

**COCONUT RESEARCH BOARD**

**COCONUT RESEARCH INSTITUTE  
OF SRI LANKA**

**REPORT FOR 1993**

**COCONUT RESEARCH INSTITUTE - REPORT FOR 1993**



# **COCONUT RESEARCH BOARD**

## **REPORT OF THE COCONUT RESEARCH INSTITUTE FOR 1993**

**Editors**

**R Mahindapala, Ph D (Exon), F I Biol(S L)**

**M de S Liyanage, Ph D, M I Biol(S L)**



## THE COCONUT RESEARCH BOARD

Mr Naomal S Dias      (*Chairman*)  
Vidya Jyothi Dr C R Panabokke  
Vidya Jyothi Mr P R Wijewardena  
Mr J L Amaratunga  
Mr D V Jayasuriya  
Mr G P P N Perera  
Mr A S Ranatunga      (*upto June*)  
Dr G W E Fernando      (*from December*)  
Mr P Kalupathirana      (*from June*)  
Mr S Vithanage      (*Ministry Representative*)  
Mrs M B Ekanayake      (*Treasury Representative*)

## COMMITTEES OF THE COCONUT RESEARCH BOARD

### 1. Research Committee

Mr Naomal S Dias (Chairman)  
Vidya Jyothi P R Wijewardena  
Dr U Pethiyagoda  
Vidya Jyothi Dr C R Panabokke  
Mr A S Ranatunga  
Mr K Karunanayake  
Dr G W E Fernando  
Prof Y D A Senanayake  
Mr W L Bogtstra (Wayamba Plantations Ltd)  
Mr C C de Silva (Kurunegala Plantation Ltd)  
Dr R Mahindapala (Director, CRI & Convenor)

### 2. Administrative Committee

Mr J L Amaratunga (Chairman)  
Mr Naomal S Dias  
Mr G Bambaradeniya  
Mr S Vithanage  
Dr R Mahindapala (Director, CRI)  
Mr D G Manamudali (Deputy Director - Adm. & Fin.,  
CRI & Convenor)

### 3. Estates Committee

Mr G P P N Perera (Chairman)  
Mr J L Amaratunga  
Mr D V Jayasuriya  
Dr R Mahindapala (Director, CRI)

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# COCONUT RESEARCH INSTITUTE OF SRI LANKA

## THE STAFF\*

(as at 31 December, 1993)

### DIRECTORATE

Director - Vacant

Deputy Director (Research) - M de S Liyanage, B Sc Agric; M Sc (New England); Ph D (Sri Lanka); F I Biol (SL).

Deputy Director (Administration and Finance) - D G Manamudali, B A; LICA

### RESEARCH DIVISIONS

#### Agronomy Division

##### *Head*

D N S Fernando, B Sc Agric; Ph D (Reading)

##### *Technical Assistants*

##### *Agronomists*

T G L G Gunasekara, B Sc Agric;  
Ph D (Wales)

H A G Gunathilake, B Sc Agric;  
Ph D (Wales)

##### *Assistant Agronomists*

K B Dassanayake, B Sc Agric  
H P S Jayasundera, B Sc Agric \*\*

##### *Assistant Agricultural Economists*

M T N Fernando, B Sc Agric

##### *Senior Technical Assistant*

M Bastian

H A Abeysoma  
M H F G Ivan Appuhamy \*\*\*  
M J I Costa  
M I A Denpathi  
R Marasinghe  
Mrs K C P Perera, B Sc  
S D J N Subasinghe, Dip Agric.

##### *Lab & Field Assistants*

D Amarasinghe  
W S M A Fernando  
E M Gunaratne Banda  
M D V Saparamadu  
D B Benet Silvan  
W E J Tissera  
*Clerk Typist*  
A A D N Athauda \*\*\*

## Genetics and Plant Breeding Division

### *Head*

R R A Peries, B Sc Agric; Ph D (Qld)

### *Geneticist/Plant Breeder*

Mrs W M U Fernando, B Sc;  
Ph D (Birmingham)

### *Assistant Geneticists/Plant Breeders*

J M D T Everard, B Sc; M Sc  
A A F L K Perera, B Sc Agric

### *Technical Assistants*

J D J Abeysekara  
R B Attanayake  
G K Ekanayake  
Mrs W B S Fernando  
L M S R Jayathilake  
M H L Padmasiri

### *Lab and Field Assistants*

P A D Milton Appuhamy  
M H Dhanasena  
W T H C Fernando  
M A Hemachandra  
T M W Peiris  
M Victor

### *Clerk/Typist*

Miss I N Jayawardena

## Soils and Plant Nutrition Division

### *Head*

Mrs M B M N Fernandopulle, B Sc Agric; M Phil; Ph D (Qld)

### *Soil Scientists*

L L W Somasiri B Sc; Ph D (Aberdeen);  
C Chem; M I Chem C  
N A Tennakoon, B Sc Agric; M. Phil;  
Ph D (Aberdeen)

### *Assistant Soil Scientists*

L P Vidhana Arachchi, B Sc Agric \*\*  
Mrs M G F S Jayasundara, B Sc Agric \*\*

### *Technical Assistants*

E M A T Banda  
Mrs S D H Bandara, B Sc  
Miss P A K  
A H Norman  
D P Panditharatne  
U S S Perera  
Miss J L J L Pinto  
Miss G S Ranasinghe  
Mrs D M Wijebandara, B Sc

*Senior Technical Assistants*

T W Fernando, L I Chem C  
G D George  
Miss S Periyathmby, N D S  
Mrs N H R M de Silva, B Sc

*Lab and Field Assistants*

N M H Chandrasoma  
K E R M Fernando  
W Gunasena  
K Murugiah  
B C E Perera  
K L Ranasinghe

*Typist Clerk*

Mrs H M W S Athauda

**Crop Protection Division**

*Head*

Mrs C N K Rajapaksa, B Sc Agric; M Sc (Texas A & M)

*Crop Protection Officer*

Mrs L C P Fernando, B Sc Agric;  
Ph D (Qld)

*Senior Field Assistant*

D M Jayakody

*Assistant Crop Protection Officers*

I Wickramananda, B Sc Agric  
H T R Wijesekara, B Sc Agric; M Sc.

*Lab & Field Assistants*

W E A Fernando  
W W F Noel Fernando  
A S M Premalal

*Technical Assistants*

K A S Chandasiri  
D C L Hapuarachchi  
S Prabath Manohar  
A H Norman  
K F G Perera  
Miss P H A P Siriwardena

*Clerk*

Mrs A Anula de Zoysa

## Biometry Division

### *Head*

D T Mathes, F I S (Lond); B Sc; Dip Stat (Vid); Dip. Bio (Reading)

### *Senior Biometrician*

T S G Peiris, B Sc;  
M Sc (Canterbury, NZ); F R S (UK)

### *Senior Field Assistant*

M E R Fernando

### *Lab and Field Assistants*

### *Analyst Programmer*

H P de Zoysa, B Sc

### *Technical Assistant*

J D J S Kularatne \*\*

A Dasanayake  
W E R C Fernando  
U T G Fernando  
W M L G Fernando  
B P Fernando  
D T Fernandopulle  
W K M K Herath  
F H A J R Silva  
J Wijedasa

## Tissue Culture Division

### *Officer-in-Charge*

Mrs W N I S C Fernando, M Sc (Russia)

### *Research Assistants*

Mrs L K Weerakoon, B Sc \*\*  
Mrs V R M K Arachchi, B Sc Agric

### *Technical Assistants*

Mrs C K A Gamage  
E S Santha

## Plant Physiology Division

### *Head*

Mrs C Jayasekera, B Sc; Ph D (Qld)

*Assistant Plant Physiologists*

N P A D Nainanayake, B Sc  
Miss C S Ranasinghe, B Sc

*Technical Assistants*

Miss W P K K Fernando  
R D N Premasiri  
Miss P S A de Saram  
L R S Silva

**Information Services Division**

*Officer-in-Charge*

P A Henry Nimal Appuhamy, B Sc Agric; M Sc (Reading)

*Assistant Information Officer*

J L J G Pinto

*Clerk/Typist*

R A L C Fernando

**Coconut Information Centre & Library**

*Librarian/Project Leader*

M J C Perera, ALA

*Assistant Librarian*

Mrs P A S F Perera, B Sc

*Clerk/Typist*

Miss S N Gunathilake

*Library Assistants*

Mrs P D U C Dharmapala  
Miss T I I Peiris

*Machine Operator*

W G L Rodrigo

**ADMINISTRATION**

*Deputy Director (Administration & Finance)*

D G Manamudali, B A; LICA

## Establishment Unit

### *Administrative Officer*

P Daluwatta

### *Administrative Assistants*

T Gunadasa  
M Leelaratne, B A

### *Supplies Officer*

P Premaratne, B A

### *Secretary to the Chairman*

Mrs T M H Fernando

### *Chief Clerk*

Miss H D Mangalika, B A

### *Clerks*

B M Dingiribandara  
A I F Fernando  
K P W Perera

### *Stenographers (English)*

Mrs M P Premaratne  
Mrs S Z Suhair

### *Supplies Assistant*

W F T Fernando

### *Clerk/Typists*

Mrs U I Abeysingha  
Mrs P C A Fernando  
Miss W S R Fernando  
Mrs M M F Fernando  
Mrs Laxmi Jayathilake  
Miss K P S Jayathilake  
Y H Wijesena

