
**ALL INDIA COORDINATED
RESEARCH PROJECT ON CASHEW**

**PROCEEDINGS OF ANNUAL GROUP
MEETING OF SCIENTISTS OF
AICRP ON CASHEW – 2013**

5 – 7 JANUARY 2014

***Venue : BIDHAN CHANDRA KRISHI VISHWAVIDYALAYA
KALYANI, WEST BENGAL***



**DIRECTORATE OF CASHEW RESEARCH
(INDIAN COUNCIL OF AGRICULTURAL RESEARCH)
PUTTUR-574 202, D.K., KARNATAKA**

ALL INDIA COORDINATED RESEARCH PROJECT ON CASHEW
DIRECTORATE OF CASHEW RESEARCH
PUTTUR-574 202, D.K., KARNATAKA

ACKNOWLEDGEMENTS

The Annual Group Meeting of All India Coordinated Research Project on Cashew was organized at Bidhan Chand Krishi Viswavidyalaya (BCKV), Kalyani (West Bengal) from 5-7 January 2014. The meeting was organized jointly by Directorate of Cashew Research, Puttur (Karnataka) and BCKV, Kalyani, where large number of BCKV staff, Officers of Development departments, NGO's/Farmers, students, besides AICRP workers had participated.

On this occasion, I would like to express my deep sense of gratitude to Dr. N.K. Krishnakumar, Deputy Director General (Hort.), ICAR for his kind advice in planning and organizing of this Annual Group Meeting of Scientists of AICRP on Cashew-2013 as well as for his valuable suggestions during the Plenary Session. I also express my heartfelt thanks to Dr. S.K. Malhotra, Asst. Director General (Hort.-I), ICAR for having inaugurated this Annual Group Meeting - 2013 and delivering the Inaugural address. I also express my sincere gratitude to Dr. C. Kole, Vice Chancellor, BCKV for having presided over this Annual Group Meeting – 2013 and delivering the Presidential address. I am grateful to Dr. Biswapathi Mandal, Pro-Vice Chancellor and Director of Research, BCKV for their unstinting support and for providing necessary infrastructure facilities for conduct of this meeting. I place on record my thanks to the authorities in the ICAR, New Delhi and BCKV, Kalyani for for all the support for the conduct of this Annual Group Meeting.

I am extremely thankful to Dr. P.C. Lenka, OUAT, Bhubaneswar for chairing the Crop Improvement session, Dr. P.K. Chattopadhyaya, Former Dean, BCKV for chairing the Crop Management Session and Dr. Abraham Verghese, IIHR, Bengaluru and Dr. H.S. Singh, CHES (IIHR), Bhubaneswar for chairing and co-chairing respectively the session on Crop Protection. I also thank Mr. Venkatesh N. Hubballi for chairing the session on Interaction between Development Departments and Research Centers. My thanks are also due to all the rapporteurs of different sessions for recording and presenting the proceedings.

I am thankful to all the members of various Committees who have worked hard for the smooth and successful conduct of this Annual Group Meeting, and all the scientific colleagues from the Coordinating Centers and Directorate of Cashew Research for their participation and cooperation in this Annual Group Meeting. I would like to make special mention about untiring efforts made by Dr. Mini Poduval and Dr. S. Chakraborti of Jhargram Centre in organizing this event. My thanks are also due to Dr. T.N. Raviprasad, Scientist-in-charge (PC Cell), Smt. Reshma K, PA and all DCR staff for the support extended in organizing this Group Meeting.

Puttur
Date : 27.1.2014

(P.L. SAROJ)
Director &
Project Coordinator (Cashew)

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PROJECT COORDINATOR'S REPORT

Prof. P.L. Saroj

Project Coordinator, AICRP on Cashew &
Director, Directorate of Cashew Research,
Puttur-574 202 (Karnataka)

Hon'ble Vice Chancellor, Dr. Chittaranjan Kole; Pro-Vice Chancellor, Dr. Biswapathi Mondal, Dr. S.K. Malhotra, Asst. Director General (Hort.II), ICAR, Dr. P.C. Lenka, OUAT, Bhubaneswar, Dr. H.S. Singh, CHES, IHR, Bhubaneswar and Dr. P.K. Chattopadhyay, Former Dean, BCKV, Dr. Manish Das, Principal Scientist, ICAR, distinguished delegates, scientists from DCR and AICRP-Cashew, officers of developmental agencies, invitees from BCKV and NGO's, press and media personnel, ladies and gentlemen.

I express my sincere thanks to the University authorities for making it convenient to host the Annual Group Meeting of Scientists of AICRP on Cashew - 2013. In this Annual Group Meeting of AICRP on Cashew, the results obtained in various experiments of AICRP Cashew for the preceding year shall be reviewed and technical programme for the following year shall be discussed and decided so that, the research programmes of AICRP Cashew can address the location specific problems of cashew cultivation, in their respective states.

I am happy to present the Project Coordinator's Report on this occasion. I would like to present a brief historical background of the AICRP-Cashew. The All India Coordinated Spices and Cashewnut Improvement Project (AICS&CIP) started in 1971 with its headquarters at CPCRI, Kasaragod, was later bifurcated into AICRP on Cashew and AICRP on Spices. The headquarters of the All India Coordinated Research Project on Cashew (AICRP on Cashew) was shifted to the newly established National Research Centre for Cashew at Puttur in 1986 which is now the Directorate of Cashew Research.

The AICRP on Cashew has a total of 14 Centres, those located on the east coast are Bapatla (Andhra Pradesh), Bhubaneswar (Odisha), Jhargram (West Bengal) and Vridhachalam (Tamil Nadu) and those located on the west coast are Madakkathara (Kerala), Pilicode (Kerala), Vengurla (Maharashtra) and Paria (Gujarat) and three centres are located in non-traditional areas, at Hogalagere (in plains region of Karnataka), Jagdalpur (Chattisgarh) and at Darisai (Jharkhand). Further, three cooperating centres are also

functioning under AICRP-Cashew – Arabhavi in Karnataka, Barapani in Meghalaya and Goa.

During the deliberations, the scientists of centres of AICRP on Cashew will be presenting the detailed results obtained during 2012-13 under various research projects in different technical sessions. However, I feel it is appropriate to highlight some of the salient results and also make a mention of some of the issues which need attention.

CROP IMPROVEMENT

Diverse cashew germplasm having desirable yield characteristics have been collected, conserved and evaluated at various centres of AICRP-Cashew. The accessions are also being evaluated for their growth characteristics to assess their suitability for high density planting and for their yield attributes to select the promising accessions as parents in crossing programmes. Presently, 1124 germplasm accessions have been conserved in different Regional Cashew Field Gene Bank's (RCFGBs). In this project the shortest plant height was noticed in JGM – 312 (3.4m) at Jhargram followed by hybrid HC 6 at Vridhachalam. The highest number of flowering laterals per square meter (27.75) was observed in PLD-62, at Pilicode. The mean no. of nuts per panicle was maximum (15.40) in case of H-675 and maximum mean nut weight (9.27g) was recorded in case of V-7 at Vengurla. The highest cumulative yield/tree for 15 years was recorded in H-73 (80.70 kg/tree) at Madakkathara.

CROP MANAGEMENT

At Madakkathara Centre, in 15 year old orchard of variety Priyanka, the per hectare yield (3250 kg) was significantly higher (3.03 times) under high density planting (5 x 4m) as compared to normal density (10 x 5m) (1070 kg). At Bhubaneswar, the maximum ground area coverage (128.92%) was recorded 6m x 4m i.e. 400plants/ha. Closer spacing of 600 plants / ha (5m x 4 m) resulted in higher plant height (4.08m), at Pilicode. At Jhargram, the maximum benefit cost ratio was obtained with bottle gourd (1.79) followed by cowpea (1.75).

CROP PROTECTION

Extensive evaluation of safer insecticides for control of tea mosquito bug and other foliar insect pests have been done by various AICRP-Cashew centers. In trials on chemical control of pest complex in cashew, the least damage score of TMB (0.11) was observed in L-cyhalothrin (0.003%) at Bhubaneswar Centre. Similarly, the lowest per cent infestation of Leaf miner, shoot tip caterpillar and leaf and blossom webber were recorded in L-cyhalothrin (0.003%) at most of the centres.

However, the cashew farmers should resort to application of pesticides only as a need based spray to prevent build-up of pesticide residues in the eco-system and to avoid pesticide resistance in the local insect pest populations.

Infestation by cashew stem and root borers is one of the primary causes for low tree density in all cashew growing tracts. Evaluation of post extraction prophylaxis (PEP) in extensive field trials has been taken up by various AICRP-Cashew centres. This indicated that chlorpyrifos 0.2% could lead to higher recovery in comparison to the other treatment and also the frequency of treatments was the least. It has been confirmed that timely treatment done at the initial stages of pest infestation only could lead to better recovery which stresses the need for regular field survey to identify pest incidence. In addition, regular adoption of phytosanitary measures such as removal of dead infested trees and CSRB infested cashew trees beyond the stage of recovery is absolutely essential in order to minimize the pest inoculum in a given locality.

Influence of biotic and abiotic factors on the incidence of pest complex of cashew has been recorded by most of the centres and it is essential to utilize this exhaustive data for pest prediction in view of the changing climate scenario. Screening of cashew germplasm available in various centres is being done on a regular basis to locate tolerant / resistant types to major pests of the region. So far, none of the cashew accessions evaluated showed pest tolerance to TMB or resistance to the attack by foliage pests.

TRANSFER OF TECHNOLOGY

The coordinating centres of AICRP also involve in transfer of technology activity and have produced more than 5.00 lakh cashew grafts during the year 2012-13 and distributed

to cashew farmers, government and non-government organizations. Frontline demonstration plots have been laid out by different centres to disseminate the recent production techniques with backup of necessary technical guidance. During 2012-13, 03 seminars and 34 trainings were organized.

I trust that all the delegates will agree that the efforts put in by scientists of AICRP Cashew Centres in terms of producing elite planting material, conducting training programmes on various themes and plant protection activities has led to a wider awareness and helped to popularize the cashew technology among farmers.

I sincerely hope that all scientists of AICRP-Cashew will be earnestly implementing the approved technical programmes for their centres as well as, the decisions that will be taken in this Annual Group Meeting. I would like to express my deep sense of gratitude to the Hon'ble Deputy Director General (Hort.) Dr. N.K. Krishna Kumar for his continued guidance and support from the Council. I also wish to thank Dr. Chittaranjan Kole for kindly agreeing to host this Annual Group Meeting at BCKV, Kalyani and extending all supports.

Before I conclude my report, I would like to thank all the scientists of the coordinating centres of AICRP on Cashew; Directors of Research, Deans and other University authorities for extending cooperation for the effective functioning of the project work in their respective centres. I sincerely acknowledge the cooperation and technical support received from my colleagues at DCR, Puttur which has enabled me to run the day-to-day work of the Project Coordinator's Cell smoothly.

Jai Hind

INAUGURAL ADDRESS

Dr. S.K. Malhotra

Asst. Director General (Hort.II), ICAR, New Delhi

Hon'ble Vice Chancellor, Dr. Chittaranjan Kole; Pro-Vice Chancellor, Dr. Biswapathi Mondal; Dr. P.L. Saroj, Director, DCR and PC, AICRP on Cashew, Dr. Manish Das, Principal Scientist (Hort.), ICAR; Dr. P.C. Lenka, OUAT, Bhubaneswar; Dr. H.S. Singh, CHES, IIHR, Bhubaneswar and Dr. P.K. Chattopadhyay, Former Dean, BCKV, scientists from DCR and AICRP-Cashew, invitees from BCKV and NGO's, press and media personnel, ladies and gentlemen.

I feel privileged to inaugurate this Annual Group Meeting – 2013, at this venue of Bidhan Chandra Krishi Viswavidyalaya, Kalyani. As you are aware, the Council has invested substantially on research regarding horticulture crops including cashew. ICAR has made great strides in the field of horticulture and has led to 10 times increase in horticultural crops over the past 10 -15 years. There is still a need to enhance the production keeping in view the enormous demand.

India is the first country in the world to pass the Food Security Bill. Of the many crops, cashew being a nutritious nut can contribute substantially in this regard. Our country was the first country which exploited the international trade in cashew in early 18th century. Earlier the situation for India was comfortable but now the situation is alarming as other countries have come into the global market scenario.

