2300	435	863
Raghav	200	4220	2100	1060	494
Damodar	480	4460	2800	542	222
Kottarakkara-1	9126	681	1800	143	442
Kanaka	20519	1920	1450	432	461
Amrutha	800	1950	1200	375	282
Sulabha	950	2192	-	423	434
Vridhachalam-3	580	-	-	50	3663
Poornima	-	-	-	-	308
KGN-1	-	-	-	750	-
H-8-6	-	-	35	-	-

11.7. Demonstration plots laid out (year- wise) and yield (2002-2006)

The number of demonstration plots laid out during 2002-03, 2003-04 and 2004-05 were 23, 22 and 21,respectively. During 2005-06, though proposals were submitted for lay out of new demonstrations and continuation of the second (9 No) and third (6No) years of already laid out demonstrations, it could not be taken up due to want of sanction from State Horticulture Mission.

Plate 7 (a to b). Role of Madakkathara Centre on distribution of elite planting material of cashew

a. Field view of commercial cashew nursery



b. Hon Minister of Agriculture, Govt. of Kerala
inaugurating the sale of cashew grafts of the new variety "Poornima".

11.8. Thrust areas identified

To evolve high yielding varieties of cashew with desirable nut characters.

1) To identify varieties resistant/ tolerant to pests and abiotic stresses.
2) To develop agro techniques for achieving higher production and productivity and sustainability including organic cashew production.
3) To improve propagation techniques for increased vigour and establishment in main field.
4) To distribute quality planting materials of elite varieties.
5) To evolve effective control measures against the major pests of cashew.
6) To develop processing techniques for value addition of kernel and cashew apple.
7) Conduct of transfer of technology programmes to farmers and extension officers.

11.9. Constraints, if any

1. Scarcity of land for conduct of new experiments is a major constraint in implementing the research programmes allotted by AICRP. This can be overcome to a large extent by the phased removal of aged and senile plants, for which timely sanctions for the university is required.
2. The vacancy of one post each of Jr. Entomologist and Grafter are adversely affecting the smooth functioning of the scheme. In the absence of an entomologist, it is not possible to implement entomology research programmes. Due to this, pest management in the farm is also adversely affected. We are also unable to answer queries from farmers and development agencies in this aspect, particularly in the context of several environment-related issues in cashew pest management.
3. The centre is undertaking pioneering works on cashew apple processing as well as runs a large commercial cashew nursery. Studies on other horticultural aspects such as use of hormones, pruning and propagation aspects are also being carried out. This requires the services of a Horticulturist and hence the sanction of the post of an Assistant Professor (Horticulture) in the Madakkathara Centre of the scheme is urgently requested.

4. The centre is taking up several transfer of technology (TOT) programmes such as on-farm trials, demonstration plots, diagnostic visits, off-campus training on cashew apple processing, handling of classes in seminars and training programmes and participation in exhibitions. Lack of conveyance is a major constraint in the effective implementation of these TOT programmes, particularly because cashew is grown in remote, inaccessible and difficult terrains. Hence purchase of a vehicle for the centre will help in effective implementation of TOT programmes.

5. The centre presently has only one small drying yard and cashew nut store. With several experiments to start yielding in the coming two- three years, a larger drying yard and cashew nut store is urgently required.

6. The station presently has only one office building, which is occupied, by administrative office, room of faculties, laboratory and seminar hall. So there is acute shortage of space for laboratory. With increase in research activities in various disciplines, more laboratory space is urgently required.

B). INFORMATION REQUIRED ON POLICY ISSUES AND RESEARCH STRATEGIES

1. **What are the likely main concerns in cashew production productivity, PHT and value addition in the future (by 2025)?**

Due to low and fluctuating market price of cashewnut, farmers are switching over to more remunerative crops, particularly rubber, in Kerala. Consequent reduction in area under cashew is a serious issue, which may further aggravate the production- demand gap in India. Value addition of products of cashew will help to improve the market price of nuts, enabling farmers to get better price for their product.

2. **Is your research programme under AICRP on Cashew adequately addressing these concerns? If not, justify the shortcomings**

The work under AICRP addresses most of the concerns in the cashew plantation sector.

3. **Are the existing thrust areas adequately covering these concerns? If not, what are the new thrust area/ theme you would like to include in future research?**

The existing thrust areas mostly cover the current concerns in cashew cultivation. However, in view of the changing scenario, the following news themes are suggested for inclusion in future research.

i. Evolution of dwarf varieties for high density planting.
ii. Possibility of intercropping with perennials like Jatropha.
iii. Improvement in the root system of grafted trees to tolerate abiotic stresses like drought, wind and poor soil conditions.
iv. Management package for better establishment and growth of cashew grafts in less favoured soils like laterite soils.
v. Technologies for small scale processing and marketing of cashewnut.
vi. Intensification of research on cashew apple utilisation including its potential for bio-fuel production.