### *Telephone Operator*

I H Nelson

## Internal Audit Unit

### *Internal Auditor*

M M P Wijesekera, LICA; Dip B Mgt.;  
M A A T

### *Typist*

Mrs W J M D M A Dias

### *Internal Audit Clerks*

M R U Attanayake  
Mrs M M J R Fernando  
Mrs R D I Somasiri

## Accounts Unit

### *Accountant*

D R C M Handalage

### *Stenographer (E)*

Miss A Herath

*Accounting Assistant*

A S Nanayakkara

*Shroff*

H B Thalgahagoda

*Book-Keepers*

B M Jayathilakabanda  
Mrs K M A Nonis  
N H R Sarathchandra  
S M Sirisoma  
R D Sumanasiri

*Accounts Clerks*

Miss A S M S Abeywickrema  
Miss R H M Dilhani  
W P C Fernando  
Miss A A N P Kanthi

*Store Keeper*

M B Upali

*Clerk/Typists*

Mrs A R S Hettiarchchi  
Miss A A N P Kanthi  
P A Nonis  
Mrs J K F Perera  
Mrs C M B I Salwatura

*Clerk*

Mrs C Munasinghe

**Engineering Unit**

*Resident Engineer*

K N A S Perera, Dip (Mech Eng) T.

*Foreman (Electrical)*

M D Bernard Praxidus

*Foreman (Mechanical)*

M J M D S Jayawardena

*Foreman (Buildings)*

R M Dayaratne

*Draughtsman*

Mrs R M S Ratnayake

*Clerk/Typists*

Mrs K A P Chandani  
J A N Thushari

*Motor Mechanic*

R M S Gamini Ratnayake  
Ratnasiri Vithanage

*Clerk*

A I F Fernando

## Estate Management Division

### *Manager*

P S Liyanagama, B Sc Agric

### *Clerk/Typists*

Mrs N R Ayagama  
W P R R Fernando

### *Assistant Manager (Farms)*

K P de Silva  
A Thavaratnarajah

### *Field Assistants*

P P Jayasundara

### *Bandirippuwa Estate*

*Superintendent* - M R L A Perera

*Field Officer* - G B A Wijesekara

*Field Assistant* - W L B Silva

*Supervisors* - M J David  
H H D B K Dissanayake  
M P W Fernando  
M A Sunil Fernando

*Clerk/Typist* - H H J E Appuhamy

### *Ratmalagara Estate*

*Superintendent* - G Vithanage

*Field Officer* - W M U Ratnayake

*Supervisor* - M P W Fernando

*Estate Clerk* - R P Victor

### *Isolated Seed Garden*

*Superintendent* - S M Wijeratne Banda

*Lab & Field Assistant* - U V M Fernando

*Clerk/Typist* - J A R Reginold

***Pothukulama Research Station***

*Superintendent* - Vacant

*Supervisors* - M Chandrasoma  
T M Keerthiratne  
W M P Weerasekara

***Walpita Estate***

*Officer-in-charge* - Newton Gamage

***Makandura Estate***

*Superintendent* - A N Eknaligoda

*Field Officer* - D L S Nethasinghe

*Supervisor* - A G B G Silva

***Maduruoya Seed Garden***

*Superintendent* - Vacant

*Supervisors* - R A Suwarnathilake  
W A H Upali

**AGRICULTURAL RESEARCH PROJECT**

***Project Coordinator***

M Jeganathan M Phil

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\* When more than one officer is listed under a designation, the names appear in alphabetical order. Unless otherwise stated, all Bachelor's degrees indicated in the staff list are from Universities in Sri Lanka.

\*\* On study leave;                      \*\*\* On overseas no-pay leave.

## REPORT OF THE ACTING DIRECTOR FOR 1993

M de S Liyanage, Ph D

### 1. GENERAL

The year 1993, witnessed a poor coconut crop islandwide showing nearly 40% drop in the national production of coconuts, due to the unprecedented drought experienced throughout the country during the early part of 1992. Though the total annual rainfall during the year was less than in the previous year, its good distribution throughout the year would certainly have a positive impact on the national production in the next year.

The coconut land suitability studies to demarcate high potential areas for coconut cultivation and intercropping within the coconut triangle were completed during the year. The soil monoliths of the high potential soils and land suitability maps in the coconut triangle were prepared. These studies have contributed to a clear understanding on the performance of coconut in a given soil type and climate. In fact, the deep latosols (sandy loam soils) in the drier part of the coconut triangle would appear to be capable of producing high yields and substantial profits from coconut.

A very successful Workshop on Land Suitability Assessment of Coconut was held in Colombo for Research Scientists, Extension Officers and Policy Planners in the Coconut Sector. The importance of this study and its potential benefits, particularly to the Extension Staff in the implementation of Government-assisted programmes were highlighted at this Workshop. It also emphasized the application of site specific technology for improving coconut plantations. The land suitability criteria have been accepted by the Ministry of Coconut Industries and Crop Diversification as a policy guideline for the development of the coconut sector.

The four year research programme of the Institute launched in 1990 was completed at the end of the year. The Research Committee reviewed the divisional research programme in order to evaluate the progress made so far. Almost all field and laboratory experiments made satisfactory progress during the year. The majority of field experiments were located in estates belonging to the Coconut Research Board (CRI).

The Coconut Research Board (CRB) accepted in principle the importance of the "Composite Approach" as a management tool for monitoring and evaluating the research programme of the Institute. In recognition of the fact that the Institute already has a portfolio of research projects, information on monitoring of programmes and programme budgetary systems etc., the Council for Agricultural

Research Project/GTZ (German Agency for Technical Co-operation) project selected the CRI from the Plantations Sector for testing the 'Composite Approach Methodology'. This exercise would facilitate prioritization of the research projects and in the re-allocation of physical and human resources for research.

The Agricultural Research Project (ARP) funded by the World Bank continued to provide assistance to the Institute for the development of manpower and infrastructure facilities for research.

The Inter-Institutional Research Programme (IIRP) on Coconut Intercropping funded by the CARP completed its fourth year of operation and made satisfactory progress. The crop and farm models established in farmer's fields continued to provide the necessary feed back, with respect to crop and animal performance and socio-economic conditions at farm level. CARP also awarded a three year research grant for a collaborative project entitled "Intercropping coconut with selected medicinal plants" to be jointly executed by the CRI/CISIR (Ceylon Institute for Scientific and Industrial Research).

A training programme in scientific writing was organized for the research and other staff of the Institute, with a view to improving and developing the technical writing skills of personnel, particularly young scientists.

The CRI continued to provide technical assistance and advisory service to the estate sector involving the Differential Fertilizer Recommendation (DFR) package based on foliar analysis. These services have enabled the Institute to establish a closer link with the estate owners and plantation managers in the coconut sector.

The three seed gardens managed by the Institute continued to make a positive contribution to the national replanting programme by providing 1.025 million seed nuts during the year, satisfying about 30% of the national demand. The Institute also provided seed nuts to the estate sector which has the necessary infrastructure to establish nurseries and raise seedlings to meet its own requirement of planting material for replanting and underplanting. It is likely that this arrangement will facilitate the availability of more seed nuts for meeting the increasing demand for coconut seedlings in the future.

On the request of the Ministry of Coconut Industries and Crop Diversification, a corporate plan comprising a medium term programme and budget proposals for the period 1995 to 1999 was prepared for the CRI.

The Ministry of Coconut Industries and Crop Diversification in consultation with the CRI formulated a new salary scheme applicable to the employees of the Institute, which was implemented at the beginning of the year.

It was noted that the Government grant for this year was only Rs. 49 million which is far below the amount required. It is noted with great satisfaction the excellent progress made by the authorities in resolving the salary anomalies, which were created when the salaries were revised in 1988.

## 2. THE COCONUT RESEARCH BOARD

During the year, the Board functioned under the Chairmanship of Mr Naomal S Dias and held eleven meetings (from 247th Meeting to 257th Meeting). The Board was reconstituted in June for a period of three years and Mr Naomal S Dias was re-appointed as the Chairman by the Hon. Minister of Plantation Industries. The Hon. Minister of Plantation Industries also appointed Mr P Kalupathirana, Chairman, Coconut Cultivation Board (CCB) as the Observer Member to the Board.

The membership and attendance at (number of meetings attended/number of meetings held) meetings are as follows:

Mr Naomal S Dias (Chairman)	(11/11)
Vidya Jyothi Dr C R Panabokke	(10/11)
Vidya Jyothi Mr P R Wijewardena	(07/11)
Mr J L Amaratunga	(11/11)
Mr D V Jayasuriya	(08/11)
Mr G P P N Perera	(07/11)
Mrs M B Ekanayake*	(08/11)
(Treasury Representative)	
Mr A S Ranatunga (upto June 15)	(05/11)
Dr G W E Fernando (from December, 01)	(01/11)
Mr S Vithanage**	(11/11)
(Ministry Representative)	
Mr P Kalupathirana (from June, 15)	(01/06)

\* Ex-officio Member

\*\* Observer Member

All other Members of the Board prior to June 15 were re-appointed by the Hon. Minister of Plantation Industries except Mr Ranatunga who was

replaced by Dr G W E Fernando, former Director of Agriculture. The Board expressed deep appreciation of the contribution made by Mr Ranatunga during his term of office.