Though we claim that we are exporting large quantity of cashew similarly, we are importing cashew thereby spending our foreign exchange. So far, African countries were not processing cashew. I learnt that cashew producing countries are also establishing processing units and so we are gradually facing shortage of raw nuts and we should sustain producers to meet rawnut requirements. Moreover, in some of the cashew producing states we are getting a high production of more than 1.5t/ha. We have sufficiently addressed the issues of germplasm conservation, as regional collections have reached around 1200 or more but we need dwarf varieties for high density planting, pest resistant particularly for TMB and CSR. Canopy management system also needs to be addressed. By introspection; of the 40 cashew varieties, very few are high yielders which need to be looked into in more detail. Our research publications should be of international quality and

have collaboration with foreign laboratories. I request that the SAU's should join hands with the Council in terms of research collaboration.

I want to share with you that ICAR has pooled the available resources for betterment of horticultural research and set up flagship programmes and network programmes and is promoting research private public partnership mode. The technology available is to be taken forth and BCKV has released a good cashew variety Jhargram-1 and it is one of the foremost Universities having 13 AICRP's.

The schemes under NHM and DCCD sponsored activities starts from quality planting material and after care activities are being well managed through the above funds. Also, the accreditation of cashew nurseries is a must for a perennial crop like cashew, which reveals its potential only after a few years.

The AICRP has a location specific approach and is being evaluated on an annual basis, so that problem do not get hidden. I hope that the technical sessions will help in accurately outlining the work schedule for crop improvement, crop management and crop protection as well as PHT activities. I am confident that this Annual Group Meeting of AICRP-Cashew will come up with a good programme through detailed discussions for the benefit of cashew farmers.

Thank you, Jai Hind.

PRESIDENTIAL ADDRESS

Dr. C. Kole

Hon'ble Vice Chancellor, BCKV, Kalyani

Prof. P.L. Saroj, Director, DCR, Puttur; Dr. S.K. Malhotra, Asst. Director General (Hort.II), ICAR; Pro-Vice Chancellor, Dr. Biswapathi Mondal; Dr. Manish Das, Principal Scientist (Hort.), ICAR; Dr. P.C. Lenka, OUAT, Bhubaneswar; Dr. H.S. Singh, CHES, IIHR, Bhubaneswar and Dr. P.K. Chattopadhyay, Former Dean, BCKV, scientists from DCR and Centres of AICRP-Cashew, my colleagues from BCKV and representatives from NGO's, press and media personnel, ladies and gentlemen.

I wish to share my experiences regarding cashew which is an amazing crop. I have been exposed to this crop during my stint at Bhubaneswar. Cashew is a very common ingredient in variety of snacks and confectioneries and has high level of unsaturated fats. Apart from the economic value of cashew kernels, alcoholic beverages have been in vogue in many of the traditional cashew growing countries of the world like Mozambique, Tanzania and Nigeria. This crop is an important supplementary income for the cashew farmers of these countries. The plant parts of cashew are also used in treatment of diarrhea, gum bleeding and for several other minor remedies. Cashew which originated in North East Brazil was first introduced to India from where it spread to South East countries as well as East Coast of Africa. Several researchers like Dr. Ohler have documented various aspects of cashew production techniques and during 1960's Nigeria was having higher production of cashew, followed by India. Subsequently, due to research efforts in which India was leading for more than three decades in terms of production as well as productivity.

Cashew is the climate resilient crop which is on par with date palm. Presently, we have several high yielding varieties which are suitable to specific regions of the country. Research on the physiological aspects of cashew has to be initiated in our country as very little research data is available to this aspect. Various physiological parameters can be correlated to the existing climatic situation and varieties may be recommended to suit the specific climate niche. I feel it is my duty as a Bio-technologist to suggest some approaches for developing cashew varieties in order to enhance their productivity. Though we notice a wide range of variability in term of growth and yield characters among the cultivated

cashew types but it is true that there is low variability in cashew in comparison to other tree crops. People have continuously selected the varieties for their apple quality and high yield till the late 1960's. However, keeping in view the export potential of this crop the quality parameters also need to be considered. We have to take up hybridization to increase the variability and adopt further selection. Going in for molecular characterization and identification of genes responsible for yield is the first step in adopting modern biotechnology approaches for increasing the productivity levels. In case of temperate crops like peach, plum, pears genes have been identified which induce fruiting within 1 – 1 ½ years. It needs to be confirmed whether the same gene can be cloned in the cashew by “Fast Track Breeding”.

I would like to tell my younger scientific colleagues that slow progress of research in India and lesser rate of development in agriculture is mainly due to lack of self confident. I would like to ask why the country is not involving in genomics as well as nano-technology approach in agriculture as compared to other fields such as telecommunication, pharmaceuticals and industries. The scientific community has sought collaboration with other developed countries for field crops like rice, wheat and maize however, such an effort could not be initiated as none of the developing countries are having cashew cultivation and hence are not interested in investing on research related to cashew. Hence, we can apply the proven principle of crop improvement available worldwide and develop our own protocols in bio-technology as well as in breeding. In a crop like cashew we have to adopt tree population mapping and make use of the existing availabilities. During the process of genetic mapping details about the linkages related to biotic and abiotic stress could be identified and incorporated in cashew as cashew is prone to incidence of insect pest as well as drought. Another new technique is identification of dwarfness in the early stage and later proceeding for further breeding activity. Use of nano-technology in date palm at Jerusalem had lead to increase of 52% extra biomass.

I believe that the three days conference will take care of many of the concerns I have expressed. It is a good start that ICAR has selected BCKV for research in cashew. I thank the Council for giving support to initiate work on cutting edge of cashew. I hope this deliberation would be of good success and promote the cashew scenario of the nation.

Thank you.

SALIENT RECOMMENDATIONS OF AGM-2013

GERMPLASM MANAGEMENT AND CROP IMPROVEMENT

1. It was advised to bring out a catalogue of the germplasm accessions available at Vridhachalam, by referring the Catalogue of Minimum Descriptors of Cashew Germplasm Accessions brought out by DCR. (Action : In-charge, Vridhachalam)
2. Performance of H-303, H-320, H- 32/4 under MLT-II and MLT-III to be submitted to PC cell by all the Centers. (Action : Concerned Centres)
3. Varieties available at the centre to be screened for earliness of flowering and fruiting. (Action : All Centres)
4. Scion Bank to be established at Tura centre based on varieties suited to the region. (Action : Tura Centre)
5. In general, germplasm should be planted at wider spacing for (7.0m x 7.0m) for better expression of its characters. (Action : All Centres)

CROP MANAGEMENT

1. During presentation, year of planting or age of plant, recommended dose of fertilizer (RDF) of region should be mentioned along with yield details. (Action : All Centres)
2. In cropping system experiments, variety of intercrops evaluated should be mentioned and pest infestation in cashew as well as intercrops needs to be recorded. (Action : All Centres)
3. Trial should be initiated to evaluate Jhargram-2 at all allotted centers immediately by lifting grafts from Jhargram Centre. (Action : Concerned Centres)

4. Efforts should also be made to record the microbiological observations regarding shelf life of RTS and Jam and observations on shelf life should be recorded at weekly intervals. (Action : Concerned Centres)
5. Refinement of treatment details to be done by having a Group Discussion at DCR, Puttur to decide the level of FYM to be applied. (Action : PC Cell, DCR)

CROP PROTECTION

1. The experiments on management of TMB and other foliage pests should be concluded after reviewing the results of consecutive five years data. (Action : All Centres)
2. All banned pesticides eg. Lindane and Carbaryl need to be deleted from the treatments. (Action : Concerned Centres)
3. While presentation, scientific names of insect pests and their natural enemies should be mentioned. There are different bio-types of TMB and CSRB, hence specimens from different geographical locations should be sent to DCR, Puttur for correct identification and DNA finger printing at NBAII. (Action : All Centres)
4. Status of key pest, potential pest and sporadic pest of the respective region should be recorded and mapped annually to know the status of pests. (Action : All Centres)
5. Rejuvenation and management of CSRB has been demonstrated successfully at DCR. The protocol for rejuvenation of cashew orchards and effective management of CSRB subsequently should be published in the form of a bulletin / technical folder. (Action : PC Cell, DCR)
6. Sealer-cum-healer developed by IIHR may be evaluated for recovery of CSRB infested trees. The interested centres may send their requirement to PC Cell. (Action : Centres)

7. Occurrence of diseases in cashew, especially blossom blight and die-back should be recorded along with the weather conditions and period of occurrence. (Action : All Centres)

INTERACTION BETWEEN DEVELOPMENT DEPARTMENTS & RESEARCH CENTRES

1. An orientation course should be organized for all newly joined scientists at different AICRP Centres. (Action : PC Cell)
2. Efforts should be made by the scientists of Jagdalpur Centre in consultation with the IGKV authorities for obtaining suitable land to initiate the trial immediately. (Action : In-charge Jagdalpur Centre)
3. A publication in form of book or monograph on cashew needs to be brought out by DCR for the benefit of all the users in the cashew sector. (Action : Director, DCR)
4. It was suggested that one village in the vicinity of research centres is to be adopted, every year for disseminating various technologies in cashew. (Action : All Centres)

TECHNICAL SESSION – I : ACTION TAKEN REPORT OF AGM-2012

Chairman : Dr. S.K. Malhotra, ADG (Hort.-II), ICAR
 Co-chairman : Prof. P.L. Saroj, Director, DCR &
 Project Coordinator (AICRP on Cashew)

Action taken report on major recommendations of the Annual Group Meeting held at NAU, Navasari, Gujarat in November 2012 was presented by Dr. T.N. Raviprasad, Principal Scientist (Ento) & Scientist-in-charge, PC Cell, DCR, Puttur.

| Sl. No. | Recommendations | Action Taken |
|---------|---|---|
| 1. | While reporting data, accession numbers are also to be given instead of collection numbers. | Communicated to all Centres and will be presented accordingly henceforth. For some germplasm collections, accession number is yet to be obtained from NBPGR. |
| 2. | The germplasm at Chintamani should be shifted to the newly established centre at Hogalagere | The germplasm available at Chintamani were shifted to Hogalagere. Grafting has been done and planting will be taken up during June – July 2014. |
| 3. | As per recommendations of QRT, the centre at Bapatla may be shifted to Pandirimamidi | Action has not been initiated, as it needs further discussion with RAC and the Council |
| 4. | Shifting of experiments of Jagdalpur Centre to newly identified area, as the present area is water logged. | So far, it has not been settled. However, University authorities are corresponding with state departments of Chhattisgarh for obtaining the alternate area. |
| 5. | Evaluation of production potential of Jhargram-2 at Darisai, Hogalagere, Jhargram, and Paria Centre. | The planting material has been multiplied by Jhargram Centre and it will be planted in identified centres during July-August 2014. |
| 6. | Under crop improvement, the Jagdalpur centre may give more emphasis on identification of low temperature tolerant material. | One accession i.e., CARS-10 has been identified, which is tolerant to cold. |
| 7. | The accessions with unique characters may be registered with NBPGR. | So far, none of the centres has reported any accessions with unique characters. |
| 8. | Under intercropping experiment, economic analysis should be done and data on the yield from different crops need not be analyzed statistically. | Economic analysis has been done and it will be presented by the concerned centre. |

| | | |
|-----|--|--|
| 9. | Sex ratio and shelling percentage should be worked out as per DCR manual. | Communicated to all centres and the parameters are worked out accordingly. |
| 10. | Banned pesticides like monocrotophos should be deleted from the treatment. | The centre Bapatla has taken action accordingly. |
| 11. | For identification of spiders, DCR should provide the booklet to all the Centres. | The booklet published by DCR has been provided to all Centres for reference. |
| 12. | The occurrence of natural enemies should be properly documented and new specimens may be sent to DCR for identification. | The centres are recording data on occurrence of natural enemies but specimens have not been submitted to DCR for identification. |
| 13. | The Centres having enough germplasm material may screen for apple characters also. | The screening for apple characters have been taken up by Bapatla, Bhubaneswar, Jagdalpur, Jhargram, Pilicode and Vridhachalam Centres. |
| 14. | The work on suitability of different apple types for preparation of Jam and RTS should also be initiated | The work has been taken up by Bapatla, Bhubaneswar, Jagdalpur, Jhargram, Pilicode, Vridhachalam and Goa Centres. |
| 15. | At Paria Centre, the V-7 may also be included in varietal evaluation trial. | V-7 has been included in the trials. |
| 16. | At Pilicode centre, the PLD 57 should be exploited as rootstock | Clonal multiplication of PLD-57 could not be started due to lack of tissue culture facilities at Pilicode centre. |
| 17. | The work done other than allotted experiment should also be brought to the notice of PC Cell. | The planting materials produced, training organized, demonstration undertaken etc., will be presented by the Centres concerned. |
| 18. | Suitable action may be taken by the PC for non-conductance of allotted experiments. | It will be reflected in performance grading of the centre. |
| 19. | Detailed data of Jhargram-2 should be presented for release in next AGM. | The data will be presented in the Plenary Session for release by DDG. |
| 20. | All centres may analyse soil nutrient status under different nutrition experiments. | Soil nutrient analysis is being done by the Centres concerned. |

After detailed discussion, the report was accepted by the house with the suggestion that the necessary steps may be initiated by PC Cell to those points where no progress has been done.