4. **Self-assessment: How would you rate and classify the outcome of your centre under AICRP on Cashew?**

The outcome of this centre is satisfactory in terms of research output and level of technology transfer.

5. **Do you think that your research outputs under last five-year programme have already been put into practice in large scale? If not, indicate the major constraints?**

Many of the research outputs have been put into practice in large scale. This is particularly true with regard to the cultivation of new varieties. However, shortage of scientific staff and lack of adequate conveyance facilities for field visits were major constraint in the smooth implementation of transfer of technology programmes. This is because cashew plantations are situated in inaccessible areas with difficult terrains.

6. **Significant/ outstanding/ extra- ordinary technology generated out of last 5-year work in AICRP on Cashew.**

i. Release of three high yielding cashew hybrids viz., Raghav, Damodar and Poornima

ii. The evolution of three promising hybrids viz., H 7, H 17 and H 21which are undergoing detailed evaluation.

iii. The recommendation of the high density planting for enhanced income from young plantations.

iv. Recommendations of 3-round spray schedule against TMB- anthracnose complex in cashew and its inclusion in the Package of Practices Recommendation for crops of Kerala.

v. The recommendations of Lamda cyhalothrin (0.003%) against Tea Mosquito Bug, as an effective insecticide with low toxicity and residue.

vi. Development of technologies for cashew apple utilization for the production of syrup, RTS and vermi compost and its successful application in the commercial running of the unit at the centre.

7. **What effects are made to disseminate the technology in last five years?**

i. Training programmes were organised for the farmers at the centre.

ii. Scientists of the centre served as resource persons in the seminars conducted at different cashew growing areas.

iii. Cashew day is conducted every year and large numbers of farmers have participated in the programme.

iv. Radio talks and TV programmes were conducted.

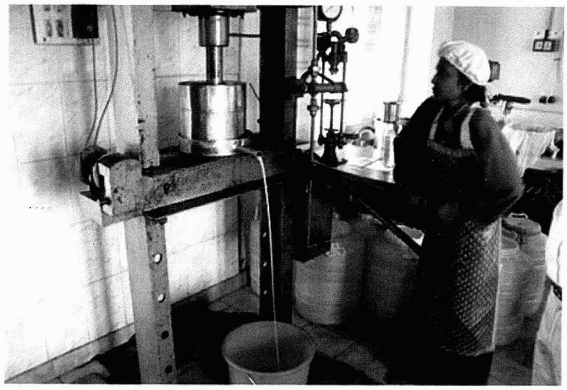
v. Popular articles, books and research papers were published.

vi. Frontline demonstrations were organised.

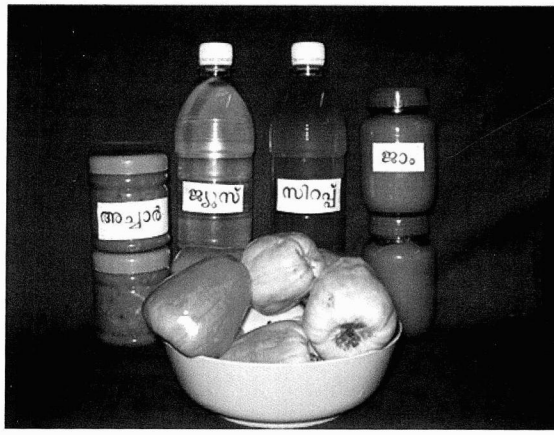
vii. A cashew museum, depicting all aspects of cashew, was established at the centre to expose the visiting farmers, officers and students to the latest technical know how on cashew.

viii. Put up stalls on cashew in different exhibitions like *Pooram* exhibition at Thrissur, exhibitions organised at the time of All India Cashew Groups Meeting at Vellanikkara and *Caju* India International Buyer- Seller meet at Kovalam.