Some Board Members participated at the Land Suitability Field Workshop covering Kakkapalliya, Panduwasnuwara and Andigama, which was found to be very useful and informative with regard to the performance of coconut in relation to different soil types.

Out of the eleven Board Meetings, six were held at the CRI, three at the Coconut Development Authority (CDA) in Colombo and two at the Isolated Seed Garden Ambekelle.

Dr R Mahindapala, Director, Coconut Research Institute continued to function as the Secretary to the Board.

### **3. COMMITTEES OF THE COCONUT RESEARCH INSTITUTE**

#### **3.1 The Research Committee**

The Research Committee held one meeting to review the progress of the implementation of the research programme.

The membership of the Committee and attendance at (number of meetings attended/number of meetings held) meetings are as follows:

Mr Naomal S Dias (Chairman)	(1/1)
Vidya Jyothi P R Wijewardena	(0/1)
Dr U Pethiyagoda	(1/1)
Vidya Jyothi Dr C R Panabokke	(1/1)
Mr A S Ranatunga	(1/1)
Mr K Karunanayake	(1/1)
Dr G W E Fernando	(1/1)
Prof Y D A Senanayake	(0/1)
Mr W L Bogtstra (Wayamba Plantations Ltd)	(1/1)
Mr C C de Silva (Kurunegala Plantation Ltd)	(1/1)
Director/CRI	(1/1)

In the absence of a Deputy Director (Research), Dr R Mahindapala Director/CRI, functioned as Convenor and was present at all meetings.

Some Members participated in the field visit to inspect the progress of crop/farm models in Gampaha, Kurunegala and Puttalam Districts.

### **3.2 Administrative Committee**

The Administrative Committee met twice during the year to consider administrative matters referred to it and to advise the Board.

The membership and attendance of the Committee (number of meetings attended/number of meetings held) are as follows:

Mr J L Amaratunga (Chairman)	(2/2)
Mr Naomal S Dias	(2/2)
Mr G Bambaradeniya	(0/2)
Mr S Vithanage	(2/2)
Director/CRI	(2/2)

Mr D G Manamudali, Deputy Director (Administration & Finance) continued to function as Convenor and was present at all meetings.

### **3.3 Estates Committee**

The Estates Committee held four meetings and made nine inspection visits to CRB properties during the year and continued to monitor the data recording systems, cost control methods and the progress of field work. The agricultural conditions of the estates and seed gardens were further improved on the advice given by the Committee.

The membership and attendance of the Committee (number of meetings attended/number of meetings held) are as follows:

Mr G P P N Perera (Chairman)	(4/4)
Mr J L Amaratunga	(4/4)
Mr D V Jayasuriya	(4/4)
Director/CRI	(3/4)

Mr P S Liyanagama, Manager (Estates) functioned as the Convenor and was present at all meetings.

### **3.4 Other Statutory Committees**

#### **3.4.1 Provident Fund Committee**

The Provident Fund Committee met regularly to attend to matters related to the administration of the Staff Provident Fund and disbursement of loans. Messrs D T Mathes and P P Fernando were the Member Representatives in the Committee while Messrs R M G D Rajapakse (upto March) and R C M Hendalage (from June) functioned as the Board's Nominee. Mr D G Manamudali continued to function as the Secretary.

The membership and attendance (number of meetings attended/number of meetings held) at the meetings are as follows:

Mr Naomal S Dias (Chairman)	(7/7)
Dr R Mahindapala, Director/CRI	(5/7)
Mr D T Mathes	(7/7)
Mr P P Fernando	(5/7)
Mr R M G D Rajapakse (upto March)	(1/2)
Mr R C M Handelage (from June)	(3/5)
Mr D G Manamudali (Secretary)	(7/7)

An interest rate of 18.5% was declared for the members for 1992.

#### **3.4.2 Board of Trustees - Medical Aid Scheme**

The Board of Trustees met regularly to attend to matters relating to the administration of the Medical Aid Scheme which continued to provide relief and assistance to the Members. Dr W M U Fernando and Mr A S Nanayakkara were member Nominees in the Board of Trustees. The Board's contribution to this scheme was Rs. 824 072.65

The Members and attendance (number of meetings attended/number of meetings held) at meetings are as follows:

Dr R Mahindapala (Chairman)	(10/12)
Mr D G Manamudali	(10/12)

Dr W M U Fernando	(06/12)
Mr A S Nanayakkara	(09/12)
Mr P Daluwatta (Secretary)	(12/12)

The Medical Aid Scheme conducted one dental clinic and one eye clinic for the Members and their families under the general health-care scheme, and a sum of Rs. 1,67475 was disbursed to the Members.

#### 4. THE COCONUT RESEARCH INSTITUTE

A brief report of activities of the Coconut Research Institute is given below:

##### 4.1 Agronomy Division

During the year 23 field experiments were continued and research projects involving intercrops and nitrogen fixing trees were managed satisfactorily.

Much emphasis was given to the management of nitrogen fixing trees and creeping covers for substitution of inorganic N fertilizers for coconuts and supply of organic matter for improvement of soil fertility. *Gliricidia* planted with seedlings performed better and produced 9/kg/tree/year, while *Gliricidia* planted with cuttings produced only 7/kg/tree/year. Further *Gliricidia* established four years ago in coconut avenues has not shown any adverse effects on the yield of coconuts. In another experiment it has been shown that replacement of artificial N requirement of a coconut palm with 35 kg of fresh *Gliricidia* foliage is possible from trees planted *in situ*. Management of creeping covers (*Pueraria*) with different management practices under coconut in the wet zone showed that N requirement of the coconut palm can be satisfied with *Pueraria* grown *in situ*.

Studies on the establishment of new seedlings in the Dry Zone have shown that seedlings grown in association with *Pueraria* and *gliricidia* showed better establishment and growth performance compared with seedlings planted without the legume components.

The study on the Biological Nitrogen Fixation of tree legumes was continued to estimate the capacity of N fixation of selected tree legumes. Twenty crop/farm models were maintained during the year and economic analyses have shown that semi-perennial crops (eg. pineapple, banana, ginger) are more profitable than traditional perennial crops (eg pepper, coffee). Further it has been shown that

intercrops do not adversely affect coconut if the soil moisture and plant nutrients are maintained at satisfactory level.

Mulberry continued to perform well under coconuts giving 13 - 14 mt/ha/year of fresh leaf yield with five prunings. This represented a 9% increase over the previous year.

A new experiment was established to study the feasibility of intercropping medicinal plant species under mature coconuts in the Wet Zone.

The experiments to investigate the effect of different types of organic matter on leaf scorch decline (LSD) palms in the Wet Zone showed no significant response to treatments.

#### 4.2 Genetics and Plant Breeding Division

The attempt to increase the nut size in palms at the Isolated Coconut Seed Garden (ISG) made further progress, when progenies arising from hand-pollination were planted in Field 14 of ISG. Crosses between palms selected for stability in nut size and nut number are expected to maintain their nut size under adverse soil water deficit.

The total quantum of rainfall received at ISG during the year (1296 mm) was 400 mm less than in the previous year (1696 mm) with January, February, June, July and August receiving little effective rain. The crops peaked in May/June, in response to the weather pattern of 1992, and was different to the pattern followed in the previous year, where crops peaked in March/April. There was clear evidence, that the cropping pattern at the ISG is strongly influenced by the agro-ecology. The trend to increased nuts on both *dwarf* and *tall* palms, recorded since 1991 continued and the *talls* produced on average of 87 nuts/palm. This was still lower than the maximum recorded in 1989 (109 nuts/palm) following a more favourable distribution of rainfall.

The evaluation of the cultivar trial at Bandirippuwa was severely affected by an adverse soil water deficit. However, in the trial at Thammenna where palms had access to deep soil water, the hybrids (*DG x T* and *DY x T*) maintained their superiority over the tall cultivars and continued to produce around 8 to 10 kg of copra per palm in the 9th year. Early data on growth and yield indicated that under sub-optimal environmental conditions, the improved cultivar *T x T* and the plus palm (mother palm) tall performed similarly which supports the

hypothesis (eco-bank concept) that the genetic diversity of ecologically adapted local material should also be maintained through their selection and propagation within an area with the same agro-ecology. This information will also be useful in emphasizing the need for more site-specific recommendations in coconut culture. The eco-bank concept was further promoted during the year and many populations showing promise were identified for selection and conservation during the coming years. Experiments were also initiated to study the combining ability of some promising germ plasm accessions with selected *tall* palms at ISG.