TECHNICAL SESSION II : CROP IMPROVEMENT

- Chairman** : Dr. P.C. Lenka, OUAT, Bhubaneswar
- Rapporteurs** : 1. Dr. J.D. Adiga, Senior Scientist (Hort.), DCR, Puttur
2. Dr. Ivi Chakraborty, Assoc. Professor, BCKV
3. Dr. Dipak Ghosh, Assoc. Professor, BCKV

Gen-1: Germplasm collection, conservation, evaluation, characterization and cataloguing

Centre-wise Recommendations & Suggestions :

BAPATLA

- Mean annual nut yield must be reflected while comparing germplasm accessions.
- Reaction to pest incidence should be recorded as per the grading suggested.
- Details pertaining to the number of nuts/panicle should be indicated for each accession.

BHUBANESWAR

- The sex ratio of hermaphrodite and male flowers is to be re-worked as per the methodology indicated in Annexure-I.

Methodology for recording sex ratio

Three trees should be selected from a variety / genotype from which three panicles are to be tagged randomly. The number of hermaphrodite flowers and staminate flowers appearing in each of these three panicles are counted on alternate days and the counted flowers are removed from the panicles. One day old flower can be identified by the change of flower colour from cream red to light red. Recording of flower count is to be continued till all the flower buds are exhausted from that panicle. The number of hermaphrodite flowers and the number of staminate flowers from each day from the particular panicle is added to get the total number of hermaphrodite flowers and the number of staminate flowers from that panicle.

Mean of hermaphrodite flowers and staminate flowers per panicle is calculated. The sex ratio is obtained by dividing mean number of hermaphrodite flowers with that of the mean number of staminate flowers (hermaphrodite: staminate).

DARISAI

- It was suggested that statistical analysis of parameters should be done for all the parameters.

HOGALAGERE

- Germplasm trials at Chintamani need to be discontinued and all germplasm accessions existing there may be transferred suitably and further maintained at Hogalagere.

MADAKKATHARA

- Data regarding canopy spread is very high and needs to be rechecked.

PILICODE

- Secondary branch pruning and alternative row thinning in closely planted germplasm was suggested to avoid shading effect.

VENGURLA

- All germplasm accessions which are consistently giving higher yield/tree may be further evaluated at wider spacing.

VRIDHACHALAM

- It was advised to bring out a catalogue of the germplasm accessions available at Vridhachalam, by referring the Catalogue of Minimum Descriptors of Cashew Germplasm Accessions brought out by DCR.

The project needs to be continued at other centres as per the guidelines.

Gen 3: Varietal evaluation trials

Expt.3: Multilocation Trial - II (MLT-II)

Centerwise Recommendations & Suggestions :

HOGALAGERE

- Project should be concluded and detailed final report to be submitted to PC cell within Feb. 2014.

JAGDALPUR

- Promising types to be clonally multiplied and planted at a new suitable location.

JHARGRAM

- Project to be concluded and details of the best performing varieties to be sent to PC within Feb. 2014.

MADAKKATHARA

- Decision may be taken about the closure of project or otherwise during field visit of the Project Co-ordinator.

The project needs to be continued at other centres as per the guidelines.

Expt.4 : Multilocation Trial III (MLT-III)

Centrewise Recommendations & Suggestions:

BAPATLA

- Data on flowering intensity/m² in all the test entries needs to be checked.
- Recording mean annual nut yield to be continued up to 10th harvest.

BHUBANESWAR:

- Released varieties included in the trials needs to be invariably indicated by name in parenthesis instead of their accession number.

HOGALAGERE

- The hybrid, H - 32/4 from DCR is performing well at many centers, including Chintamani. The details of the performance of H - 32/4 should to be sent to PC Cell within February 2014.

General Recommendations :

- Performance of H-303, H-320, H- 32/4 under MLT-II and MLT-III to be submitted to PC cell by all the Centers .

The project needs to be continued at other Centres as per the guidelines.

Gen 3 : Varietal evaluation trials (MLT - V) :

Centerwise Recommendations & Suggestions :

DARISAI

- It was suggested that statistical analysis should be done for all the parameters.

HOGALAGERE

- The sex ratio of hermaphrodite and male flowers to be re-worked as per the methodology indicated.

The project needs to be continued at other Centres as per the guidelines.

Gen 3 : Varietal evaluation - MLT – VI :

Centerwise Recommendations & Suggestions :

ARABHAVI

- Data as well as the method of analysis to be rechecked and presented to PC Cell before February 2014.

TURA

- Varieties available at the centre to be screened for early flowering and fruiting.

The project needs to be continued at other Centres as per the guidelines.

Gen 4 : Hybridization and selection

Centerwise Recommendations & Suggestions :

BAPATLA

- Further crossing program should be stopped for 2-3 years and best performing hybrids among the existing hybrids needs to be identified.
- Data on hybrids obtained so far should be compared with BPP-8, as check.

HOGALAGERE

- Data on canopy spread is misleading and should be rechecked.

VENGURLA

- Data on the mean annual nut yield should be rechecked and analysed and final details to be submitted to PC Cell before February 2014.

The project needs to be continued at other Centres as per the guidelines.

Gen 5 : Characterization of germplasm for Cashew apple.

Centerwise Recommendations & Suggestions :

BAPATLA

- The local variety BPP-8 Should be included as check while comparing apple characters.
- Statistical analysis to be rechecked for mean annual nut yield.
- Data on percentage of juice recovery to be rechecked.

JAGDALPUR

- Observations to be recorded from the collection of Centre and data should not be mixed with observations on the varieties from farmers' plot.

The project needs to be continued at other Centres as per the guidelines.

General Recommendations :

1. Details of germplasm collection of different Centers should be submitted to PC cell. I.C. number has to be obtained for all the germplasm available in the respective RCFGB.
2. In hybridization programme, identifying best hybrids suitable for region is important and has to be prioritized.
3. In MLT – II, H-303 of Vengurla center performing well at some centres. It should be recommended for release in Centers, where it is performing well by clonal multiplication.

4. Variety adaptable to climatic condition of particular region with good performance needs to be identified.
5. In non-traditional area, cashew varieties performing well under lower temperature conditions (< 10⁰ C) to be identified and evaluated.

**Programmes allotted to different Centers of AICRP on Cashew
for the next year – 2014-15**

| Programmes | | Centres |
|------------|---|---|
| Gen.1. | Germplasm collection, conservation, evaluation, characterization and cataloguing. | Bapatla, Bhubhaneswar, Hogalagere, Darisai, Jagdalpur, Jhargram, Madakkathara, Paria, Pilicode, Vengurle, Vridhachalam, Arabhavi, Tura and Goa. |
| Gen. 3. | Varietal evaluation trial | |
| | Multilocation trial – II (earlier MLT–1992) | Bapatla, Bhubhaneswar, Jagdalpur, Madakkathara, Vengurle and Vridhachalam. |
| | Multilocation trial–III (earlier MLT–2002) (Planted during 2003) | Bapatla, Bhubhaneswar, Hogalagere, Madakkathara, Vengurle and Vridhachalam. |
| | Multilocation trial–V (performance of released varieties) | Bapatla, Bhubhaneswar, Hogalagere, Jagdalpur, Jhargram, Madakkathara, Pilicode, Vengurle, Vridhachalam, Darisai, Paria, Arabhavi and Tura. |
| | Multilocation trial–VI (Special MLT) | Darisai, Paria, Arabhavi, Tura and Goa. |
| Gen. 4. | Hybridization and selection | Bapatla, Bhubhaneswar, Hogalagere, Jagdalpur, Jhargram, Madakkathara, Vengurle, Vridhachalam and Goa. |
| Gen. 5. | Characterization of germplasm for cashew apple | Bapatla, Bhubhaneswar, Jagdalpur, Jhargram, Pilicode and Vridhachalam |

TECHNICAL SESSION III : CROP MANAGEMENT

Chairman : Dr. P. K. Chattopadhyaya, Former Dean, BCKV, Kalyani

Rapporteurs : 1. Mr. E. Eradasappa, Scientist (Pl. Breeding), DCR, Puttur
2. Dr. S. Debnath, Asstt. Professor, BCKV, Kalyani

Hort.1 : NPK fertilizer treatment

Centre-wise Recommendations & Suggestions :

HOGALAGERE

Observations on TMB and CSRB infestation to be recorded in different treatments.

General Recommendations :

- Soil nutrient status prior to imposing treatment and during the subsequent period should be recorded.

Hort.2 : Fertilizer application in high density cashew plantations

General Recommendations :

- Year of planting or age of plant and recommended dose of fertilizer (RDF) of region should be mentioned.
- Soil nutrient status should be recorded.

Center wise Recommendations & Suggestions :

BHUBANESWAR

- Higher levels of organic carbon content after harvest in S1M2 treatment needs clarification.

HOGALAGERE

- Data should be analyzed for individual treatment effect and also for the interaction effect.

MADAKKATHARA

- Yield data needs to be checked and analyzed properly.

VENGURLA

- Year-wise data of observations needs to be submitted to the PC Cell within February 2014.

Hort.3. Drip irrigation trial

Centre wise recommendation

HOGALAGERE

- Recording of data to be done as per the observation format provided and statistical analysis should be done properly.

Hort. 4. Expt. 2 High density planting – Observation trial

General Recommendations :

- Experiment should be concluded and final report should be submitted to the PC Cell within February 2014.
- New experiment on pruning with region specific variety needs to be formulated.
Trial to be continued in all allotted centres by adopting the general recommendations.

Hort.6. Intercropping in Cashew

General Recommendations :

- Soil nutrient status in different treatments to be recorded.
- Pest infestation in cashew as well as intercrops needs to be recorded.
- Variety of intercrops evaluated should be mentioned.
Trial to be continued in all allotted centers with the following general recommendations.

Centre-wise recommendation

DARISAI

- Results should be presented with relevant photographs to get an accurate representation of the trials.

JAGDALPUR

- The trials have not been initiated by this Centre for several years. Efforts should be made by the scientists of the Centre for obtaining land suitable for initiating the trial immediately.

VENGURLA

- Proper statistical analysis of parameters should be done.

Hort.7. Organic management of cashew

General Recommendations :

- Refinement of treatment details to be done by having a Group Discussion at DCR, Puttur to decide the level of FYM to be applied.
- The trial will be further continued with refined treatment details at all allotted centers with additional observations on pest and disease infestation.

Hort.8. Spacing cum fertilizer trial :

General Recommendation :

Trial to be continued in all allotted centers as per the guidelines.

Hort.9. Evaluation of production potential of newly developed variety Jhargram-2 at different spacing

General Recommendation

Trial should be initiated at all allotted centres immediately by processing grafts from Jhargram Centre.

Hort.10. Varietal screening of cashew apple for preparation of RTS and Jam

General Recommendations :

1. Guidelines for uniform recording of data should be circulated from Madakkathara Centre to the allotted centres for uniform presentation.
2. Those centres which did not initiate the trial, should initiate the trials during the cropping season of 2014.
3. Efforts should also be made to record the microbiological observations regarding shelf life of RTS and Jam.
4. Observations on shelf life should be taken at weekly intervals.