Plate 8 (a to d). Pioneering efforts of Madakkathara Centre in cashew apple utilization



a. Functioning of cashew apple processing unit



b. Cashew apple products developed by the centre

c. Launching of the second commercial product of the centre "Cashew drink" by Hon. Minister of Agriculture, Govt of Kerala

d. Training activities of the unit

8. Have the research outcome been published adequately? If yes, give details?

i) Popular articles

1. Jayalekshmy, V.G and Abdul Salam, M.A. 2002. Poshaga Gunameriya Kasumanga (In Malayalam). *Kerala Karshakan* Nov. 10
3. Jose Mathew, Mareen Abraham and Mini. C. 2005. Kasunedan kasumauv (In Malayalam). *Karshakan* 13 (3): 8-9
4. Mini, C. 2005. Kasumanga, kasumanga (In Malayalam). *Karshakan* 13 (3): 12-14
5. Mareen Abraham and Jose Mathew. 2005. High yielding varieties for enhanced income from cashew (In Malayalam). *Karshakan* 13 (3): 15-17
6. Mahapatro, G.K. and Mini, C. 2005. Integrated insect-pest management in cashew (In Malayalam). *Karshakan* 13 (3): 17-18
7. Jose Mathew.2005. Better management for better cashew yields (In Malayalam). *Karshakan* 13 (3): 19-21
8. Jose Mathew and Mini.C.2005. Kasumavu gaveshanathinte kalari (in Malayalam) (Cashew Research in Kerala). *Karshakan* 13 (3): 22 and 69
9. Jose Mathew. 2005. *Cashew - management* (In Malayalam). Kerala Karshakan 51(7): 6-7 & 31
10. Mini, C. and Mahapatro, G.K. 2005. *Cashew- insect and disease management* (In Malayalam). *Kerala Karshakan* 51(7): 10-11
11. Mareen Abraham. 2005. *Cashew- Plenty of varieties* (In Malayalam). *Kerala Karshakan* 51(7): 8-9
12. Mini. C. and Mahapatro, G.K. 2005. *Kasumavu Keeda Roga Chikilsa* (In Malayalam). *Kerala Karshakan*. 51 (7): 10-11
13. Mini, C. and Jose Mathew. 2005. Cashewnut kernel is good for heart (In Malayalam). *Karshakasree* 11(3): 52-54
14. Mini, C. and Jose Mathew. 2005. High density planting for cashew. *The Hindu Daily*, 15 December 2005, pp.17
15. Mini. C, Sally K Mathew and Jose Mathew. 2006. Cashew nursery: watch against diseases and insects. *Karshakan* 14(9): 60-61.
16. Mini.C., 2006. Cashew apple in different forms *Kerala Karshakan*. 52 (4): p 22 and 24

ii). Bulletins/CD

- CD on "Production and processing technology of cashew" (In English)

iii). Folders/leaflets

1. A leaflet on "Scientific cultivation of cashew" (In Malayalam) by John, P.S, Mini, C., Susannamma, K. and Mareen, A.

2. A leaflet on "Cashew Nursery" by Mini C and Jose Mathew (In Malayalam)

3. A leaflet on 'Improved Cashew varieties' by Mareen Abraham and Jose Mathew (In Malayalam)

iv). State recognized journals/ national seminars/symposia

1. Mini, C. and Jose Mathew. 2005. Bright prospects for cashew. *Kissan World* 32 (12): 56-57

2. Mahapatro, G.K., Pathummal Beevi, S., Jose Mathew and Biju, C.R., 2005. Advancing in ant-technology in India: issues and strategies. Cashew Bulletin XLIV (**1**): 11-20

3. Mahapatro G.K. and Jose Mathew 2006. Cashew stem and root borer: management aspects. *Cashew Bulletin*

4. Mareen, A., Jose Mathew and Mahapatro, G.K. 2006. H-1593 – A promising cashew hybrid. *Cashew Bulletin* XLIV (3): 9-13

5. Mini.C., John, P.S and Sushama, P.K. 2005. Vermicompost preparation from the organic wastes of cashew garden. *The Cashew* XIX (4): 15-19

6. Mahapatro, G.K. and Jose Mathew. 2005. Integrated pest management in cashew: concepts and practices. *Cashew Bulletin* XLIII (7): 5-15.

7. Jose Mathew and Mahapatro,G. K.2005. Organic farming in cashew. *Agrobios Newsletter* 4 (1): 60-64

8. Jayalekshmy, V.G. 2002. Genetics and breeding of cashew. **In:** *Recent trends in cashew nut production and processing.* Cashew Research Station, Madakkathara, pp. 14-22.

9. Jayalekshmy V.G. and Meagle Joseph 2002. Economic analysis of cashew graft production. **In:** *Recent trends in cashew nut production and processing.* Cashew Research Station, Madakkathara, pp. 42-49.

10. Jayalekshmy V.G. 2002. Germplasm cataloguing and varietal wealth of cashew. **In:** *Recent trends in cashew nut production and processing.* Cashew Research Station, Madakkathara, pp. 53-59.

11. Jayalekshmy V.G. 2002. Economic analysis of cashew apple processing. **In:** *Recent trends in cashew nut production and processing.* Cashew Research Station, Madakkathara, pp. 221-225.