The progeny trials at Bandirippuwa and Rathmalagara received differential levels of fertilizers from this year, to evaluate their suitability in different farming systems. The superiority of hybrids over *Talls* was again apparent in the progeny trials, with crosses involving San Ramon, showing conflicting results, apparently influenced by the agro-ecology in which each trial is conducted.

The search for superior coconut genetic material both indigenous and introduced, continued under the coconut genetic resource conservation programme. Purified material from Razeena Estate, Akuressa (Mahena accession) was planted at the conservation site in Poththukulama. Sri Lanka participated actively in the development of the International data-base on coconut genetic resources set up under the auspices of the Coconut Genetic Resources Network (COGENT) of the International Plant Genetic Resources Institute (IPGRI).

#### 4.3 Soils and Plant Nutrition Division

Eleven field experiments and three laboratory/glasshouse studies on nutritional, soil physical and water use aspects of coconut progressed satisfactorily. A new experiment was commenced on the 'Characterization of the physical properties of coconut growing soils and the studies on the development of coconut roots' funded by a grant from the CARP.

Results of the N x K x Mg experiment on coconut seedlings showed an increasing trend in the leaf production with high levels of nitrogen treatments when compared with high potassium and phosphorus treatments.

Studies showed that adding organic manures improved the availability of Magnesium (Mg) from dolomite. Poultry litter gave the highest Mg value while *Gliricidia* showed the lowest (when compared with cow dung and artificial fertilizers). The study also indicated that these organic manures contain considerable amounts of Mg which could be used in order to minimize the application of Mg fertilizer for coconut.

Application of *Gliricidia* was shown to increase the soil nitrogen levels in the top soil than in the sub soil. However, *Gliricidia* planted within the plots and applied to coconut palms has shown that the nitrogen levels have increased in the top soil as well as in the sub soil.

A pot experiment was set up for evaluation of soil phosphorus (P) status of various soil types using *Pueraria phaseoloides* and Pangola grass as indicator plants. Ten different soil series were used for the experiment. The response to applied P in each soil series was assessed using the Chaminade Index. Analysis of P results are in progress.

The land suitability mapping project was continued in the Kurunagala, Puttalam and Gampaha Districts. During the period, areas of Wariyapola, Kurunagala, Nalanda and Gampaha were surveyed and mapped. There were about 70 soil series within the survey area. Based on the potential coconut yield of each soil series, soil characteristics and agro-ecological regions in which each soil series occur one inch sheets were used in each District to categorize these areas in to different land suitability classes varying from S1 - S5 depending on the production potential of coconut.

Land form units were identified by air photo interpretation and the relationship between different kinds of soils and different land form units were then established. These relationships were used for mapping of the soil series.

During the year, DFR service was provided to 285 large coconut estates (> 50 ac) covering an area of about 10100 ha. The computer model for the Differential Fertilizer Recommendation (DFR) was further refined to include soil analyses data and land suitability classes.

#### 4.4 Crop Protection Division

Field evaluation of the insecticides, monocrotophos, methamidophos, carbofuran, and carbosulfan for relative effectiveness for black beetle control is in progress. Results obtained so far revealed that there was a marked reduction of the insect damage to the coconut palm due to insecticidal treatment.

The field study on evaluation of application methodology and four concentrations of Chlorpyrifos to control termites in nurseries was completed. Dipping seednuts in an appropriate concentration of chlorpyrifos for 3 minutes prior to planting was found to be superior to the spraying method. Three to five ml of chlorpyrifos in one liter of water was found to be the best concentration for termite control and this was released as a new recommendation.

Studies on the effect of plant extracts (biopesticides) on termites is in progress. Laboratory investigations indicated promising results in termite control with castor seed and ginger rhizome extractions.

Studies on the effect of nutrient content of coconut leaves in relation to black beetle attack showed that high damage was associated with palms containing low nitrogen (N) and magnesium (Mg) levels in leaves.

Evaluation of systemic fungicides against *Ganoderma* root rot disease is being continued. Field investigations on the use of dazomet (Basamid G) as a fumigant for coir dust were concluded. Basamid suppressed the fungi and nematode populations in the coir dust medium for a period upto four weeks.

Studies on bee keeping in coconut plantation is being continued. Bee colonies at Walpita Estate (intercropped) performed better than the colonies in Bandirippuwa Estate (monocropped).

Preliminary studies on the activity patterns of parasitoids of coconut caterpillar are in progress. Studies on coconut scale and its natural enemy complex are being continued. A new species of scale parasitoid was recorded.

A new trap was developed for red weevil and work is now in progress to redesign the trap to reduce costs.

During the year crop protection services were provided to control coconut caterpillar black beetle, coconut scale and the weed *Chromolaena odorata* ('Podisinghomaran').

#### 4.5 Tissue Culture Division

In experiments on clonal propagation of coconut, immature zygotic embryo explants consistently showed somatic embryogenesis. Difficulties in shoot development were observed from time to time. Somatic embryos derived from leaf explants gave rise to callus which in turn produced either shoot-like structures or haustorial type tissues.

Root cultures were continued to select a basic medium for callogenesis from root tips.

The investigations on optimized rhyso-genesis gave encouraging results and indicated a beneficial effect of concentrated auxin solutions on rhyso-genesis.

The comparative study on the response of putative drought tolerant parental palms and their open pollinated progeny to water deficit was continued. Fifteen embryo cultured seedlings that survived different water stress conditions were planted in the germplasm conservation block of Poththukulama Research Station.

The effect of household sugar and fertilizer grade potassium chloride on embryo cultures was tested.

Raising of embryo cultured seedlings of '*dikiri pol*' was continued during the year.

The research programme of the Division was reviewed by a Panel of Scientists appointed by the Board.

#### **4.6 Plant Physiology Division**

During the year studies on water-use efficiency (WUE) of the coconut palm were carried out with satisfactory progress. *In situ* photosynthesis measurements and leaf sampling were completed for 300 young coconut palms growing in the germplasm conservation trials planted at Poththukulama Research Station, Bandirippuwa Estate and the progeny trial at Mangalaeliya Estate. Stable carbon isotope discrimination ratio of collected samples were analyzed with the assistance of the International Atomic Energy Agency. Potential use of <sup>13</sup> C discrimination as a selection tool for high yield and water use efficiency is in progress.

Field evaluation of Ambakelle Special and T x T seedlings was continued. One Ambakelle Special young palm came into flowering this year. The routine photosynthetic and total canopy area measurements of the young seedlings collected throughout the years will be utilized, to determine the optimum canopy size and changes in assimilation pattern at the bearing stage of coconut seedlings. A new glasshouse experiment was established with the seednuts obtained from the selected palms for drought tolerance at ISG. This experiment will be used to determine the relationship between water-use efficiency and carbon isotope discrimination in

coconut seedlings. The experiment on optimum canopy and root size for maximum productivity entered its third year of operation. Preliminary results on the effect of canopy and root pruning on final nut yield and female flower production revealed that pruning of 50% of the leaflets from the proximal end of the fronds in 60% of the lower most mature fronds has no significant effect on the final yield, whereas pruning of 25% of roots in the manure circle area down to a depth of 0.5 m showed a decreasing trend in nut yield.

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Studies on CO<sub>2</sub> assimilation and water relations of the coconut palm were continued with satisfactory progress.

Experiments on field evaluation of embryo-cultured seedlings and amputated polybagged seedlings were continued.

#### 4.7 Biometry Division

The Division continued to assist the Research Divisions in designing field experiments, analysis and interpretation of data.

A simple model was developed to estimate the solar radiation at Bandirippuwa Estate, using sunshine duration. This method is more flexible than the existing method of Angstrom formula.

The calibration trial recorded a 25.4% decrease in the total number of bunches as compared to 1992. The year recorded a drop of 54% in the number of nuts per palm over the previous year. The copra yield was 1632.3 kg/ha as against 2877.2 kg/ha, recorded in 1992.

The trial on monthly harvesting of coconut recorded 41.2% increase in number of bunches as compared to two monthly harvesting. The increase recorded for the number of nuts was 28.4%.

Assistance was provided to various Divisions on the use of data based packages and statistical packages.

The three Agro-meteorological stations at Bandirippuwa Estate, Ratmalagara Estate and Isolated Seed Garden were maintained satisfactorily. A fairly good distribution of rainfall was recorded in all three stations. An increase in yield for these three stations could be anticipated during 1994.

#### **4.8 Multi-disciplinary Projects**

##### ***Premature Decline of Palms***

Three experiments on leaf scorch decline (LSD) continued with satisfactory progress. Studies on the root system of healthy and LSD palms revealed that LSD palms have significantly lesser number of active roots than healthy palms. Also the number of active roots decreased with increasing severity of symptoms. A new experiment was established to determine the effect of applied cytokinin on canopy vigor and the physical status of treated LSD palms were monitored regularly. Preliminary results of the rehabilitation of LSD palms at Walpita Estate showed no significant effect on the recovery or improvement of the status of LSD palms by organic manure treatments.