**Programmes allotted to different AICRP Cashew centers
for the next year – 2014-15**

| Programmes | | Centres |
|------------|--|--|
| Hort.1. | Nutrient management for yield maximization in cashew. | Bhubhaneswar (Var. Balabhadra), Madakkathara (Poornima), Hogalagere (Chintamani-1), Paria (V-4) |
| Hort.2. | Fertilizer application in high density cashew plantations | Bapatla, Bhubhaneswar, Hogalagere, Jhargram, Madakkathara, Pilicode, Vengurle and Vridhachalam. |
| Hort.3. | Drip irrigation trials | Hogalagere, Vengurle and Vridhachalam. |
| Hort.4. | High density planting - observational trials | Bapatla, Bhubhaneswar, Hogalagere, Jagdalpur, Jhargram, Madakkathara, Vengurle and Vridhachalam. |
| Hort.6. | Intercropping in cashew | Bapatla, Bhubhaneswar, Darisai, Jhargram, Madakkathara, Paria, Vengurle, Vridhachalam and Arabhavi. |
| Hort.7. | Organic management of cashew | Bapatla, Bhubhaneswar, Hogalagere, Darisai, Jagdalpur, Jhargram, Madakkathara, Vengurle, Vridhachalam, Arabhavi and Barapani/Tura. |
| Hort.8. | Spacing Cum Fertilizer Trial | Darisai, Paria, Arabhavi and Barapani/Tura. |
| Hort.9. | Evaluation of production potential of newly developed variety Jhargram -2 at different spacings. | Jhargram, Hogalagere, Darisai, Paria |
| Hort.10. | Varietal screening of cashew apple for preparation of RTS and Jam | Bapatla, Bhubhaneswar, Darisai, Hogalagere, Jagdalpur, Jhargram, Madakkathara, Paria, Pilicode, Vengurle, Vridhachalam, Arabhavi Tura and Goa. |

TECHNICAL SESSION IV : CROP PROTECTION

- Chairman** : Dr. Abraham Verghese, Director, NBAII
- Co-Chairman** : Dr. H. S. Singh, CHES, Bhubaneswar
- Rapporteurs** : 1. Dr. Sudarshan Chakraborty, Assoc. Prof., RRS, BCKV, Jhargram
2. Dr. Avinash Kumar Gupta, Scientist, SG CARS, Jagdalpur.

Ent. 1: Chemical control of pest complex in cashew

Expt. 3. Evaluation of insecticides for the control of TMB and other insect pests

BAPATLA

- Time of application of spray schedule has to be mentioned in the table.
- The experiments should be concluded after reviewing the results of consecutive five years data.

HOGALAGERE

- Infestation and damage of cashew apples due to TMB should be recorded.

DARISAI

- Due to absence of Entomologist, experiment could not be laid out. Posting of entomologist may be pursued by University authorities.

JAGDALPUR

- Infestation and damage of cashew apples due to TMB should be recorded.

JHARGRAM

- Due to absence of Entomologist experiment could not be laid out in 2013, but it will be taken in 2014.

ARABHAVI

- No entomological trial could be conducted. At this centre the post of entomologist was lying vacant.

Trial should be continued in all allotted centers as per the approved technical programme.

Ent. 2 : Control of cashew stem and root borer

Expt. 2 : Curative control trial

BAPATLA

- The application of Lindane and/ or Carbaryl need to be deleted from Bapatla, Hogalagere and Jhargram Centres.

Ent.3: Influence of biotic and abiotic factors on the incidence of pest complex of cashew

- The experiments may be continued at all the centres.
- List of insect pests and natural enemies with their scientific name need to be presented.
- Proper statistical analysis to obtain the regression coefficient (R^2) between insect pest occurrence and their natural enemies with the existing weather parameters need to be done and presented.

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

- The experiments may be continued at all the Centres as per approved technical programme.

General Recommendations:

- Possibility of including bio-agent / bio-pesticide may be included in the experiment.
- Special attention should be given to incidence of mealy bugs, thrips, etc., which have potential to become major pests.
- Application of Copper oxy-chloride, to avoid fungal infection of treated bark should be taken up in trials for CSRB management.
- Repeated inspection of trees top worked for rejuvenation to be done regularly for identification of CSRB infestation.
- Role of *Oecophylla* ant as a predator for TMB should be observed and reported by different centres.
- For TMB and other insect pests, L-Cyhalothrin has been found effective and may be recommended after examination of the results by the PC cell. In addition, new insecticides may be evaluated so that, effective chemical is available as and when resistance against recommended insecticide is reported.
- Alternatives to chlorpyrifos needs to be explored as this chemical is being gradually phased out from usage in plant protection.

**Programmes allotted to different AICRP Cashew centers for
the next year – 2014-15**

| Programmes | | Centres |
|--|---|---|
| Ent.1. Chemical Control of pest complex in cashew. | | |
| Expt 3. Evaluation of insecticides for the control of TMB and other insect pests | | Bapatla, Bhubhaneswar, Hogalagere, Darisai Jagdalpur, Jhargram, Madakkathara, Paria, Vengurle and Vridhachalam. |
| Ent. 2. Control of Cashew Stem and Root Borers | | |
| Expt. 2 Curative trials | | Bapatla, Bhubhaneswar, Hogalagere, Jagdalpur, Jhargram, Madakkathara, Vengurle and Vridhachalam. |
| Ent. 3. | Influence of biotic and abiotic factors on the incidence of pest complex of cashew | Bapatla, Bhubhaneswar, Hogalagere, Darisai, Jagdalpur, Jhargram, Madakkathara, Paria, Vengurle, Vridhachalam, and Arabhavi. |
| Ent. 4. | Screening of germplasm to locate tolerant / resistant types for major pests of the region | Bapatla, Bhubhaneswar, Hogalagere, Jagdalpur, Jhargram, Madakkathara, Vengurle and Vridhachalam. |

TECHNICAL SESSION – V : INTERACTION BETWEEN DEVELOPMENT DEPARTMENTS & RESEARCH CENTRES

Chairman : Sri Venkatesh. N. Hubballi, Director,
Directorate of Cashew and Cocoa Development

Rapporteurs : 1. Dr. P.B.Pushpalatha
2. Dr. Umamaheshwara Rao, CRS. Bapatla.

Dr. N.K. Krishna Kumar, Hon'ble DDG (Hort.) was also present during the deliberations and gave his valuable suggestions.

In his opening remarks, Sri. Venkatesh N. Hubballi, Director, DCCD emphasized the necessity of taking up different development projects by Research centers for the benefit of farmers. He made presentation about the activities of DCCD with emphasis on various development projects available with DCCD for implementation through various agencies.

Later, Shri Swapan Kumar Choudary, Nari Bikash Sangh, Bankura, West Bengal raised the issue on the availability of quality planting materials. He mentioned that the variety V-4 promoted at present was not found suitable to West Bengal.

The Project Coordinator, DCR, Puttur suggested purchase of suitable planting materials from certified nurseries and also emphasized that selected personnel can be given training on nursery production technology. It was opined that consistently performing good varieties or types can be selected and propagated, rather than insisting on released varieties. Dr. P.L. Saroj mentioned it is not mandatory that Vengurla-4 only need to be cultivated, those varieties like Jhargram-1, BPP-8 etc., can also be grown if it is continuously performing well under farmers field. Sri. Venkatesh N. Hubballi, DCCD, raised the issue of wastage of cashew apple and informed that funding can be made available for cashew apple utilization and proposal need to be submitted through institutes.

Dr. H.S. Singh, CHES, Bhubaneswar emphasized the necessity of utilizing the experience of retired hands, NGO's etc., for taking up and implementing various development programmes. The Director, DCCD supported this and indicated that recently Dr. P.C. Lenka has been appointed as Chief Technical Consultant for DCCD. Mr. Saphal Mandal, ADO, Agricultural Department, Digha raised the subject of removal of cashew plantations and planting of eucalyptus which was discussed in detail.

Dr. V.N. Singh, M.D., Tamil Nadu Forest Plantation Corporation Ltd., shared his experiences about planting of cashew and highlighted the problems of high density orcharding in cashew. He opined that farmers would favour cashew if they are aware of its sustained demand. Later, the Hon'ble DDG (Hort.) interacted with the scientists and officials from various development agencies, NGO's and farmers present and emphasized that a " Monograph of Cashew" covering all aspects of cashew production technology, post harvest aspects, marketing etc., is a need of the hour. It was also suggested to have a

separate meeting with development agencies, exporters, processing industry etc., to have a detailed futuristic outlook.

The following decisions were taken during the session.

1. All the AICRP Centres should take extensive TOT programmes to create awareness among farming community for profitable cashew cultivation, with the financial assistance from TSP of ICAR.
2. A “Cashew Monograph” need to be brought out from DCR for the benefit of all the end-users in the cashew sector.
3. A separate interface meeting between research and development organization need to be conducted to address many issues confronted by the development departments may be organized by DCCD.
4. It was suggested that one village in the vicinity of research centres is to be adopted, every year for disseminating various technologies in cashew.
5. Utilization of cashew apple need to be exploited to the desired extent by training self help group of woman’s with empowering to women group to start their own entrepreneurship.
6. Master plan for cashew development in each state need to be brought out for sustainable development.

PLENARY SESSION

| | | |
|--------------------|---|---|
| Chairman | : | Dr. N.K. Krishnakumar, DDG (Hort.), ICAR |
| Co-Chairman | : | Prof. P.L. Saroj, Director, DCR |
| Rapporteurs | : | 1. Dr. T.N. Raviprasad, Prin. Sci. (Ag. Ento.), DCR 2. Dr. S. Jeeva, Horticulturist, RRS, Vridhachalam |

This session was chaired by Dr. N.K. Krishnakumar, Hon'ble DDG (Hort.), ICAR and the rapporteurs presented the decisions taken during individual technical sessions. The DDG mentioned that the decisions should be recorded explicitly so as to provide clear indication of the activity. He also expressed that statistical analysis of data and detailed conclusions of each trial should be presented.

Later, Dr. J.P. Makati, AES, Paria presented the decisions of the session on Action Taken by different centres. It was suggested that the Vice Chancellor of Dr. Y.S.R. Horticulture University should be contacted for final decision regarding shifting of Bapatla Centre to a more suitable location. The scientists of Bhubaneswar should critically survey the cashew germplasm in different districts of Odisha. The DDG indicated that henceforth funding will be based on annual grading of each centre. The Vice Chancellor of Indira Gandhi Krishi Viswavidyalaya, Raipur, may be contacted regarding shifting of trials at Jagdalpur to a suitable location within two months, while funding shall be kept in abeyance till action is taken. DCR may prepare a spread sheet for data documentation with necessary formula and supply the same to all the centres. The tissue culture work at Pilicode can be taken up at CPCRI, Kasaragod and hardened plants can be supplied. Pollen cryopreservation of released varieties should be attempted at DCR. A team of scientists should visit Vengurla centre to make independent assessment of KGG-1 and KGG-2 which are local high yielding collections.

The decisions of the technical session on crop improvement were presented by Dr. Adiga, DCR, Puttur. It was suggested that a committee should make a realistic estimate of germplasm strength and identify the duplicates by DNA fingerprinting. Another centre can establish a conservation block of promising germplasm apart from DCR. At Pilicode, the germplasm types can be evaluated under pruned conditions. At Vengurla, the high yielding accessions should be evaluated at a wider spacing. The germplasm collections at Vridhachalam should be subjected to DNA fingerprinting and duplicate should be removed.

The decisions of crop management session were presented by Dr. E. Eradasappa, DCR, Puttur. Under high density planting fertilizer application dose should be on per hectare basis. Also the leaf content of nutrient, plant uptake etc., should be considered for determining the fertilizer dosage. Raw data pertaining to observational trials on high

density planting should be obtained from all the centres and submitted to PC Cell. The same may be got analysed from the scientists of statistics section of IIHR, Bengaluru. In organic management trial, Dr. A.N. Ganesh Murthy may be invited for participation in the Group Meeting to be held at DCR for deciding the dosages to redesign the treatments.

The decisions of the technical session on crop protection were presented by Dr. Avinash Gupta. It was suggested to record the annual occurrence of the major pests viz., *Helopeltis antonii*, *Plocaederus ferrugenus* and *Plocaederus obesus* from different locations and prepare a geographical map of pest incidence to be published by DCR. Regarding disease occurrence in cashew a white paper may be brought out by making a mention of blossom blight which is possibly due to *Alternaria* infection.

Guidelines and Data Recording / Reporting Formats

I. CROP IMPROVEMENT

Gen.1: Germplasm collection, conservation, evaluation, characterisation and cataloguing.

Objectives:

The main objectives of the project are to

- (a) To evaluate the existing germplasm collections
- (b) To collect local germplasm with desirable characters such as high yield, cluster-bearing habit, bold sized nuts, short duration of flowering etc. from different cashew growing areas.
- (c) To establish clonal germplasm conservation blocks

Centres:

Bapatla, Bhubaneswar, Hogalagere, Jagdalpur, Jhargram, Madakkathara, Pilicode, Vengurla, Vridhachalam.

Technical Programme:

- (a) Germplasm collection:

During the germplasm collection surveys, the data may be recorded in the format given in Proforma – CI-1.