12. Jayalekshmy V.G. and Abdul Salam. M.A. 2002. Cost of establishment of a cashew apple processing unit and production cost of cashew apple syrup. *The Cashew* XVI(2)

13. John P.S. 2002. Principles and practices of integrated nutrient management with special reference to cashew. **In:** *Recent trends in cashew nut production and processing.* Cashew Research Station, Madakkathara, pp. 60-78.

14. John. P.S. 2002. High density planting in cashew. **In:** *Recent trends in cashew nut production and processing.* Cashew Research Station, Madakkathara, pp. 87-93.

15. John. P.S. and Ancy Joseph. 2002. Cashew plantation establishment and management. **In:** *Recent trends in cashew nut production and processing.* Cashew Research Station, Madakkathara. pp. 113-128.

16. Susannamma Kurien. 2002. Pest management in cashew. **In:** *Recent trends in cashew nut production and processing.* Cashew Research Station, Madakkathara, pp. 161-173.

17. Mathew, J. 2004. Utilisation of cashew apple. *Times Food Processing Journal* 4 (3): 29-31

18. Kurien, S., Mahapatro, G.K. and Mathew, J. 2004. Managing the cashew stem and root borer: an integrated strategy. *Proc. of National symposium on Input Use Efficiency in agriculture: issues and strategies*, November 25-27, 2004, Thrissur, pp. 124-125

19. Mini, C., John, P.S., and Sushama, P.K. 2004. Vermicompost preparation from organic waste of cashew garden. *Proc. First Indian Horticulture Congress* 2004, 6-9 Nov 2004, New Delhi, pp.263

20. Mahapatro, G.K. and Jose Mathew. 2005. Integrated pest management in cashew: principles and practices. *The Cashew Bulletin* XLIII (7): 5-15

21. Mahapatro, G.K, Pathummal Beevi, S., Jose Mathew and Biju, C.R. 2006. Advancing in ant-technology in India: issues and strategies. *Cashew Bulletin* XLIV (1): 11- 20

22. Mareen, A., Jose Mathew and Mahapatro, G.K. 2006. H-1593 – A promising cashew hybrid. *Cashew Bulletin* XLIV (3): 9-13

23. Mini. C., John, P.S and Jose Mathew. Effect of scion storage on grafting in cashew. *The Cashew* XX (2): 14-19

24. Mini, C. and Jose Mathew 2006. Utilisation of cashew apple- popularizing cashew syrup. *Proc. Golden Jubilee Souvenir of the Karnataka Cashew Manufactures Association*, 22nd April 2006, Mangalore

25. Mini, C., Jose Mathew, Jessy Thomas, K. 2006. Economic potential of cashew apple processing. *Cashew Bulletin*, XLIV (6): 5-8.

26. Jose Mathew, Usha K.E and Latha, A. 2006. Opportunities for organic nutrition in cashew. Abstracts, National Seminar on "Convergence of technologies for organic horticulture", TNAU, Coimbatore, 20-21 July 2006, pp. 175

27. Mahapatro, G.K., Pathummal Beevi, S., Mareen Abraham and Jose Mathew. 2006. Advancing towards organic technologies for pest management in cashew: a holistic approach. Abstracts, National Seminar on "Convergence of technologies for organic horticulture", TNAU, Coimbatore, 20-21 July 2006, pp. 184-185

28. Jose Mathew and Mini. C. 2006. Improving resource use efficiency in cashew. *Abstracts. Natl. Symp on Improving Input Use Efficiency in Horticulture*. August 9-11, IIHR, Bangalore. pp. 139

29. Mahapatro G.K. and Jose Mathew.2006. Cashew trees harbouring red-ant nests need no spraying. *Abstracts. Nat. Symp. on Improving input use efficiency in Horticulture*. August 9-11, IIHR, Bangalore. pp.186.

30. Mahapatro, G.K. Jose Mathew and Mini. C. 2006. Critical cashew crop-phenophases verses pest management in cashew. *Lead Papers and Abstracts*, National seminar on *Plant Physiology* entitled "Physiological and molecular approaches for the improvement of agricultural, horticultural and forestry Crops", 28-30 November 2006, Kerala Agricultural University, Vellanikkara, pp. 124

31. Mini, C. and Jose Mathew.2006. Priming on seed viability and seedling vigour in cashew. National Seminar on Plant Physiology, 28-30th November 2006, KAU, Vellanikkara, pp. 156

32. Remyamol, K.K, Indira. V, Mini. C and Pushpalatha, P.B.2006. Quality evaluation of blended cashew apple RTS beverages. *Abstracts of papers*, 18th Indian Convention of Food Scientists and Technologists, 16-17 November 2006 (icfost 2006), Hyderabad, pp. 64