##### ***Immature Nutfall***

Studies related to physiological characters of the coconut palm in relation to Immature nutfall were continued with good progress. Water relations, root water extraction pattern and net assimilation studies of the coconut palm throughout the year confirmed that soil water availability to supply the canopy demand and the vapour pressure deficit (VPD) between leaf to air are the main factors which influenced carbon assimilation. The general growth pattern of the developing nuts was not altered during the dry period. However, limited availability of assimilate was compensated by shedding of more immature nuts.

#### **4.9 Estate Management Division**

Administration and management of agricultural land at the Head Office and outlying units come under the purview of the Division. Accordingly, four estates, three seed gardens and the demonstration farms were managed by the Division. In deference to a decision taken by the CRB, the Research and Demonstration Farm in Minneriya was handed over to the Coconut Cultivation Board during May. The Passekudah Research and Demonstration Farm continued to be out of control (since June 1990) on account of the terrorist activities in the region.

The rainfall during the year has been satisfactory with a good distribution throughout the year at all stations. Heavy rains during the latter part of the year caused temporary water-logged conditions at the Isolated Seed Garden and at Poththukulama Research Station.

The adverse effect of two consecutive droughts in the first quarter of 1991 and 1992 on palms was clearly manifested by the reduced yield with an overall drop of about 8% over that of the previous year, the worst affected being Makandura Seed Garden showing a drop as high as 83% followed by Walpita Estate with a 40% drop and Rathmalagara Estate least affected with a 1% drop in yield. In contrast, Isolated Seed Garden, Ambakelle recorded an overall increase of 7% in yield. This increase can be attributed to the intensive soil and moisture conservation practices adopted. Maduru Oya Seed Garden did not suffer from the drought as it has an assured supply of water for irrigation and with the older plantation approaching full bearing status, a general trend of increasing yield is observed.

From the three seed gardens, a total of 1,003,340 seed nuts had been supplied during the year, which recorded a decrease of 10% over the previous year.

The Differential Fertilizer Recommendations (DFR) were followed in all properties. The localized deficiency symptoms of nutrients, mainly Mg and K have been corrected by spot application of appropriate fertilizer ingredients. In addition to the DFR, organic manuring was confined only to young palms.

In all properties, agricultural conditions were maintained satisfactorily. The recommended cultural practices were carried out. Emphasis has always been placed on soil moisture conservation practices.

The polybagged coconut seedlings continued to be a popular source of high quality seedlings. Although nearly 6700 seedlings were supplied during the year, the demand was much higher.

#### **4.10 Information Services Division, Library and Coconut Information Centre**

The Division continued to function in the transfer of CRI recommendations to the coconut sector. During the year several one day training programmes for the staff of the coconut estates, and Research Extension Dialogues between CRI and CCB Staff were organized for the first time. Also, several field days, seminars and other extension programmes were conducted during the year. One issue of the Coconut Bulletin (Vol. 8 No. 1 & 2) and "Pol Pawath" (Vol. 14 No.1 & 2) were in print. The Division also participated in several exhibitions. Due to heavy demand, the guide book on Coconut Cultivation (English) was reprinted.

A large number of coconut estates were inspected on request and necessary advice was given.

Routine services of the Library were conducted uninterrupted and satisfactorily throughout the year. The periodical section was reorganized after weeding out the less used journals.

The Coconut Information Centre activities were satisfactorily continued with proper management of the databases and information dissemination service.

The Library's role as the coordinating centre of the Agricultural Information Network (AGRINET) was performed satisfactorily with additional activities such as participation of external exhibitions and coordinating user seminars, etc.

#### **4.11 Administration Division**

The Budget expenses during the year was 66.7 million, made up of 55.2 million as Recurrent Expenditure and 11.5 million as Capital Expenditure. The total revenue (excluding transport) for the year was 17.7 million. The Government grant was Rs. 49 million.

The normal welfare activities were continued. The employer - employee relationship was cordially maintained. Identified surplus staff of 17 were offered the Bulumulla Package and 10 of them accepted the offer and left the services voluntarily.

The Staff Provident Fund and Medical Aid Scheme progressed satisfactorily.

Maintenance work of buildings, electricity, vehicles and machinery were carried out by the Engineering Unit satisfactorily.

### **5. OUTSIDE FUNDED PROJECTS**

#### **5.1 AGRICULTURAL RESEARCH PROJECT**

The Agricultural Research Project (ARP) funded by the World Bank and administered by the Ministry of Agricultural Development and Research

continued the activities on the development of the infrastructural facilities at the Institute.

All deficiencies in the civil works carried out at the Institute's Head Quarters have been satisfactorily rectified. This included the auditorium, screen house and quarters. Tender evaluation for the construction of a field laboratory, office and chemical stores at the Isolated Seed Garden, Rajakadaluwa is being finalized.

Two officers completed their postgraduate (Ph D) programmes overseas while one other has been awarded a fellowship to read for the M Phil overseas.

The Project continued to provide spares for equipment, library books, office equipment and furniture.

## **5.2 Other Projects**

The International Atomic Energy Agency (IAEA) continued to provide two research grants under the Technical Co-operation Programme (TCP) and Contract Research Projects (CRP).

The Inter-Institutional Research Programme (IIRP) on Coconut Intercropping progressed satisfactorily with regular project monitoring reviews. The Project Steering Committee also visited crop/farm models in the Gampaha, Kurunegala and Puttalam Districts.

The Sri Lanka Council for Agricultural Research Policy (CARP), awarded a research grant under the contract research programme.

## **6. EXTENSION ACTIVITIES**

The second diagnostic survey on coconut growers problems and the compilation of the report were completed during the year. This report raised some important issues affecting the coconut small-holders that will require immediate attention of the research staff.

For the first time, the Institute launched several Research Extension Dialogues (RED) between the Research Staff of the CRI and Extension Staff of the CCB, in order to update the knowledge of the Extension Officers and to find

immediate solutions to the field problems encountered by the coconut growers. It would also encourage closer interaction among researchers and extensionists of the two Boards.

The Institute also produced a documentary video film on coconut entitled 'Kapruka Surakimu' for telecasting over Rupavahini, in order to demonstrate the CRI recommended agricultural practices and to update the knowledge of the coconut growers and the general public.

The Institute introduced a series of one day training programmes on specific topics in order to cater to the needs of the growers who would prefer special training in a topic of their choice.

The Institute also organized a series of lectures and demonstrations for the first batch of students following the National Diploma Course in Plantation Management offered by the Affiliated University Colleges at Kuliypitiya and Rahangala.

## 7. VISITORS

The important visitors to the Institute include the following.

Dr N de Alwis	- Department of Agriculture
Dr P Abeyagunawardna	- University of Peradeniya.
Dr G D Bowen	- International Atomic Energy Agency and Expert from Adelaide Australia.
Mr D M K Bandara	- National Institute of Plantation Management.
Mr C P Cheng	- Malaysia.
Dr R L de Silva	- Consultant, Colombo.
Mr M Elfferich	- The Netherland.
Mr D E F Fernandez	- NARESA , Colombo.
Mr J X Grussenmeyer	- France.
Dr P P Hardcastle	- University of Aberdeen, United Kingdom
Mr Hornung	- Wye Collage, United Kingdom
Mr H J Holler	- Germany.
Mr M S Jayasinghe	- Secretary, Ministry of Coconut Industries & Crop Diversification.
Dr S H Justin	- Wye College, United Kingdom.
Mr A Karunaratna	- Coconut Development Authority, Colombo.
Dr A H Khan	- CAB International, United Kingdom

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|------------------------|---|
| Dr S Krishnapillai     | - Tea Research Institute, Talawakelle.                          |
| Mr J A M Karunaratna   | - Integrated Rural Development Project, Gampaha.                |
| Mr D Liyanage          | - Ministry of Coconut Industries & Crop Diversification.        |
| Mr B Moir              | - Food & Agricultural Organization, Rome.                       |
| Mr P Nath              | - Food & Agricultural Organization, Rome.                       |
| Mr D Nilaweera         | - Secretary, Ministry of Agricultural Development and Research. |
| Mr T Nibe, J I C A     | - Japan.  |
| Mr L B Ojikudu         | - Nigeria.  |
| Mr S Philip            | - University of Aberdeen, United Kingdom                        |
| Mr J P Shell           | - Food & Agricultural Organization office, Colombo.             |
| Mr L I Sheng           | - China.  |
| Mr S M A Senanayaka    | - Pecrodep, Kandy.  |
| Mr M K Sabri           | - Asian Development Bank, Bangladesh.                           |
| Dr H Somapala          | - Central Agricultural Research Institute, Gannoruwa.           |
| Dr S Somasiri          | - Department of Agriculture, Peradeniya.                        |
| Mr S R Venner          | - United Kingdom  |
| Mr W L Van Schie       | - The Netherland.   |
| Mr N M Van Schie       | - The Netherland.   |
| Mr D Vernon            | - ISNAR, The Hague.   |
| Dr D T Wettasinghe     | - GTZ, Team Leader, Colombo.                                    |
| Dr U Pde S Waidyanatha | - Perrinial Crop Development Project, Kandy.                    |
| Dr G Wadasinghe        | - University of Peradeniya.                                     |
| Mr R Yatawara          | - Hayleys Ltd., Colombo.  |

## 8. ACKNOWLEDGEMENTS

The Co-operation given by the Deputy Director (Admin. & Fin) and Staff of the Coconut Research Institute in the successful implementation of the programme of work is gratefully acknowledged.