- (b) Germplasm evaluation:

In germplasm evaluation, only promising types (yielding more than 8 kg/tree/year; nut weight more than 7 g and shelling percentage more than 28) are to be reported. The data may be recorded and reported in the format given in Proforma – CI – 2.

- (c) Germplasm characterisation and cataloguing:

The clonal accessions in the gene bank, which have completed 10 years of planting and given 6 annual harvests may be characterised and catalogued. For characterization of accessions, the data may be recorded in the format given in Proforma – CI – 3.

Three plants/accessions may be used for recording observations and the mean values may be used for cataloguing the accessions.

PROFORMA – CI-1: Data recording sheet for cashew germplasm collection

| Sl. No | Item | Description | |
|--------|---|--|----------|
| 1 | Name of collecting Centre | | |
| 2 | Team/collector(s) | | |
| 3 | Source of collection | | |
| 4 | Name and address of farmer/ collection site | | |
| 5 | Latitude | Longitude | Altitude |
| | | | |
| 6 | Collector's number | | |
| | Name of collection | | |
| 7 | Date of collection | | |
| 8 | Age of tree | | |
| 9 | Tree habit | Upright and compact/ upright and open/ spreading | |
| 10 | Branching pattern | Extensive/ Intensive | |
| 11 | Season of flowering | | |
| 12 | Apple colour | Yellow/ Red/ Pink | |
| 13 | Apple Shape | Cylindrical/ Conical to obovate/ Round/ Pyriform | |
| 14 | Apple Size | Small/Medium/ Large | |
| 15 | Nut Size | Small/Medium/ Large | |
| 16 | No. of fruits/panicle | | |
| 17 | Attachment of nut to apple | Loose/ Intermediate/ Tight | |
| 18 | Estimated yield/m ² | | |
| 19 | Other notes from collector | | |
| | a) Plant height (m) | | |
| | b) Canopy spread (m) | | |
| | c) Trunk girth (cm) | | |
| | d) Trunk bark type | | |
| | e) Flowering laterals/ m ² | | |
| | f) Non flowering laterals/ m ² | | |
| | g) Yield per plant (kg) | | |
| | h) Soil type | | |
| | i) Sex Ratio | | |
| | j) TMB infestation | | |

PROFORMA – CI – 2 : Performance of cashew accessions

| Accession No. | Year of Planting | Nut yield/plant during the reporting year (Kg) | Cumulative nut yield/plant (No. of annual harvests) | Mean weight /nut (g) | Mean weight/apple (g) | Shelling (%) | Field tolerance to TMB (low/medium/high) |
|---------------|------------------|--|---|----------------------|-----------------------|--------------|--|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| | | | | | | | |

PROFORMA – CI-3 : Characterization and evaluation of cashew genetic resources

| Sl. No. | Item | Description |
|---------|--|---|
| 1 | Site | |
| 2 | Accession number/Tree No. | |
| 3 | Age of tree | |
| 4 | Tree habit | Upright and compact/upright and open/spreading |
| 5 | Tree height (m) | |
| 6 | Tree spread (m) (mean of diameter in two directions) | |
| 7 | Cracks on trunk bark | Absent (Smooth) / Present (Rough) |
| 8 | Crotch angle of main branches | Acute (<90°)/Obtuse (>90°) |
| 9 | Ease of peeling bark from twigs | Difficult / Easy |
| 10 | Extension growth of twigs (cm) (During major growth flush) | |
| 11 | Branching pattern (Predominant one) | Extensive / Intensive |
| 12 | Twig diameter (mm) (on current seasons shoot at an inter node) | |
| 13 | No. of leaves per twig (Mean of 10 twigs) | |
| 14 | Colour of young leaves | Red, Yellow Red, Green Yellow, Purple |
| 15 | Colour of mature leaves | Light green / Green / Dark Green / Purple |
| 16 | Odour of leaves (Crushed young leaves) | Mango like / Turpentine like / other |
| 17 | Inter nodal length (cm) (Current Season's growth) | |
| 18 | Leaf shape | Obovate /(club shaped) /Ovate / Oblong / Circular |
| 19 | Leaf Margin | Wavy / Smooth |

| | | |
|----|---|--|
| 20 | Leaf apex shape | Pointed / Rounded / Indented (with slight notch) |
| 21 | Leaf size (l x w) | |
| 22 | Brittleness of leaf | Leathery/Brittle |
| 23 | Angle of leaf petiole relative to stem | Acute (<90°) / Obtuse (>90°) |
| 24 | Leaf cross-section | Level/Reflexed/Incurved/Twisted |
| 25 | Season of flowering | Early(Nov-Dec) / Mid (Dec.-Jan) / Late (Jan-Feb) |
| 26 | Flowering intensity/m ₂ (from 4 directions at mid canopy) | |
| | a) No. of laterals/m ² | |
| | b) No. of flowering laterals/m ² | |
| 27 | Flowering duration (days) (from 10 panicles & 4 directions) | |
| | Date of Start | |
| | Date of end | |
| 28 | Inflorescence shape | Narrowly Pyramidal (conical) / Pyramidal (deltoid) / Broadly Pyramidal |
| 29 | Inflorescence size (l x w) | |
| 30 | Colour of boot leaf | Light Green / Dark Green |
| 31 | Compactness of inflorescence | Loose / Compact |
| 32 | Type of inflorescence branching | All around (main axis) / Two sided (opposite side of main axis) |
| 33 | Secondary flowering | Absent / Present |
| 34 | Sex Ratio (Ratio of hermaphrodite flowers to the total number of flowers in a panicle): | |
| 35 | Flower colour (corolla) | White / Cream / Pink |
| 36 | Mature cashew apple colour | Yellow / Red / Yellow Red / Red Purple |
| 37 | Cashew apple shape | Cylindrical / Conical to Obovate / Round / Pyriform |
| 38 | Size of cashew apple (l x w) (mean of 10 apples) | |
| 39 | Weight of cashew apple (g) (mean of 10 apples) | |
| 40 | Shape of cashew apple base | Angular/ Rounded/ Flattened/ Obliquely flattened |
| 41 | Ridges on cashew apple | Absent/Broken/Entire |
| 42 | Cashew apple apex | Level/Oblique |

| | | |
|----|--|---|
| 43 | Grooves on apex of cashew apple | Absent/Shallow(notched)/Deep (furrowed) |
| 44 | Cavity at apex of cashew apple where nut is attached | Absent/Shallow/Deep |
| 45 | Skin of cashew apple | Smooth and glossy/ Rough and dull |
| 46 | Attachment of nut to cashew apple | Loose/Intermediate/Tight |
| 47 | Colour of mature nut shell | Buff/Grey/Ash grey/Pink or Crimson tone |
| 48 | Nut shape | Kidney shaped/Oblong-elipsoidal |
| 49 | Cashew nut dimensions (length x width x thickness) | |
| 50 | Shape of nut base | Round/Flattened/Obliquely flattened/Angular |
| 51 | Suture of nut | Round/Angular |
| 52 | Flank of nut | Flattened/Rounded/Bulging |
| 53 | Stylar scar on nut | Small (narrow)/Large (Wide) |
| 54 | Shape of nut apex | Rounded/Intermediate/pointed |
| 55 | Nut weight (g) (mean of 100 nuts) | |
| 56 | Relative position of suture and apex | Suture projection in front of apex/in-line with apex/behind apex) |
| 57 | Shelling percentage (from 10 nuts) | Shell (pericarp) thickness 9mm |
| 58 | Uniformity of shell thickness | Not uniform/uniform |
| 59 | Seed (Kernel) weight (g) (Mean of 10 kernels after shelling dry nuts): | |
| 60 | Attachment of peel to kernel | Loose/Tight |
| 61 | Seed (Kernel) dimensions (l x w x t) | |
| 62 | Cotyledonary grooves | Shallow/Deep |
| 63 | No. of annual harvests and cumulative yield (kg) : | |
| 64 | Tea mosquito susceptibility | Low/medium/high |
| 65 | Remarks, if any | |

Gen.3: Varietal evaluation

Expt.3: Multilocation trial-II (MLT-II) (MLT-92) with varieties from Bapatla, Vengurla, Vridhachalam and NRCC, Puttur.

Objectives:

(a) To evaluate the performance of new set of high yielding varieties in different locations.

Centres:

Bapatla, Bhubaneswar, Jagdalpur, Madakkathara, Vengurle and Vridhachalam.

Experimental details:

Design : RBD
Replication : Three

Varieties to be utilized in the MLT-II (MLT-92)

Bapatla : T.No.30/1, 3/33, 10/19, 3/28
Vengurla : H-68, 367, 303, 255, 320
Vridhachalam : M 44/3 (VRI-2), M 15/4
NRCC, Puttur : 107/3 (NRCC-Sel-1), 40/1 (NRCC-Sel-2)

Technical Programme:

Proforma CI-4 {The data to be recorded and reported in the format given below i.e. Proforma CI-4 (a-c)}

PROFORMA – CI – 4 : Performance of cashew varieties/genotypes in MLT II (MLT 92)

CI-4 (a)

| No. | Variety/Genotype | Plant Height (m) | Trunk Girth (cm) | Canopy Shape | Canopy Spread (m ²) |
|-----|------------------|------------------|------------------|--------------|---------------------------------|
| | | | | | |

CI-4(b)

| Variety/Genotype | Date of first flowering | Date of last flowering | Duration of Flowering | Flowering intensity /sq m (mean of all 4 sides) | No. of fruits/panicle | Nut weight (in g) | Yield/plant (in kg) |
|------------------|-------------------------|------------------------|-----------------------|---|-----------------------|-------------------|---------------------|
| | | | | | | | |

CI-4 (c)

| Variety/Genotype | Yield (kg/tree) Harvest No. | Cum. yield (kg/tree) No. of harvests | Nut Wt. (g) | Apple Weight (g) | Shelling % | Field tolerance to TMB (Low/Medium/High) (mention mean damage score) |
|------------------|-----------------------------|--------------------------------------|-------------|------------------|------------|--|
| | | | | | | |

Expt.4: Multilocation Trial III (MLT – 2002) (Planted in 2003)

Objectives:

The objective of the experiment is to evaluate the performance of TMB tolerant accessions and promising hybrids identified from each centre to different locations.

Centres:

Bapatla, Bhubaneswar, Hogalagere, Madakkathara, Vengurle and Vridhachalam.

Experimental details

This trial was taken up in 2003 planting season with 11 entries (10 test varieties and one local check)

| Sponsoring Centre | Promising Hybrids | TMB tolerant type |
|-------------------|-------------------|-------------------|
| CRS Bhubaneswar | BH 6, BH 85 | -- |
| CRS, Madakkathara | H 1597 | K 22-1 |
| RFRS, Vengurle | H 662, H 675 | -- |
| RRS, Vridhachalam | -- | H 11 & H 14 |
| NRCC, Puttur | H 32/4 | Goa 11/6 |
| Total | 6 | 4 |

Three Replications

Spacing : 7.5 m x 7.5 m

Plot size : 4 plants/plot

Technical Programme:

Proforma CI-5 {(The data on performance of cashew varieties/genotypes in MLT–III may be reported in the format given above i.e. Proforma CI-4(a-c)}

Expt. 4: Performance of Released Varieties. (MLT- V)

Objectives:

To evaluate the identified 25 cashew varieties released from different centres / SAUs for their performance in different locations.

Centres:

Arabhavi, Bapatla, Bhubaneswar, Darisai, Hogalagere, Jagadapur, Jhargram, Madakkathara, Paria, Vengurle, Vridhachalam and Tura.

Experimental details:

Two rows each, of the cashew varieties (listed below) comprising of six plants per row.

| Sl. No. | Varieties | Sl. No. | Varieties | Sl. No. | Varieties |
|---------|----------------|---------|----------------|---------|------------|
| 1 | BPP-4 | 10 | Dhana | 19 | NRCC Sel-2 |
| 2 | BPP-6 | 11 | Kanaka | 20 | Ullal-1 |
| 3 | BPP-8 | 12 | Priyanka | 21 | Ullal-3 |
| 4 | Bhubaneswar-1 | 13 | Amrutha | 22 | Ullal-4 |
| 5 | Chintamani-1 | 14 | Vengurla-1 | 23 | UN-50 |
| 6 | Jhargram-1 | 15 | Vengurla-4 | 24 | Goa-1 |
| 7 | Madakkathara-1 | 16 | Vengurla-6 | 25 | Bhaskara |
| 8 | Madakkathara-2 | 17 | Vengurla-7 | | |
| 9 | K-22-1 | 18 | Vridhachalam-3 | | |

Proforma CI-6:

The data on performance of the 25 varieties released may be recorded and reported in the format given in Proforma-CI – 4(a-c).