33. Mini. C and Jose Mathew. 2006. Uses of cashew apple- popularizing cashew apple syrup (In Hindi). *The Cashew* XX (2): 2-7

vii). Books/Part of books published

1. John, P.S. and Jayalekshmy, V.G. (Eds.). 2004. **Recent trends in cashew nut production and processing.** Cashew Research Station, Madakkathara, Kerala Agricultural University, Thrissur

2. Jose Mathew, Meera V. Menon and John P.S. (Eds.). 2004. Proc. of ICAR National Symposium on Input use efficiency in agriculture- issues and strategies: Lead papers, 25-27 Nov. 2004, Thrissur, Kerala

3. John, P.S., Meera V. Menon and Jose Mathew (Eds). 2004. Proc. ICAR National Symposium on Input use efficiency in agriculture - issues and strategies: Extended Summaries, 25-27 Nov. 2004, Thrissur, Kerala

4. Latha, A., John P. S. and Jose Mathew (Eds.). 2004. Management of agricultural inputs in humid tropics. Kerala Agricultural University, Thrissur, 99 p.

5. Jose Mathew and Mini, C. (Eds.) 2005. *Scientific Cashew Cultivation* (In Malayalam – *Sastriya Kasumavu Krishi*). CRS, Madakkathara, 92p

6. Jose Mathew and Mareen Abraham (Eds.) 2004. Enhanced profit through cashew apple processing (In Malayalam). CRS, Madakkathara, 62p

7. Mini.C., Jose Mathew and Augustine A. 2005. *Technologies for Cashew Apple Processing*. Kerala Agricultural University, Mannuthy, Thrissur, Kerala, 55p.

8. Jose Mathew, Mini C., Mareen A. and Mahapatro, G.K. 2005. *Caring an Uncared Crop - a profile of Cashew Research Station, Madakkathara*. Kerala Agricultural University, Mannuthy, Thrissur, Kerala, 15p.

9. Are the scientists from AICRP engaged in teaching? If yes, at UG or PG level? What percentage of workload is devoted for teaching? No. of students guided for academic degree programme

Yes. Mostly at P.G. and PhD. The percentage workload is around 5-10 %

Guidance to MSc (Ag) students on thesis programmes on Cashew

1. Morphological, biochemical and molecular markers for genetic analysis of cashew (*Anacardium Occidentale* L.): Student: D. Ushavani; Chairman: Dr. V.G. Jayalekshmy

2. Nutrient management in cashew nursery. Student: M.S. Sinish; Advisory Committee Member: Dr. P.S. John

3. Evaluation and management of pest complex in cashew grafts. Student: K.B. Deepthy; Chairman: Dr. Susannamma Kurien

Dr. P.S. John guided (as major advisor) one M Sc. (Ag) and One Doctoral student of the College of Horticulture

Dr. Mini.C guided one M Sc student in Horticulture (Olericulture) and was a member of advisory committee of an M Sc (Home Science) student

Dr Jose Mathew is guiding a Ph D student in Agronomy and served as the advisory committee member of an M Sc (Ag.) student at COH, Vellanikkara.

10. Name the agencies with which the centre has established linkages?

i. State Development/ Line Departments (Agriculture, Horticulture, Rural Development Departments, Forest Departments):

Department of Agriculture
Department of Forests

Department of Rural Development
Kudumbashree Mission
Plantation Corporation of Kerala Ltd
Rehabilitation Plantations Ltd

ii. NGOs

Wayanad Social Service Society

iii. Directorate of Cashewnut and Cocoa Development (DCCD)

iv. Private Cashew Processing Units

The Kerala State Cashew Development Corporation Ltd, CAPEX

11. What is the monitoring mechanism at SAU, NRC on Cashew and ICAR levels?

Associate Professor and Head of the station is in charge of the scheme and Associate Director of Research, RARS, Pattambi is the controlling officer. Project Coordinator (Plantation Crops) and Professor (Research Coordination) are monitoring the research activities of the scheme. Director of Research, KAU controls all the research activities undertaken at the station at the university level. The Associate Director of Research (Monitoring and Evaluation) represents the Director of Research for monitoring the projects. Monthly and Annual Reports are submitted to the Director of Research, KAU and ADR, Pattambi. Monthly and Annual Reports of the scheme are submitted to Project Coordinator (Cashew), NRCC, Puttur.

12. What are the major advantages (two or three) from AICRP on Cashew to the Institute or area?

-Exchange of research findings and their testing- what extent

One of the major advantages from AICRP is the exchange of germplasm and scions of different varieties among the different coordinating centres. The AICRP mechanism benefits the cashew farmers and the institute by way of increased opportunities for the adoption of new findings elsewhere in the country.