The valuable contributions made by the Chairman and Members of the Board and those who served at various Committees is acknowledged with deep appreciation.

The continued support given by the following organizations is also acknowledged.

Ministry of Coconut Industries and Crop Diversification.

Ministry of Plantation Industries

The Agricultural Research Project of the Ministry of Agricultural Research and Development.

The British Council and the Overseas Development Administration.

Coconut Development Authority

Sri Lanka Council for Agricultural Research Policy

GTZ/CARP Project

International Atomic Energy Agency

Asia & Pacific Coconut Community

Natural Resources, Energy and Science Authority of Sri Lanka

National Institute of Plantation Management

Rupavahini Corporation

National Livestock Development Board

Sri Lanka Cashew Corporation

Wayamba Plantations Ltd

Kurunegala Plantations Ltd

## REPORT OF THE AGRONOMY DIVISION

Head - D N S Fernando, Ph D

### 1. GENERAL

On farm research projects were given priority. This programme gives a greater opportunity for research personal to interact with farmers to identify their problems in managing intercrops under coconut. Further, reasons were sought for the low adoption rate of cropping models by the farmers despite the attractive profits generated by proposed models. Trials were continued with the use of leguminous crops as green manure and possibilities of incorporating NPT trees such as *Gliricidia* into crop models were also tested.

The International Atomic Energy Agency (IAEA) in Vienna and the Council For Agricultural Research Policy (CARP) continued their financial support for several on-going projects on Biological Nitrogen Fixation and Adaptive Research Trials on farming systems involving intercrops, intercrops with animal husbandry and medicinal plants under coconut.

### 2. RESEARCH PROJECT

#### PROJECT 1: STUDIES ON THE IMPROVEMENT OF SOIL ORGANIC MATTER STATUS AND WATER HOLDING CAPACITY

Experiment 1.10: Effect of three methods of management practices on the performance of *Pueraria phaseoloides* and their effects on coconut production - 1992

Experiment 1.10.1: Saddhatissa Estate, Divulapitiya (Wet Zone Lateritic soil) - 1992

The following treatments, applied in 1992 were repeated again in 1993 on the cover crop *Pueraria Phaseoloides* to compare their performance under different management practices and effects on coconut production.

- T<sub>1</sub> - *Pueraria* lopped and applied to coconut palms
- T<sub>2</sub> - *Pueraria* shaded to control excessive growth
- T<sub>3</sub> - Light harrowing of *Pueraria*
- T<sub>4</sub> - Coconut only (control)

During the year the growth of *Pueraria* was very promising and per palm contribution (from a coconut square) of fresh material was 50 - 55 kg.

However, analysis of coconut yield data have not shown significant differences between treatments on nut or copra yield. Coconut palms were fertilized with the DFR mixture during the year.

The experiment is in progress.

*D N S Fernando, H P S Jayasundera, & K C P Perera.*

**Experiment 1.10.2:** Pothukkulama Research Station. Pallama (Dry Intermediate Zone, Sandy loam soil) - 1992

During the year growth of *Pueraria* was very poor. Therefore the treatments were not imposed and *Pueraria* had to be planted several times as newly emerged seedlings were destroyed by snails breeding in large numbers in the estate.

*D N S Fernando, H P S Jayasundera, & H A Abeysoma.*

**Experiment 1.11:** Comparison of biomass yield of *Gliricidia* cuttings and seedlings and their effect on coconut yield - 1989

Results indicate that *Gliricidia* trees raised from seedlings continued to perform better than those from cuttings, giving a fresh biomass yield of 7 kg-tree-year under coconut. In response to management treatments, trees pruned at three monthly intervals produced the highest biomass. Of the two type of planting material, trees raised from seedlings produced 9 kg-tree-year compared to 7 kg-tree-year from cuttings.

Records on nut yield data maintained suggest that intercropping with *Gliricidia* has no significant effects on the nut yield.

The experiment is in progress.

*M de S Liyanage & R Marasinghe.*

**Experiment 1.14:** Effect of tree management on BNF in *Gliricidia* and *Leucaena* grown under coconut - 1992

In the short-term study, five trees each of *Gliricidia*, *Leucaena* and *Cassia* grown under coconut were harvested, one year after <sup>15</sup>N application. The harvested material was separated into different plant components and weighed. Of the three species, *Gliricidia* and *Cassia* produced the highest total fresh biomass yield of around 6 kg/tree. The ground samples of each species were sent to

Siebersdorf Laboratory in Vienna for  $^{15}\text{N}$  analysis and estimation of biological nitrogen fixation in one year old legume trees.

In the long term experiment, initial pruning of legume trees was done one year after planting at 1 m height, followed by the application of 10%  $^{15}\text{N}$  enriched ammonium sulphate fertilizer in solution. At four and six months after  $^{15}\text{N}$  application, trees were pruned again to determine above ground biomass yield. At four monthly pruning interval, *Gliricidia* produced the highest biomass dry matter yield of 0.71 kg/tree followed by *Leucaena* while *Cassia* recorded the highest biomass dry matter yield of 1.25 kg/tree, in response to six monthly pruning treatments. At each pruning time, a sample was taken for  $^{15}\text{N}$  analysis and estimation of biological nitrogen fixation.

The experiment is in progress.

*M de S Liyanage, D N S Fernando, H P S Jayasundara, & H A Abeysoma.*

## **PROJECT 2: REHABILITATION OF LOW - YIELDING PLANTATIONS**

**Experiment 2.2.3: Effect of cultural operations designed to induce root formation on rehabilitation of low yielding plantations, Rathmalagara Estate, Madampe - 1993**

Based on the results of two previous experiments (2.2.1 & 2.2.2 terminated in 1990) the experiment was designed to induce new root formation by pruning older roots and replacing hard lateritic gravel soil with materials favorable for root growth. Quarter circle trenches of 60 cm deep and 30 cm wide were cut either at 30 cm or at 60 cm away from the base of the palm. The trenches were filled separately with green manure, cow dung choir dust (all these were mixed with top soil at 1:1 ratio) and top soil. Recording of data on growth performance of coconut palms were commenced during the year.

The experiment is in progress.

*D N S Fernando, T G L G Gunasekera, & K C P Perera.*

**Experiment 3.3: Development of suitable cropping system to increase productivity of new planting/replanting. Poththukulama Research Station, Pallama - 1990**

Results showed that the growth of coconut palms was not-adversely affected by hedge rows of *Gliricidia* and *Leucaena* raised from seedlings. The

growth of *Gliricidia* and *Leucaena* trees was managed by pruning three times during the year at 1 m height. Of the two species, *Gliricidia* produced a higher fresh biomass yield of 22 kg/tree/year compared to *Leucaena* (18 kg/tree/year), which was used as a green manure for effective palms.

As an annual crops, *Cassava* was established in the alley between hedgerows without coconut, which produced a fresh tuber yield of 3.5 t/ha.

The experiment is in progress.

*M de S Liyanage, H A J Gunathilake, & M J I Costa.*

**Experiment 3.4: Effect of cultural practices on the establishment and growth of coconut seedlings in the Dry Zone. Pothtukulama Research Station - 1990**

As in the previous year (1992), different management treatments continued to show a positive response on the growth of coconut seedlings, of which *Pueraria* cover had the most favorable effect on the palm. Each palm in *Gliricidia* plots was supplied with 50 kg fresh biomass while those in pitcher irrigated plots received 55 l of water during the dry period.

The experiment is in progress.

*M de S Liyanage, & M J I Costa.*

**Experiment 3.5: Study the feasibility of coconut/cashew mixed cropping in the Dry Zone, Kamandaluwa Estate, Andigama - 1991**

The growth performance of both crops, coconut and cashew in the five models were satisfactory. However, there were no significant differences in the growth parameters of coconut and cashew among the five different models. A row of nitrogen fixing trees (*Gliricidia sepium* and *Acacia auriculiformis*) established in the alternative rows in between coconut and cashew rows reduced weed growth in the unutilized areas.

The experiment is in progress

*H A J Gunathilake, & M de S Liyanage.*

**Experiment 4.2.3: On farm cropping models in the Wet and Intermediate Zone of coconut - 1987**

Recording of agronomic and economic data of five crop models, out of eleven was completed during the year. These models were located in Dambadeniya (Wet Zone), and Pothuwatawana, Athuruwela, Sagaragama and Ingaradaula (Intermediate Wet Zone). Recording of agronomic and economic data of the other six crop models at Indiwina, Thulawala, Narangoda, Bihalpola, Welipannagahamulla and Muttibendiwela is in progress. Of these six crop models, models at Thulawala and Muttibendiwela were re-modelled with the introduction of two short term cash crops, namely, ginger and Kiriala.

The recently established nine crops/farm models are progressing well at Bogahawatta, Udulla, Gaspe, Kandanehedara, Ratmalagara Estate, Deegalla, Ambepussa and two models at Walpita Estate.