Gen 3: Special Multi Location Trial (MLT- VI)**Objectives:**

To evaluate selected released varieties in new centres started during XI Plan (2009).

Centres:

Arabhavi, Darisai, Paria, Goa and Tura.

Experimental details:

Two rows each, of the cashew varieties (listed below) comprising of six plants per row.

Varieties :

| | | | | |
|--------------|----------|---------------------------|-------|---------------|
| NRCC Sel-2 | Bhaskara | BPP-8 | Dhana | VRI-3 |
| VRI (CW) H-1 | H 303 | Vengurla-4 (Common check) | | Local Check * |

*** Local Check for New Centres :**

| | | |
|------------------------|---|----------------|
| BAU Centre | : | BPP8 |
| Paria, Arabhavi & Tura | : | V-4 |
| Goa | : | Goa-1 or Goa 2 |

Gen.4: Hybridisation and selection.**Objectives:**

The objective of the experiment is to utilize the high yielding genotypes selected from germplasm for crossing with other genotypes having desirable traits like bold nuts, cluster bearing habit, compact canopy, short flowering period, late synchronised flowering types and high shelling percentage.

Centres:

Bapatla, Bhubaneswar, Hogalagere, Jagdalpur, Jhargram, Madakkathara, Vengurla and Vridhachalam.

Experimental details:

Parents and cross combinations be identified by respective centres based on promising yield traits in the parents.

Technical Programme:

The data on the evaluation of hybrids may be recorded and reported in the Format given in Proforma CI-7.

CI-7 : Performance of cashew hybrids :

| Hybrid No. | Cross combinations | Year of Planting | Height | Stem Girth | Mean Canopy Spread | Date of first flowering | Date of last flowering | Duration of Flowering |
|------------|--------------------|------------------|--------|------------|--------------------|-------------------------|------------------------|-----------------------|
| | | | | | | | | |

| Hybrid No. | No. of fruits per panicle | Nut weight | Apple weight | Year of first fruiting | Total yield/plant | Incidence of TMB (Low/Medium/High) |
|------------|---------------------------|------------|--------------|------------------------|-------------------|------------------------------------|
| | | | | | | |

Gen.5: Characterization of germplasm for cashew apple.

Objectives:

The objective of the experiment is to identify germplasm having preferred apple characters suitable for value addition.

Centres:

Bapatla, Bhubaneswar, Jagdalpur, Jhargram, Pilicode and Vridhachalam.

Physical characters of apple in different germplasm.

| Germplasm details | Mean nut yield/tree | Apple Wt. | Apple nut ratio | Colour of apple | Juice recovery (%) |
|-------------------|---------------------|-----------|-----------------|-----------------|--------------------|
| | | | | | |

Bio-chemical characters of apple in different germplasm.

| Germplasm details | Total Sugars | TSS | Acidity | Tannin Content | Vitamin C |
|-------------------|--------------|-----|---------|----------------|-----------|
| | | | | | |

II. CROP MANAGEMENT

Hort.1a. Nutrient management for yield maximization in cashew

Objective:

To investigate the effect of nutrient management approaches on growth, yield and soil properties

Centres: Bapatla, Bhubaneswar, Hogalagere, Jhargram, Madakkathara and Vridhachalam

Technical Programme:

Treatments

T1: 100 % recommended dose of N, P and K fertilizer (RDF)*

T2: 100 % RDF + 10 kg FYM / plant / year

T3: 100 % RDF + 10 kg FYM / plant / year + foliar spray of major nutrients (3% Urea + 0.5% H₃PO₄ + 1% K₂SO₄)

T4: 100 % RDF + 10 kg FYM / plant / year + foliar spray of secondary and micronutrients (0.5% ZnSO₄ + 0.1% Solubor** + 0.5% MgSO₄)

T5: 100 % RDF + 10 kg FYM / plant / year + foliar spray of major nutrients (3% Urea + 0.5% H₃PO₄ + 1% K₂SO₄) + foliar spray of secondary and micronutrients (0.5% ZnSO₄ + 0.1% Solubor + 0.5% MgSO₄)

T6: Control

*100% RDF = The dose of N, P and K fertilizer as per the Centre's recommendation

** Solubor = Source of fertilizer for Boron

Experimental details:

| | | |
|--------------------------|---|---|
| Design | : | RBD |
| No. of replications | : | 4 |
| No. of plants/treatments | : | Six |
| Spacing | : | 7 m x 7 m |
| Variety | : | Recommended cashew variety to the region / Centre |

* Foliar spray needs to be given at three different stages *viz.*, flushing, flowering and nut development.

All the centres should record incidence of TMB in Nutrient management trials and follow need based recommended spray schedule to manage TMB incidence.

Hort.1b. On-farm trials

On-farm trials (at two locations) should be conducted by all the centres in the farmer's fields using the best planting material with the following doses of fertilizers:

| Treatment | N | P ₂ O ₅ | K ₂ O |
|---------------------------|---------------------------------------|-------------------------------|--|
| Recommended dose | 500 | 125 | 125 g/plant |
| Alternate doses suggested | | | |
| (i) | 1000 | 250 | 250 g/plant |
| (ii) | 1500 | 250 | 375 g/plant |
| Source: | | | |
| (i) | N as urea | (ii) | P ₂ O ₅ as rock phosphate / superphosphate |
| (iii) | K ₂ O as muriate of potash | | |

Note: Centres should carry out soil and leaf analysis once in two years for NPK contents.

Data to be recorded:

The proforma for recording observations is given below **(CM 1)**. Statistically analysed data be reported as per the Proforma **CM 2**.

Soil sampling: Soil samples be collected from different treatments after nut harvest and 40 days after fertilizer / manure application at 0-30 cm depth, 1 m away from the base of the plant. Soil samples be analysed for pH, EC, organic carbon, available N, P, K, Fe, Mn, Zn and Cu as per the Proforma **CM 3**. Leaf samples may also be collected (4th and 5th mature leaf from the shoot tip) from all the four sides of the tree.

CM 1: Data recording format for nutrient management trial

| Repl. No. | Treatment | Plant height (m) | Trunk girth (15 cm above ground level) (cm) | Mean canopy diameter (m) | Canopy height (m) | Canopy surface area (m ²)* |
|-----------|-----------|------------------|---|--------------------------|-------------------|--|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

| Date of first flowering | Date of last flowering | Duration of flowering (days) | Mean nut wt. (g) | Mean apple wt. (g) | Nut yield during the reporting year (kg/plant) | Cum. yield (kg/plant) (Total No. of harvests) | TMB infestation (Low/Medium/High) |
|-------------------------|------------------------|------------------------------|------------------|--------------------|--|---|-----------------------------------|
| 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |

Canopy surface area = $\pi r l$,

where r = Canopy diameter / 2

$l = \sqrt{[\text{canopy height (ch)}]^2 + r^2}$ (Square root of $ch^2 + r^2$)

Ground area covered by plant canopy

Ground area covered by plant canopy = πr^2

Where, r = radius of the canopy (m), (r = Canopy diameter/2)

Canopy diameter = (length of canopy EW + length of canopy NS) / 2

Example: If radius is 2 m, the total area covered by the plant canopy is $\pi \times 2^2 = 12.56 \text{ m}^2$. In case of 10 m x 5 m spacing (normal density), the area is of 50 m^2 . Hence, the percent ground area covered by the plant canopy = $(12.56/50) \times 100 = 25.6\%$. Similarly, per cent ground area covered by plant canopy can be calculated for given spacing or plant density.

CM 2: Format for reporting data (annual yield and cumulative yield data should be given separately)

| Treatment | Mean Annual nut yield (kg/plant) | Mean Cumulative nut yield (kg/plant) for harvests |
|-------------------------------|----------------------------------|---|
| T1 | | |
| T2 | | |
| T3 | | |
| T4 | | |
| T5 | | |
| T6 | | |
| Mean | | |
| SEm \pm / CD (0.05 or 0.01) | | |

CM 3: Format for soil analyses data

| Treatment | pH | EC (d Sm ⁻¹) | Organic carbon (%) | Available N (kg/ha) | Available P (kg/ha) | Available K (kg/ha) | Available Fe (mg/kg) | Available Mn (mg/kg) | Available Zn (mg/kg) | Available Cu (mg/kg) |
|-------------------------------|----|--------------------------|--------------------|---------------------|---------------------|---------------------|----------------------|----------------------|----------------------|----------------------|
| T1 | | | | | | | | | | |
| T2 | | | | | | | | | | |
| T3 | | | | | | | | | | |
| T4 | | | | | | | | | | |
| T5 | | | | | | | | | | |
| T6 | | | | | | | | | | |
| Mean | | | | | | | | | | |
| SEm \pm / CD (0.05 or 0.01) | | | | | | | | | | |

Hort.2 : Fertilizer application in high density cashew plantations

Objective:

To study the response of vegetatively propagated material of cashew to different doses of NPK fertilizers at different spacing. Pruning shall be adopted as a farm operation.

Centres: Bapatla, Bhubaneshwar, Hogalagere, Jhargram, Madakkathara, Pilicode, Vengurle and Vridhachalam

Technical Programme:

| | | | |
|-----------|-------------------|--------------|---------------|
| Design : | Split-plot | Main plot : | Plant density |
| Subplot : | Fertilizer levels | Total area : | 2.5 ha |

Treatments:

| | | | |
|-------------------------|------|---------------|------------|
| Plant density: 3 levels | S1 = | 200 plants/ha | (10m x 5m) |
| | S2 = | 400 plants/ha | (6m x 4m) |
| | S3 = | 500 plants/ha | (5m x 4m) |

| | | | | |
|----------------------|------|----------|-------------------------------------|----------------------------|
| Fertilizer: 3 levels | M1 = | 75 kg N | 25 kg P ₂ O ₅ | 25 kg K ₂ O /ha |
| | M2 = | 150 kg N | 50 kg P ₂ O ₅ | 50 kg K ₂ O /ha |
| | M3 = | 225 kg N | 75 kg P ₂ O ₅ | 75 kg K ₂ O /ha |

| | | | | |
|-------------------------|------------------------|-------------------|------------------------|-------------------|
| Fertilizer application: | 1 st year : | 1/5 th | 2 nd year : | 2/5 th |
| | 3 rd year : | 3/5 th | 4 th year : | 4/5 th |
| | 5 th year : | Full dose | | |

Technical Programme:

The data recording format **CM 4** is same as **CM 1**. Format for reporting data are given in **CM 5** and **CM 6**

CM 5: Effect of plant density and fertilizer application on ground area coverage by canopy (%)

| Treatments | Ground area coverage by canopy (%) | | | Mean |
|------------------------------|------------------------------------|----|----|------|
| | M1 | M2 | M3 | |
| S1 | | | | |
| S2 | | | | |
| S3 | | | | |
| Mean | | | | |
| MP/SP-SEm, CD (0.05 or 0.01) | | | | |

CM 6: Effect of plant density and fertilizer application on nut yield (plant/ha both for annual and cumulative yield)

| Treatments | Cashew yield (kg/plant or kg/ha) | | | Mean |
|------------------------------|----------------------------------|----|----|------|
| | M1 | M2 | M3 | |
| S1 | | | | |
| S2 | | | | |
| S3 | | | | |
| Mean | | | | |
| MP/SP-SEm, CD (0.05 or 0.01) | | | | |

MP = Main plot SP = Sub plot

Hort.3. Drip Irrigation Trials

Objective:

To study the response of cashew to supplementary irrigation during flushing and flowering phases and to work out the critical stages of irrigation

Centres: Hogalagere, Vengurle and Vridhachalam

Technical Programme:

Treatments

| | | |
|---------|---|--|
| T1 | : | No irrigation |
| T2 | : | Irrigating 20% of Cumulative Pan Evaporation (CPE) |
| T3 | : | Irrigating 40% of CPE |
| T4 | : | Irrigating 60% of CPE |
| T5 | : | Irrigating 80% of CPE |
| Spacing | : | 7m x 7m |
| Variety | : | Chintamani-1 (Hogalgere Centre) Vengurle-7 (Vengurle) VRI-3 (Vridhachalam) |

Each treatment will be imposed in a block of 50 plants.