- National perspective/ policy formation

This is particularly true with regard to varietal adoption. For example, the variety Dhana- released by this centre is recommended for cultivation in *Maidan* tract of Karnataka as well as in the state of Orissa. Likewise, Vridhachalam-3, released from T.N., is recommended for cultivation in Kerala.

-Uniform research policies

This is very much significant in dealing with complex issues such as the control of TMB and CSRB and release of varieties.

- Overlapping and duplication or research work is avoided

This is a significant advantage of AICRP with resultant saving in resources, both human and financial.

-Global issue tacking opportunity

This aspect requires much attention in the AICRP set up. Apart from the research responsibilities, AICRP should be given more responsibility in policy and global issues as well.

-SWOT analysis

This is an important tool for strategic planning.

13. Awards/ rewards/ honours at state/ national level received by Central institute/ Scientists?

1. Dr. Jose Mathew bagged the **BOLT** (Broad Outlook Learner Teacher) **Award** during 2004 for the district of Thrissur instituted by Air India and Malayala Manorama to recognize excellence in academics.

2. The paper entitled "Economic potential of cashew apple processing" authored by Mini, C., Jesy Thomas, K. and Jose Mathew was awarded with **Certificate of Merit** for the poster during the *National Symposium on Underutilized Horticultural Crops held at* IIHR, Bangalore during 8-9 June, 2006

3. Awarded the **First Prize** in Poster presentation for the paper entitled "Cashew trees harboring red ants need no spraying" authored by Mahapatro G.K and Jose Mathew in the technical session on *Pesticide Use Efficiency* during the National seminar on "Improving Input Use Efficiency in Horticulture" at Atria Hotel, Bangalore, during 9-11 Aug 2006.

14. Have the research review and database done before the start of research projects?

This exercise is invariably done before the start of research projects.

15. How the research projects are generated? Give the complete flow chart?

(i. Existence of research problems- feed back ii. Identification of research problems by the scientists iii. Research review- data collection iv. Formulation of research projects v. Approved from SRC/RAC/ Academic staff discussions etc.)

Farmers and extension personnel's raise field problems in the Zonal Research and Extension Advisory Committee (ZREAC) meeting conducted every year. These problems are discussed thoroughly and the new research programmes are chalked out based on the recommendations of ZREAC. These projects are presented in the project coordination group of the concerned crop as well as in the Faculty Research Committee (FRC). The projects are

implemented, after the approval of FRC and administrative sanction by Director of Research. Research highlights are subsequently presented in the ZREAC and mid-term corrections are made as per the suggestions.

16. What sort of mechanism existed in your institute to run AICRP on Cashew? How the administrative (SAU) and technical mechanism (NRC on Cashew) established the strong linkage?

The Agronomist i/c of the AICRP on cashew is the Head of the research Station also and hence there is no question of dual control in administrative matters. Since the Agronomist of the scheme is also the Head of Station, it ensures the full co-operation of the centre in terms of infrastructural facilities and human resources for the conduct of the AICRP project. Such an arrangement also ensures smooth linkage between KAU and NRCC on technical and administrative matters.

17. What mechanism the centre has established to have technical coordination with other centres?

Though no formal mechanism has been established, the centre frequently coordinates with other centers with regard to uniformity in the conduct of the AICRP experiments, recording of observations and exchange of germplasm.

18. What will be the situation if AICRP on Cashew funding did not exist? What sort of technical leadership is provided by NRC on Cashew?

In the absence of AICRP funding, there will be acute shortage of funds for the conduct of research projects. Consequently, there will be sharp decline in human resources engaged in cashew research and the research activities will be drastically reduced. NRC on Cashew is providing technical leadership on research project formulation, uniform procedures for data recording and interpretation of results.

19. Do you feel that existing staff position is adequate? How would you like the AICRP to be recasted? Give justification worth vision

No. Apart from the existing post of Agronomist, Junior Breeder and Junior Entomologist, one post of Junior Horticulturist is to be provided in the scheme for the centre. The justification for the post is given below: -

The need for strengthening research on cashew apple utilization is highly urgent, in view of the colossal national waste in the absence of economic utilization of cashew apple. The centre is doing exemplary works on cashew apple utilization and is the national leader in this aspect. It is intended to intensify research on cashew apple utilization and value addition of cashew nut at this centre for which the post of a Junior Horticulturist is highly urgent. The Jr. Horticulturist can also be entrusted with the research work on cashew nursery such as strengthening the root system of cashew grafts, use of root trainers and other management aspects.