Information gathered from the completed crop models suggests that the returns from traditional perennial crops, viz. pepper, coffee are not encouraging. Although it increases the total net returns, often marginally the return on unit capital invested is considerably low, compared to monoculture systems. Therefore, investment on such enterprises is not encouraged if alternative investment opportunities are not available.

However, returns from semi-perennial intercrops viz. pineapple, banana, ginger etc. are attractive. Results from the crop models at Dambadeniya and Pothuwatawana suggests that these crops are particularly important as alternate sources of income, if replanting is undertaken.

The experiment is in progress.

*H A J Gunathilake, M de S Liyanage, M T N Fernando, & S D J N Subasinghe.*

**Experiment 4.2.4: Coconut-based farming systems in small holdings (1989) (Inter Institutional Research Programme)**

Coconut and intercrops in the crop/farm models performed satisfactory due to favorable weather conditions, specially due to well distributed rainfall.

Of the perennial crops, as expected, pepper performed better in the WZ (929 g/vine) than in the IMZ (583 g/vine). Cocoa in the crop models at Danowita (WZ) came into production in three years, confirming the findings of

Walpita Estate (WZ). The performance of cashew was remarkable and reached production within 2.5 years of planting and continues to perform well under both conditions, with coconut seedlings (3 years old) and mature coconut (45 years old).

Crop models which included pineapple and banana together were more attractive to the farmers due to high returns. Among annuals, ginger performed best in the WZ and in a crop model at Divulapitiya, it produced 40 kg/coconut square with the existing perennial crops namely coconut, coffee, and pepper.

Coconut yields in Table 1 clearly indicated that intercropping did not affect the yield of coconut in areas where there is sufficient soil water storage and both crops are properly managed.

The experiment is in progress

*H A J Gunathilake & M de S Liyanage.*

**Experiment 4.2.6: Selection and evaluation of adopted, stable, high yielding and high quality cultivars of pasture grass species of *B. brizantha*, *P. maximum* and *P.puerperium*. - 1991 (Inter - Institutional Research Project)**

Fifty clones of *brizantha* (45 clones from Sri Lanka and 5 from Colombia) were planted at the Research Farm of the University of Ruhuna, Matara. Two months after establishment, harvesting was started at 6 week intervals and plant height, dry weight, no of tillers per plant, organic matter percentage, ash content, and *in vitro* organic matter digestibility (IVOMD) were recorded. The genotypes with high dry matter digestibility and IVOMD were selected and established in plots to obtain sufficient number of cuttings for multiplication.

*S G J N Senanayake & D N S Fernando.*

## **PROJECT 7: STUDIES ON THE NUTRIENT REQUIREMENT OF COCONUT**

**Experiment 7.12.1 (a & b): Demonstration on the use of cover crops and *Gliricidia* in coconut lands. Ratmalagara and Walpita Estates - 1988**

At both locations, *Gliricidia* produced leaf matter more than the

required amount, but the growth of *pueraria* at Walpita Estate was poor compared to Rathmalagara Estate. During the year, there was no difference between in nut production or in copra production in treatment plots.

The experiment is in progress.

*D N S Fernando, M N Dias, & K C P Perera.*

**Experiment 7.12.2 (a):** Substitution of inorganic nitrogen for coconut palms with two different sources of organic matter. Ratmalagara Estate - 1991

During the year *Gliricidia* growth was satisfactory and the production of green matter per tree was 5 - 7 kg (5-7 *Gliricidia* plants can provide a sufficient amount of green matter per palm).

There was no significant difference in nut or copra production between treatments.

The experiment is in progress.

*D N S Fernando, M N Dias & R Marasinghe.*

**Experiment 7.12.2 (b):** Substitution of inorganic nitrogen for coconut palms with two different sources of organic matter. Siringapatha Estate, Intermediate Wet Zone, Badalgama - 1992

*Gliricidia* seedlings were planted at early part of the year and are making satisfactory growth. During the year treatments were imposed except the application of *Gliricidia*.

The experiment is in progress.

*D N S Fernando, M N Dias, M Bastian, & M A Wasanthimala.*

**Experiment 7.12.3:** Substitution of inorganic nitrogen for coconut seedlings with two different sources of organic matter. Bandirippuwa Estate, Intermediate Dry Zone, Bandirippuwa - 1992

The objective of the experiment was to study the possibility of substituting inorganic N fertilizer with *Gliricidia* and cow dung. The fertilizer

treatments were arranged in a randomized block design with four replicates.

- T1 - Control ( no fertilizer for coconut)
- T2 - YPM mixture at variable rates with the age.
- T3 - *Gliricidia* loppings equivalent to the nitrogen in YPM mixture
- T4 - Cow dung equivalent to the nitrogen in YPM mixture.

Different fertilizer treatments will be applied during 1994.

*D N S Fernando, M N Dias, & K C P Perera.*

### **PROJECT 17: PREMATURE DECLINE OF PALMS**

**EXPERIMENT 17.4:** Studies on effect of root pruning and incorporation of organic manure on LSD palms, Walpita Research Station - 1989

During the year, yield records were maintained and data on the size and shape of nuts collected at alternative picks.

A palm by palm survey was carried out to count scorched fronds, and data has indicated that treatments have no effect on leaf scorch at initial stages (incipient and mild) but all treatments except the same soil, have shown a positive effect (statistically not significant) on LSD and % affected fronds have decreased.

The experiment is in progress.

*D.N.S.Fernando, N P A D Nainanayake, & M.Bastian.*

### **PROJECT 20: INTERCROPPING**

**Experiment 20.6:** Effect of mixed cropping on the yield and productivity of coconut in the Dry and Dry Intermediate Zone. Margaret Estate, Pallama - 1990

The growth performances of intercrops was severely affected by continuous damage from out side cattle. Therefore it has been decided to relocate the experiment elsewhere.

*H A J Gunathilake, M de S Liyanage, & M J I Costa*

**Experiment 20.7: Performance of mulberry under coconut in the Intermediate Zone, Ratmalagara Estate, Madampe - 1990**

Mulberry was harvested five times during the year due to good growth as a result of well distributed rainfall during the year. The crop was pruned at two heights ; 50 and 120 cm; produced a fresh leaf yield of 14.12 and 13.68 mt/ha respectively. The yield increase was approximately 9.2% compared to the yield (12.72 mt/ha) obtained last year.

The coconut yields in the intercropped and monoculture areas were 61.1 and 53.0 nuts-palm-year respectively showing that there was no significant effect due to intercropping with mulberry.

*H A J Gunathilake & M de S Liyanage*

**Experiment 20.8: Adaptability of selected multipurpose trees for coconut lands. Ratmalagara Estate, Madampe - 1990**

Among multipurpose tree species, *Gliricidia sepium* gave the highest fresh biomass yield of approximately 10 kg/tree, while *Calliandra calothyrsus*, *Acacia auriculiformis* and *Leucaena leucocephala* produced only 4 kg-tree, with three prunings per year. *Gliricidia* also showed a high cropping ability giving 41 sprouts-tree. These results suggest that *Gliricidia* followed by *Calliandra* are the most suitable species for coconut lands and *Acacia mangium* performed poorly under coconut. Coconut yield records indicated that none of the leguminous tree species had any detrimental effect on coconut production throughout the year.

The experiment is in progress.

*M de S Liyanage & M Bastian.*

**Experiment 20.9: Intercropping coconut with selected medicinal plants. Walpita Estate - 1993**

Sri Lanka imports Rs. 80-100 million worth of plant materials used in perfumery and pharmacy. To meet local demand, cultivation of some medicinal plants in the intermediate zone under coconut is proposed.

The research activities scheduled for next three years are (i) evaluation of intercropping performance and chemical quality of the selected medicinal plants and adaptive research (ii) assessment of intercropping models and

identification of more promising medicinal plants for further testing and (3) refinement of cultural practices.

The medicinal plants selected for testing as intercrops in coconut were *Cassia angustifolia* (Senehekola), *Piper longum* (Thippili), *Solanum xanthocarpum* (Katuwelbatu), *Plectranthis zeylanicus* (Iriweriya), *Kaempferia galanga* (Inguru piyal), *Plumbago indica* (Rathnitol) *Withania sominifera* (Ammukkara) and *Adhatoda vasica* (Adhatoda).

During the year, the above plant species were established in 4x4 m plots under coconut and in an open area (without coconut). The growth performance of all the species established under coconut were satisfactory compared to those in the open area except Iriweriya.

The experiment is in progress

H A J Gunathilake

(This collaborative project with the Ceylon Institute of Scientific and Industrial Research is funded by the Council for Agricultural Research Policy.)

#### **PROJECT 29: STUDIES ON FERTILIZER USE.**

**EXPERIMENT 29.2 (b): Studies on the localized application of fertilizer in coconut, lateritic gravel soil. Rathmalagara Estate, Madampe - 1993**

The objective of this experiment is to assess the efficiency of localized application of inorganic fertilizer and to select a suitable material to retain the nutrients in the soil until they are absorbed by the palm.

Pits of 60 cm x 60 cm x 60 cm were dug at 60 cm away from the base of the palm. The recommended fertilizer mixture at the rate of 3 kg-palm-year was applied in two split doses.