Calculations: Quantity of water required per plant per day to meet 20% CPE

Example:

Age of the plant : 5 years and canopy diameter: 4 m

If the total ground area covered by the plant canopy is $\pi \times 2^2 = 12.56 \text{ m}^2$. If CPE is 5 mm, 20% of CPE = 1 mm. Therefore, quantity of water required for irrigating 12.56 m^2 area = $(12.56 \times 1)/1000 = 0.01256 \text{ m}^3$, 1 m^3 water = 1000 litres. Therefore, $0.01256 \text{ m}^3 = 12.56$ litres/plant/day. Similarly, the water required per plant per day can be calculated for a given ground area covered by the plant canopy and CPE.

The data recording format **CM 7** is as below.

CM 7 : Data recording format for Drip Irrigation trial

| Repl. No. | Treatment | Plant height (m) | Trunk girth (15 cm above ground level (cm)) | Mean canopy diameter (m) | Canopy height (m) | Canopy surface area (m ²)* |
|-----------|-----------|------------------|---|--------------------------|-------------------|--|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

| Date of first flowering | Date of last flowering | Duration of flowering (days) | Mean nut wt. (g) | Mean apple wt. (g) | Nut yield during the reporting year (kg/plant) | Cum. yield (kg/plant) (No. of annual harvests) | TMB infestation (Low/Medium/High) |
|-------------------------|------------------------|------------------------------|------------------|--------------------|--|--|-----------------------------------|
| 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |

Soil moisture content at three different depths viz., 0-30, 31-60 and 61-90 cm be determined treatment-wise before and imposing the irrigation treatments during critical period of cashew (January to March/ April). Irrigation should be started only after commencement of 50% of flowering in cashew. The data be recorded and tabulated as per the format given in **CM 8**.

CM 8: Soil moisture content (SMC) before and after imposing irrigation treatments

| Irrigation Treatment | SMC at the base of the plant at dripping point | | | |
|-------------------------------|--|----------|----------|------|
| | 0-30 cm | 31-60 cm | 61-90 cm | Mean |
| T1 No irrigation | | | | |
| T2 20% CPE | | | | |
| T3 40% CPE | | | | |
| T4 60% CPE | | | | |
| T5 80% CPE | | | | |
| Mean | | | | |
| SEm, CD (0.05 or 0.01) | | | | |

Hort.4. High density planting - observational trial

Objective:

The main objective of this experiment is to find out the optimum plant population per unit area for yield maximisation in cashew

Centres: Bapatla, Bhubaneshwar, Hogalagere, Jagdalpur, Jhargram, Madakkathara, Vengurle and Vridhachalam

Experimental details: Spacing of 4 m x 4 m accommodating 625 plants/ha

The data be recorded and tabulated as per the format given in **CM 9** and **CM 10**

CM 9: Format for reporting data

| Repl. No. | Treatment | Plant height (m) | Trunk girth (15 cm above ground level (cm)) | Mean canopy dia. (m) | Canopy height (m) | Canopy surface area (m ²)* | Date of 1 st flowering | Date of last flowering | Duration of flowering (days) | Mean nut wt. (g) | Mean apple wt. (g) | TMB infestation (Low/Medium/High) |
|-----------|-----------|------------------|---|----------------------|-------------------|--|-----------------------------------|------------------------|------------------------------|------------------|--------------------|-----------------------------------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |

*Canopy surface area = $\pi r l$

Where r = Canopy diameter / 2; $l = \sqrt{[\text{canopy height (ch)}]^2 + r^2}$ (Square root of $ch^2 + r^2$)

CM 10: Format for recording yield data

| Replication No. | Treatment | No. of plants/block | No. of nuts/plant | Yield | | Cumulative yield (No. of harvests) | |
|-----------------|-----------|---------------------|-------------------|------------|---------|------------------------------------|-------|
| | | | | (kg/plant) | (kg/ha) | kg/plant | kg/ha |
| | | | | | | | |

Hort.6. Intercropping in cashew

Objective:

To find out suitable intercrops with cashew in the initial years of orchard development

Centres: Arabhavi, Bapatla, Bhubaneswar, Darisai, Jhargram, Madakkathara, Paria, Vengurle and Vridhachalam

Experimental details:

Design : RBD Replications : Three

In Bhubaneswar centre, design is split plot with 4 main plot and 3 sub plot treatments and 3 replications

Spacing : 8 m x 8 m; main crop (cashew)

Note : Intercrops which can be evaluated may be either vegetable, flower or tuber crops which have sufficient market demand in the vicinity. Medicinal or aromatic crops can also be cultivated wherever sufficient demand is available for the same.

Technical Programme:

The data sheet for recording observations on main crops **CM 11** is same as per the Proforma **CM 9**. Soil moisture content be determined at three different depths (0-30 cm, 31-60 cm and 61-90 cm) at 1 m away from the base of the cashew plant and between two rows of cashew plants where intercrops are being grown. Data on yield of intercrops and economics be worked out as per the proforma given in **CM 12**.

CM 12: Data sheet for recording observations on intercrops in cashew orchard

| Repl. No. | Treatment | Yield from intercrops | | Total cost of cultivation (Rs.) | Total returns from intercrops/ha (Rs.) | Net profit/ha (Rs.) | B:C ratio |
|-----------|-----------|-----------------------|-------|---------------------------------|--|---------------------|-----------|
| | | kg/plot | kg/ha | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| | | | | | | | |

Hort.8: Spacing cum fertilizer trial

Objective: To find out appropriate spacing and fertilizer doses for cashew

Centres: Arabhavi, Darisai, Paria and Tura

Experimental details:

Design : Split plot Spacing : 8 m x 8 m
10 m x 5 m
6.5 m x 6.5 m

Fertilizer doses: 3 [Appropriate fertilizer dose be selected by consulting PI (Crop Management)]

Varieties

Darisai : BPP 8 Paria, Arabhavi & Tura : V-4

Local check for new Centres for Hort.6, Hort.7 and Hort.8

Darisai : BPP 8 Paria, Arabhavi & Tura : V-4

Hort.9: Evaluation of production potential of newly developed variety Jhargram-2 at different spacings

Objective: To find out appropriate spacing for the newly released cashew variety Jhargram-2

Centres: Jhargram, Hogalagere, Darisai and Paria The above centres should procure the planting material from Jhargram Centre.

Spacing details:

(i) 4 x 4m (ii) 6 x 6m (iii) 7 x 5m (iv) 8 x 8m

No. of replications : 4

Hort.10: Varietal screening of cashew apple for preparation of RTS and Jam**Objectives:**

The objective of the experiment is to evaluate suitability of cashew apple for value addition in terms of RTS and Jam.

Centres:

Bapatla, Bhubaneswar, Jagdalpur, Jhargram, Pilicode and Vridhachalam.

Organoleptic evaluation of products viz., RTS and Jam in different varieties**a. RTS**

| Variety | Taste | Colour | Flavour | Total acceptability | pH | Shelf life in days |
|---------|-------|--------|---------|---------------------|----|--------------------|
| | | | | | | |
| | | | | | | |

b. Jam

| Variety | Taste | Colour | Flavour | Total acceptability | pH | Shelf life in days |
|---------|-------|--------|---------|---------------------|----|--------------------|
| | | | | | | |
| | | | | | | |

III. CROP PROTECTION

Ent.1: Chemical control of pest complex in cashew.

Expt.3. Evaluation of insecticides for the control of TMB and other insect pests

Objectives:

The project is aimed to find out efficacy of insecticides for the management of tea mosquito bug and other insect pests of cashew.

Centres:

Bapatla, Bhubaneswar, Hogalagere, Darisai, Jagdalpur, Jhargram, Madakkathara, Paria, Vengurla and Vridhachalam.

Experimental details:

Design : RBD No.of trees/treatment : 2 (Two)
Replications : 4 (Four)

For the control of tea mosquito and other minor pests the following treatments were approved for implementation:

Treatments:

| | Treatment / test insecticides |
|-----|---|
| T-1 | First spray with Neem oil soap (4%) followed by L-cyhalothrin (0.003%) as second spray within 15 days followed by neem oil soap (4%) as third spray |
| T-2 | Imidachloprid 17.8 SL (0.6ml/l) all the three sprays |
| T-3 | Acetamaprid 20 SP (0.5g/l) all the three sprays |
| T-4 | L-cyhalothrin (0.003% - 0.6ml/l) all the three sprays |
| T-5 | Recommended spray schedule for the region |
| T-6 | Untreated Control |

Layout:

Two trees in each treatment should be separated from the adjoining set of treatment trees at least by one row of guard trees all around. These guard trees should also be sprayed with same insecticide of the respective treatment. In case there is only one row of the guard trees, the corresponding half portion of the canopy facing the treated trees should receive the respective insecticide treatment.

Technical Programme:

Observations:

Select 52 leader shoot at any side of canopy and label individually. Pre-treatment observations are to be recorded one day prior to each spraying and post-treatment observations at 30 days after each spray.

Observations on incidence of the following pests are to be recorded.

- i) Tea mosquito bug
- ii) Leaf miner
- iii) Leaf and blossom webber
- iv) Apple and nut borer
- vi) Shoot tip caterpillar
- v) Other pests of regional importance like mealy bugs, mites, aphids etc.

Observations should be recorded using proforma appended (CP-I to CP-4).

Tea mosquito bug:

Adults and nymphs present in marked or 52 leader shoots in any side of canopy are to be counted. Total number of shoots (non-flowering laterals) and panicles (flowering laterals) are to be recorded separately in the above area. The damaged shoots / panicles are also to be scored using 0-4 scale as given in these proforma.

Leaf miner:

The total number of infested leaves in the five damaged laterals among the marked 52 leader shoots is to be counted and percentage damage may be worked out.

Leaf and blossom webber:

The number of webbed tips of shoots / panicles (laterals) and number of caterpillars are to be recorded on 52 above leader shoots and percentage damage may be worked out.

Inflorescence thrips:

Damage (corky growth or presence of scab) on 100 nuts and apples/tree selected at random needs to be scored as below

0 = No damage

1 = 1 - 25 per cent nut or apple surface damaged (upto 1/4 of the damage surface area).

2 = 26 - 50 per cent nut or apple surface damaged (upto 1/2 of the damage surface area).

3 = 51 - 75 per cent or apple surface damaged (upto 3/4 of the damage surface area).

4 = 76 - 100 per cent or apple surface damaged (more than 3/4 of the damage surface area).

Damage symptoms should be recorded on the panicle at different stages of nut development after final round of spray.

Apple and nut borer:

All the apples and nuts in the selected 52 leader shoots should be examined and the numbers infested to be recorded and percentage damage may be worked out.

Shoot tip caterpillars / inflorescence caterpillars

Spread out one square metre white cloth at two places below the canopy of each tree and count the total number of caterpillars fallen six hours after each spray.

Natural enemies:

Should be recorded as indicated below. One month after second / third round of spray, select 52 panicles at random and tap against 30 x 30 cm square card board and count the number of spiders and ants present per panicle.

Temperature:

At the time of each spray, temperature may be recorded. Minimum temperature which plays important role in TMB build up needs to be mentioned in the area.

CP-1: Proforma for reporting tea mosquito incidence in experimental plots of each treatment.

Name of the Treatment:

Replications No.

| Tree No | Leader shoot No. | Tea mosquito damage score (0-4 scale)* Individual score values on each plant part damaged | | No. of nymphs | No. of adults | Total population |
|-------------|------------------|--|----------|---------------|---------------|------------------|
| | | Lateral Shoots | Panicles | | | |
| I | 1 | | | | | |
| | 2 | | | | | |
| | 3 | | | | | |
| | | | | | | |
| | 52 | | | | | |
| II | | | | | | |
| Grand Total | | | | | | |

Observations are to be recorded on one or two days before first spraying and 30 days after each spray.

Damage score rating technique :

- 0 No damage
- 1 1 to 3 necrotic streaks/lesions on the shoot / panicle including apple and nut
- 2 4 to 6 coalescing or non coalescing lesions / streaks on the shoot / panicle including apple and nut
- 3 Above six coalescing or non-coalescing lesions / streaks on the shoot / panicle including apple and nut
- 4 Lesions / streaks confluent or wilting or drying of affected shoot / panicle including apple and nut

$$\text{Mean score value} = \frac{\text{Total score}}{\text{Total Number of lateral shoots + panicles}}$$

CP-2 : Proforma for recording the damage of leaf and blossom webber, shoot tip caterpillar, leaf miner, apple and nut borer and pests of regional importance under each treatment.