20. Suggest the measures or future strategies for

a. Minimizing the raw cashewnut import

i. Expansion of area under cashew in traditional and new areas.
ii. Use only grafts of high yielding varieties.
iii. Adoption of scientific crop management and crop protection practices for the existing and new plantations.
iv. Replanting senile plantations with high yielding grafts.
v. Explore the possibility of growing cashew as an inter crop in other plantations having sufficient sunlight such as root wilt affected coconut plantations.
vi. Encourage growing two to three cashew trees as a component crop in homestead gardens.
vii. Promote cashew as a second line of defense in coastal regions, particularly in tsunami- prone areas.
viii. Insist the Plantation, Forest and other government corporations to maintain at least the existing cashew area with scientific management, without permitting conversion to other crops.
ix. Identify suitable varieties for different agro climatic and edaphic regions rather than blanket recommendation for the entire state.
x. Give special incentives to exploit the unique capability of cashew to grow in unfavorable situations to utilize wastelands.

b. Maximizing the quantity and quality of cashew kernel export

ii. Maximizing production of cashew in India by increasing both area and productivity.
iii. Promote the cultivation of cashew varieties with bold nut.
iv. Promote organic cashew production.
v. Get "Geographical Indication" status for premium products from selected cashew tracts like "Kannur Cashew".

c. Making the cashew farming sustainable and profitable to the Indian farmers

i. Promote organic cashew production, with group certification, linked to processing and exporting.

ii. Promote high density planting to ensure better returns from young plantations and simultaneously intensify the research efforts to evolve dwarf cashew to suit the system.

iii. Popularize and commercialize the technology of cashew apple processing developed by Kerala Agricultural University for production of unfermented products such as syrup, squash and jam with stress on their nutritional and medicinal properties.

iv. Exploit the technologies developed by Kerala Agricultural University for production of fermented products such as alcohol, liquor and wine, including its potential as biofuel, with relaxation in excise rules, as is being done in Goa.

v. Institutionalize a price stabilization mechanism to ensure good price for raw cashew nut that is proportional to the price of kernel.

vi. Establish "Cashew Board" to serve as a single agency to look after various activities such as cultivation, processing, marketing, export and by- product utilization.

vii. Promote small scale processing of cashew nut by farmers' co-operatives to avoid middleman and get better returns for farmers.

21. Indicate how the research of AICRP on Cashew has improved the agro- economic scenario and socio- economic impact of the area of your center's jurisdiction. Statistical data available at Agricultural/ Horticultural Departments of State Government be used giving sources.

i. Though there is an alarming trend of decline in area under cashew in the state over the years, the increasing rate of adoption of scientific crop production technologies, which was mostly developed by the centre, has contributed substantially for the improved and sustained productivity of the crop in the state, in spite of the increasing senility of more than 35 % of the plantations and inability for adoption of appropriate crop protection measures due to the opposition for the application of insecticides, as a fall out of the *endosulfan* issue.

Productivity of cashew (kg/ha) in Kerala in comparison with all India and other state figures

	2001-2002	2002-2003	2003-2004	2004-05	2005-06
Kerala	870	890	890	900	900
All India	710	760	800	810	815
Highest (Maharashtra)	880	1000	1100	1200	1300
Lowest	470(Karnataka)	470(Karnataka)	500(Karnataka)	610 (T.N)	640 (T.N)

The data presented clearly showed that the productivity is not only sustained over the years at a higher level but also slightly increased. The productivity of cashew in Kerala is maximum among the different states, next to Maharashtra, all through the years. The data also shows that the productivity improvement in cashew in Kerala is 40-85% higher than that of the state with the lowest productivity.

ii. The increased productivity in Kerala is mostly contributed by the spread of high yielding cashew varieties. The centre has till now released 11 cashew varieties, including three during the reporting period and its share is about 25% in the total number of varieties released in India.

iii. The added advantages of the newly released varieties such as TMB tolerance of Damodar and high shelling percentage, kernel grade and high density planting suitability of Poornima, needs special mention, since they have economic impact in terms of reduced infestation of TMB and increased price of cashew nut.

iv. Consequent to the withdrawal of endosulfan due to the issue at Padre in Kasargod district, the centre has developed recommendations for the control of TMB-anthracnose complex with least adverse impact on the environment but suppressing pest buildup, which has helped the farmers in saving the crop, in the event of high infestation of cashew.

iv. A comprehensive recommendation on CSRB control was formulated by the centre, which has significant economic impact in saving the crop, since 5-10% of cashew trees are affected by it every year

vi. The successful running of the commercial cashew nursery shows the commitment of the centre, not only in developing technologies, but also in transferring it to the farmers. The centre supplies planting materials of the varieties developed by it to the progeny orchards maintained by the farms under the Department of Agriculture, Plantation Corporation of Kerala, Aralam Farm and Private nurseries as well as other farms of KAU, facilitating increased spread of varieties. It supplies grafts in large quantities for distribution through schemes sponsored by Department of Agriculture and State Horticulture Mission. Direct supply of grafts to needy farmers is also undertaken.

vii. The centre has done pioneering works on the development of technologies for cashew apple processing and its commercialization. It gives direct regular employment to three women in its commercial cashew apple processing unit for the production of cashew apple syrup and cashew apple drink. The unit also earns considerable income for the university. The unit gives regular training to different stakeholders to encourage the establishment of commercial units in major cashew growing tracts.

viii. The persistent transfer of technology initiatives of the centre for the economic utilization of cashew apple, which is currently wasted totally causing huge national loss, has started bearing fruits. Sri. Tomychan Syriac, one of the trainees who got preliminary training on cashew apple utilization at this centre has started the first ever cashew apple processing unit in private sector at Iritty, Kannur under the trade name "TOMCO PRODUCTS". He is using the technology developed by the centre for the production of cashew apple syrup and cashew apple drink. The KVK, Kannur under KAU gave him vocational training and post training assistance and guidance in the establishment of the unit starting from project preparation and obtaining FPO license up to marketing.

C. Information required as per QRT guidelines

1. **Whether the work being carried out under AICRP derives full support from other related programmes including basic and strategic research?**

   Yes. The AICRP work gets full support from other related programmes.

2. Whether there is a sense of ownership and wider acceptance of AICRP in the SAUs?

The AICRP has wider acceptance in KAU in view the merit and practical utility of the projects as well as due to the technical support available from the coordinating centre.

3. Optimum utilization of manpower under AICRP?

The AICRP staff is fully utilized for the conduct of the project.

4. Mechanism existing between SAU's and AICRP in monitoring the research programmes to avoid distortions, duplication, overlapping etc?

The services of AICRP staff are also utilized for the conduct of the KAU project on cashew, transfer of technology programmes and teaching, without anyway affecting the smooth functioning of AICRP project.

5. What are the strategic plans prepared by AICRP on the following aspects?

(1.Cashew crop 2.Natural resources- Major emphasis on sustainability of production system developed by AICRP Cashew)

The strategic plans proposed for the centre has been transmitted to project coordinator for incorporation in the 11th plan proposals.

6. AICRP Centers- are they sufficient?

(i. Need to review the situation ii. Increase or decrease in the number of centers iii. Country potential iv. Disadvantaged areas)

Not applicable to the centre.

7. What is the requirement under recurring contingency?

In view of the increased labour cost in Kerala, the amount presently allotted under recurring contingencies is insufficient for the conduct of the research projects. Hence at least a minimum increase of 25% in recurring contingencies is required for the implementation of the envisaged programmes.

8. What is the relationship between AICRP and SAU's? What are the roles of Project Coordinator?

(Guidance and support. Actual participation. Competes by generating technology, testing of technology and trials. Germplasm enhancement. Germplasm distribution)

The works done under AICRP and KAU projects are complimentary. The Madakkathara centre is getting required germplasm from other centers and the centre is giving germplasm to all others who ask for it.

9. Views on appointment of Zonal PC or P.I

Appointment of a Subject Coordinator is desirable for better co ordination and uniformity in the conduct of research projects under different disciplines.

10. Views on AICRP- Inter AICRP Linkages

There are good linkages between different centers of AICRP in the exchange of germplasm and conduct of experiments. To improve the linkage and facilitate adoption of improved practices and understand constraints in other centres, it is desirable to give opportunities to AICRP scientists to visit sister-centers at least once in their service in the AICRP project.

11. Additional budget requirements for project Coordinator's Cell, provided NRCC is upgraded as Project Directorate for Cashew Research.

Not applicable to the centre.

12. Views on how to organize Annual Workshops?

(Focus on generation of new ideas, participation from SAU's, scientists and executives from NGOs, State Development/ Line Departments)

The annual workshops may be organized in major cashew growing tracts of the country in rotation. This will give scientists an opportunity to get an idea about improved technologies that are adopted elsewhere in the country for adoption in their area. Likewise the farmers/extension officials/researchers of that location can be benefited from the expertise of the scientists from other centers.

13. Does AICRP Unit maintain database on crop/ commodity/ natural resources?

The centre maintains the relevant database.

14. Training programmes under HRD for young scientists and other staff.

In the context of increasing competition from other countries, in terms of area, production, productivity, processing and marketing, there is an urgent need to acquaint the AICRP scientists with the varietal characteristics, cultivation practices and processing technologies adopted in those countries. Hence training or exchange visits may be organized for cashew scientists among major cashew growing countries like Brazil, Vietnam, and Tanzamia.

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