Name of the treatment * :

Replication No.

| Tree No | Leader shoot No. | Total No. of lateral /panicles | No. of laterals damaged by | | | | Total No. of apples and nuts | No. of apples and nuts damaged by apple and nut borers | Population of leaf and blossom webber | Natural enemies (spiders and ants)/ panicle ** |
|-------------|------------------|--------------------------------|----------------------------|-----------------------|----------------|------------------------------------|------------------------------|--|---------------------------------------|--|
| | | | Leaf and blossom webber | Shoot tip caterpillar | Leaf miner *** | Other pests of regional importance | | | | |
| I | 1 | | | | | | | | | |
| | 2 | | | | | | | | | |
| | ... | | | | | | | | | |
| | ... | | | | | | | | | |
| | 52 | | | | | | | | | |
| II | | | | | | | | | | |
| Grand Total | | | | | | | | | | |
| % damage | | | | | | | | | | |

* Observations are to be recorded one day before first spraying and 30 days after each spraying.

** In each tree 52 panicles are to be selected separately at random and tapped on 30 cm² card board area and count the population one month after II and III round of spray.

*** Total number of infested leaves in the five damaged laterals among the marked 52 leader shoots is to be counted and percentage damage may be worked out.

CP-3 : Proforma for recording the damage of leaf miner and population of inflorescence caterpillars in the experimental plots of each treatment.

Name of the Treatment:

Replication No.

| Tree No. | Leaf miner damage | | | Inflorescence caterpillars | |
|-------------|-------------------|--------------|-----------------------|----------------------------|---|
| | Lateral No. | Total leaves | No. of damaged leaves | Spot No. | Total No. of Inflorescence caterpillars collected |
| I | 1 | | | 1 st spot | |
| | 2 | | | 2 nd spot | |
| | ... | | | .. | |
| | 5 | | | 5 th spot | |
| Grand Total | | | | | |
| % damage | | | | | |

CP- 4 : Format for reporting data

- a) Damage score of tea mosquito bug (30 days after each spray)
- b) Percent incidence of miner pests (30 days after each spray)
- c) Natural enemies/predators recorded:

| Treatment | Pre-treatment count | | | Post treatment count | | | | | | | | | Yield (kg/tree) |
|-----------|---------------------|---|---|----------------------|---|---|----------------|---|---|-----------------|---|---|-----------------|
| | | | | After I spray | | | After II spray | | | After III spray | | | |
| | a | b | c | a | b | c | a | b | c | a | b | c | |
| | 1 | 2 | | 1 | 2 | | 1 | 2 | | 1 | 2 | | |
| T1 | | | | | | | | | | | | | |
| T2 | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| T6 | | | | | | | | | | | | | |

- a1 = TMB mean damage score a2 = TMB mean population / 52 leader shoots
- b = mean percent damage/total population of other pests
- c = mean count of natural enemies / 52 panicles

Local check for new centres : Darisai : BPP-8 Paria : V-4

Ent.2: Control of cashew stem and root borer (CSRB).

Expt.2: Curative trial (Post extraction prophylaxis).

Objectives:

The objective of the experiment is to assess the efficacy of different curative treatments using chemicals against cashew stem and root borer (CSRB).

Centres:

Bapatla, Bhubaneswar, Hogalagere, Jagdalpur, Jhargram, Madakkathara, Vengurla and Vridhachalam.

Experimental details:

Design : CRD

The following treatments have to be applied after removal of the grubs in the stem and root zone. Care should be taken while removing the bark, and no girdling should be done (i.e. bark to be left on at least half of the stem circumference).

Treatments:

- I. Chlorpyriphos (0.2%)
- II. Monocrotophos (0.2%)
- III. Untreated check (only removal of CSRB grubs followed)
- IV. Treated check (using the most effective treatment under earlier prophylactic trials at the respective centres)

The treatments are to be applied sequentially on trees as and when infested trees are available. Sequential treatments refer to T-1 on first infested tree, T-2 on second infested tree, and so on. Fresh attack / residual inoculum needs to be checked up at monthly intervals on all treated trees and uninfested trees should also be checked up for symptoms of infestation and treated suitably.

Technical Programme:

Data to be collected as per **CP-5** and reported as per proforma **CP-6**

CP-5 : Format of observations under post-extraction prophylaxis (curative trials)

| Treatment | No. of trees treated | No. of trees without reinfestation / persistent attack | % of trees without attack (out of total trees treated) | Details of physical parameters | | | | | |
|-----------|----------------------|--|--|--------------------------------|-----------------|-----------|------------------------------|------------------|------------------|
| | | | | Tree No. | Stem girth (cm) | Age (Yrs) | % bark circumference damaged | Zone of attack * | Canopy yellowing |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | | | | | | | | |

***Zone of attack:** (Enter code of appropriate zone(s)

- I. Collar + Root II. Collar + Stem III. Only root IV. Only stem V. Collar+Root+Stem

CP-6 : Format for reporting efficiency of different treatments.

| Treatment | % of trees without reinfestation / persistent attack (persistent) |
|-----------|---|
| 1 | 2 |
| | |

CP – 7 Format for reporting physical parameters of treated trees

| Physical parameters of trees observed | | | |
|---------------------------------------|--------|-------------------------------|--------------------|
| | | No. of trees in each category | |
| | | Without reinfestation | With reinfestation |
| Stem girth (in cm) | <60 | | |
| | 60-80 | | |
| | 80-100 | | |
| | >100 | | |
| Total | | | |
| (in yrs) | <5 | | |
| | 5-10 | | |
| | 10-15 | | |
| | >15 | | |
| Total | | | |
| % bark circumference damaged | <25 | | |
| | 25-50 | | |
| | 50-75 | | |
| | >75 | | |
| Total | | | |

| | | | |
|------------------|-----------------|--|--|
| Zone | C+R | | |
| | C+S | | |
| | R | | |
| | S | | |
| | C+R+S | | |
| Total | | | |
| Canopy yellowing | a) Yellowed | | |
| | b) No yellowing | | |
| Total | | | |

Ent.3: Influence of biotic and abiotic factors on the incidence of pest complex of cashew

Objectives:

The project aims to study the population dynamics of pests of regional importance and correlate the population with weather parameters.

Centres:

Arabhazi, Bapatla, Bhubaneswar, Hogalagere, Darisai, Jagdalpur, Jhargram, Madakkathara, Vengurla and Vridhachalam.

Technical Programme:

Details of pests occurring during different months in surveyed locations may be presented as per CP-8.

CP – 8 : Format for recording observations on bioecology of pests of regional importance and pest complex

| Month of observation | TMB mean damage score (mean of 52 shoots) | Leaf & blossom webber (% shoots damaged) (52 leader shoots) | Apple & Nut borer (% of apples damaged / 52 panicles) | Leaf miner (% of mined leaves) on five laterals | Leaf thrips (mean no. per 10 leaves) | Thrips damage on 100 nuts / apples * | Shoot tip caterpillar (% infested shoots / 52 leader shoots) | Panicle damage (% of damaged panicles- out of 52 panicles) by inflorescence caterpillars * |
|----------------------|---|---|---|---|--------------------------------------|--------------------------------------|--|--|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| | | | | | | | | |
| | | | | | | | | |

* = Observations may be restricted on green nuts or matured nuts with apples once in a year.

* *= Observe for deposit of faecal matter on the leaves of the same panicle or on leaves of shoots exist below the marked panicle

Observation on natural enemies :

Collect pest infested shoots/panicles at least 50 No. per week and maintain separately in a 2 litre plastic bottles lined at bottom with cotton covered with blotting paper. Collection needs to be done minimum of eight weeks coinciding with flushing and flowering. The parasitoids emerged out can be collected by covering the whole bottle in a black cloth and fixing a test tube 1.0 cm width on the lid. (Fig.1). The mouth of the test tube is to be covered with a paper having punch hole. Inside the tube blotting paper strips are to be maintained.

Collect fruit borer attacked apples and nuts during fruiting season at least 50 No. per week and maintain as described above (Fig.1) and collect the parasitoids emerging from nuts. This needs to be done at least for eight weeks during fruiting season. The collected parasitoids are to be sent to DCR, Puttur for arranging identification.

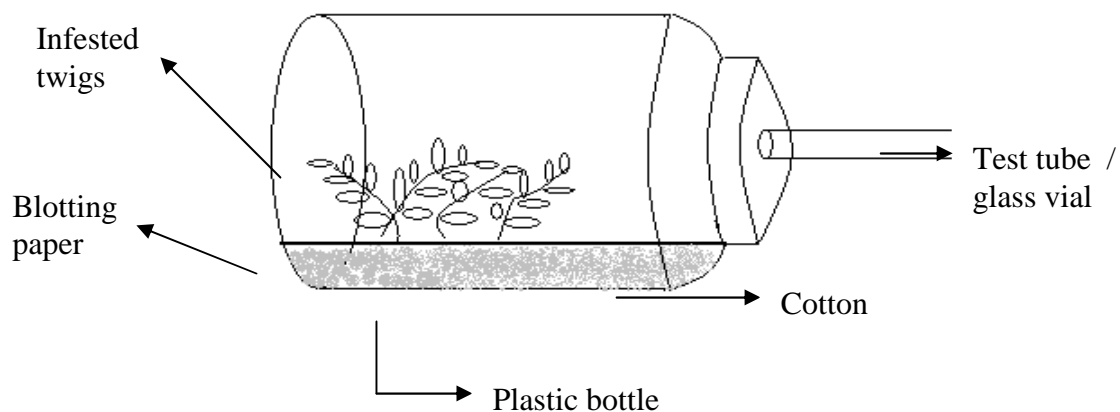


Fig. 1 Set up of collection bottle for parasitoid emergence

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

Objectives:

To identify germplasm accessions tolerant / resistant to the pests of regional importance.

Centres:

Bapatla, Bhubaneswar, Hogalagere, Jagdalpur, Jhargram, Madakkathara, Vengurla and Vridhachalam.

Technical Programme:

The various accessions available in each centre may be screened to locate the tolerant / resistant types in the available germplasm and data collection should be as per format CP - 9.

Yield loss assessment due to lepidopteran flower pests

Centres - All AICRP-C Centres having Entomology trials

Methodology for yield loss assessment :

The assessments are based on comparing the extent of fruiting/damage between panicles which are protected from tea mosquito bug (TMB) alone versus those in which both TMB and lepidopteran pests are controlled. For this purpose, a total of 110 pairs of panicles of similar size (7 to 10 days after initiation of flowering) are chosen at random on a few trees of single promising cashew variety and labelled. Among them, one in each pair is protected with L-cyhalothrin (0.005%, 1ml per litre of water) applied by dip method twice at three weeks interval, while the other was protected from TMB by mechanical killing of the pest on each day. As additional precaution, any pair of panicles showing symptoms of TMB infestation on the 60th day are omitted from the observations as escapes, before recording the final harvestable fruit set due to the impact of flower pests and compare using Student's 't' test. Among labelled panicles, those having harvestable nuts are counted separately and percentage of panicles having harvestable fruit set is worked out. While counting final harvestable fruit set per panicle, fruits in the green nut stage (matured nuts) and dry nut stage (fully matured nuts) are only selected and other developing nuts existing in mustard, peanut and marble size stages are ignored as these were further susceptible to fruit drop due to physiological reasons and insect injury. After recording final harvestable fruit set in all protected and unprotected panicles, the percentage of yield loss is worked out as follows

$$\text{Yield loss \%} = \frac{(\text{Mean number of nuts in protected panicles} - \text{Mean number of nuts in unprotected panicles})}{\text{Mean number of nuts in protected panicles}} \times 100$$

The extent of damage due to flower pests on each panicle is recorded. This is done by indirect method based on the deposition of faecal matter of these pests on the lamina of leaves in the panicle bearing lateral shoot or neighbouring lateral shoot existing exactly below the labelled panicles and the percentage of panicles showing symptom of damage is worked out.

CP-9: Format for recording observations on evaluation of germplasm accessions

| Accession No. | TMB mean damage score 0-4 scale in 52 leader shoots | Leaf blossom & webber (% shoots damaged) 52 leader shoots | Damage by Inflorescence thrips on nuts / apples | Inflorescence caterpillars (% of damaged panicles out of 52 panicles) |
|---------------|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| | | | | |

ANNUAL GROUP MEETING OF SCIENTISTS OF AICRP ON CASHEW – 2013

LIST OF DELEGATES

| | |
|--|---|
| INDIAN COUNCIL OF AGRICULTURAL RESEARCH | |
| Dr. N.K. Krishna Kumar Deputy Director General (Hort.) Indian Council of Agricultural Research, Krishi Anusandhan Bhavan –II, Pusa Gate, NEW DELHI – 110 012. | Mr. E. Eradasappa Scientist (Plant Breeding) DCR, Darbe P.O., PUTTUR - 574 202, D.K., KARNATAKA. |
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