Treatments are as follows:

- T<sub>1</sub> - Control (no fertilizer)
- T<sub>2</sub> - Recommended fertilizer (broadcast and mulch)
- T<sub>3</sub> - Two pits/palm, filled with cowdung
- T<sub>4</sub> - Two pits/palm, filled with choir dust
- T<sub>5</sub> - Four pits/palm, filled with cow dung
- T<sub>6</sub> - Four pits/palm, filled with choir dust.

Records on growth parameters were maintained during the year.

The experiment is in progress.

*D N S Fernando, M N Dias, & R Marasinghe.*

# **REPORT OF THE GENETICS AND PLANT BREEDING DIVISION**

**Head - R R A Peries, Ph D**

## **1. GENERAL**

The progenies resulting from pollinations in the nut size improvement studies were planted in field 14 of the Isolated Seed Garden (ISG), Ambakelle. The poor rainfall distribution in 1992, resulted in lowered crops in the early part of the year at ISG, but they gradually showed improvement towards the middle of the year.

Experiments were set up at Andigama Farm, Giriulla for the evaluation of collected germplasm. Studies were also initiated for evaluating the combining ability of drought tolerant germplasm accessions, with the elite palms of ISG.

Several coconut populations showing physiological adaptation were identified during the year. Both in-situ (eco-banks) and ex-situ conservations of these populations will be carried out during the next year.

## **2. RESEARCH PROJECTS**

### **Project 5: PRODUCTION OF IMPROVED COCONUT VARIETIES**

#### **Experiment 5.1.1: Evaluation of five improved cultivars at Bandirippuwa Estate, Lunuwila - 1984**

This experiment was maintained satisfactorily in its ninth year from planting. Fertilizer was applied at 3 kg per palm from the Urea based APM in two split applications in June and November.

Despite the fact that the total quantum of rainfall during 1992 was much higher (2054 mm) than in 1991 (1676 mm), the year 1992 was characteristic with the prolonged rain-free period from January to March. This pattern of rainfall was apparently very deleterious to the palms, particularly to the two hybrid cultivars, resulting in nearly 50% of them going out of production during the current year (Table 1). There was also a marked reduction in nuts per palm in the tall cultivars. The nuts per palm in all cultivars remained less than 10 during the year.

The fruit component analysis (FCA) of this trial during the year is shown in Table 2. Eventhough the nut numbers were drastically reduced, the nut size remained stable and unchanged compared to the previous year (CRI, Annual

Report 1992). It would appear that current weather during nut development/maturity has influenced the nut size, but the nut number was reduced due to the prolonged rain-free period during early inflorescence development, when apparently a large proportion of developing nuts were shed prematurely. The overall effect of adverse weather was the reduced copra content per palm which was below 2 kg in all cultivars, whereas this value ranged between 3 kg and 5 kg in the previous year.

**Table 1.** *Percent palms in flower, the number of palms harvested, and the number of nuts per palm from each cultivar during the current (9th year) and previous year, in the evaluation of cultivars trial at Bandirippuwa estate, Lunuwila.*

Cultivar	Percentage flowering		Number of palms harvested		Number of nuts harvested		Nuts/palm	
	Year 8	Year 9	92	93	92	93	92	93
<i>DG x T</i>	93	99	74	34	1664	216	22	06
<i>DY x T</i>	99	100	73	42	1891	275	26	07
<i>T x T</i>	93	96	61	57	1397	47	23	08
M.T	90	99	59	49	1203	432	20	09
P.P.T	89	95	59	51	1321	387	22	08

(Note: 80 palms per treatment in 04 blocks.)

**Table 2.** *Results of fruit component analysis of the evaluation of cultivars trial at Bandirippuwa. (Data is the mean of six picks in 1993).*

Fruit component	Cultivar									
	DG x T		DY x T		T x T		MT		PPT	
	A	B	A	B	A	B	A	B	A	B
Fresh nut weight (g)	1396	0.34	1208	0.40	1272	0.31	1355	0.31	1365	0.31
Dehusked weight (g)	674	0.25	596	0.29	665	0.32	706	0.29	657	0.26
Split nut weight (g)	486	0.23	442	0.24	520	0.24	544	0.25	503	0.22
Kernel weight/nut (g)	316	0.22	285	0.24	329	0.25	349	0.25	325	0.21
EC weight (g/nut)	126	na	191	na	213	na	226	na	210	na
EC weight (kg/palm)	1.3	na	1.3	na	1.7	na	2.0	na	1.7	na

(na = not analyzed; A = weight in grams; B = CV; EC = Estimated copra)

**Experiment 5.1.2: Evaluation of five improved cultivars at Thammenna Estate, Puttalam - 1984**

Thammenna Estate trial received a much less quantum of rainfall during 1992 (827 mm) compared to 1991 (1129 mm) which was very much less than that experienced at Bandirippuwa. The rain-free periods were much greater with zero rainfall from January to end March and little effective rain in August (8 mm) and September (15.2 mm). However in this deep latosol, above ground climate had much less effect on the yield of palms compared to Bandirippuwa. Palms had access to deep soil water (Jayasekera et.al, 1993) and the yield of the tall cultivars, showed no difference compared to the previous year (Table 3). There was a marginal reduction in per palm yield in the hybrid cultivars, and this was due mainly to a few susceptible palms shedding their immature buttons during the prolonged rain-free periods.

Despite the 'adverse' above ground weather conditions, the total copra production per palm followed a similar pattern to that of the previous year (CRI, 1992) and this ranged between 5.0 kg and 10.7 kg amongst the different cultivars (Table 4). Hybrid cultivars showed a marked superiority in this aspect compared to the tall.

**Table 3.** *The percent palms in flower, the number of palms harvested and the number of nuts from each cultivar during the current year (9th year and previous year, in the evaluation of cultivars trial at Thammenna Estate, Puttalam.*

Cultivar	Percentage flowering		Number of palms harvested		Number of nuts harvested		Nuts/palm	
	Year 8	Year 9	92	93	92	93	92	93
	92 Dec	93 Dec						
DG x T	98	99	76	76	4526	4091	60	54
DY x T	93	95	64	71	2990	2968	47	42
T x T	90	95	57	66	1490	1994	26	30
M.T	83	93	49	69	1217	1482	24	24
P.P.T	95	98	63	70	1884	2135	30	31

(Note: 80 palms per treatment in 04 blocks.)

**Table 4.** *Results of fruit component analysis of the evaluation of cultivars trial at Thammenna. (Data is the mean of six picks in 1993).*

Fruit component	Cultivar									
	DG x T		DY x T		T x T		MT		PPT	
	A	B	A	B	A	B	A	B	A	B
Fresh nut weight (g)	1146	0.24	1110	0.25	1213	0.25	1314	0.29	1302	0.26
Dehusked weight (g)	619	0.28	581	0.25	625	0.24	653	0.27	639	0.25
Split nut weight (g)	453	0.22	437	0.21	487	0.21	503	0.23	496	0.22
Kernel weight (g)	297	0.24	284	0.24	314	0.22	331	0.26	322	0.23
EC weight (g/nut)	198	na	186	na	200	na	209	na	204	na
EC weight (kg/palm)	10.7	na	7.8	na	6.0	na	5.0	na	6.3	na

(na = not analyzed; A = weight in grams; B = CV; EC = Estimated copra)

**Experiment 5.1.3: Evaluation of five improved cultivars at Dambakande Estate, Kurunegala - 1984**

The continuation of this trial became very difficult after the

management changed hands (CRI, 1992). Free grazing of cattle within the trial area led to destruction of the foliage. Tender nuts were all consumed by the inhabitants. All efforts to revive the trial proved futile. After discussions with the Sri Lanka Army (the present management) the experiment was terminated in September.

*R R A Peries, J M D T Everard, M H L Padmasiri & W B S Fernando.*

**Experiment 5.1.4: Evaluation of five improved cultivars at Palugaswewa Estate, Rajakadalawa - 1985**

No measurements were made up to August of this year, as a result of the decisions taken in 1991 (c.f. CRI, 1991). Since palms have now begun to produce nuts, fruit component analysis will be carried out from 1994. A census of palms taken in August indicated that 59 palms of DG x T; 62 palms of DY x T; 42 palms T x T; 33 palms Moorock tall and 46 palms Plus palm tall were in bearing out of 80 palms per treatment in each cultivar. The total number of palms in flower were not significantly different between the cultivars in its eighth year.

**Experiment 5.1.5: Evaluation of five improved cultivars at Suriyapura Estate, Henegama - 1986**

The problems encountered regarding the management of the trial remained unsolved and cultural practices such as the establishment of husk pits could not be carried out. The routine fertilizer application was carried out twice during the year with 3 kg of urea based APM per palm.

Heavy button shedding was experienced during the year which resulted in a decreased yield of nuts. No nut collection was therefore attempted during the year. Followed by the hybrids the three tall cultivars had achieved approximately 80% flowering by the end of the 8th year from planting (Table 5).

**Experiment 5.2: Identification of parent palms for use in the breeding programme. Response of genotypes to year to year changes in weather at ISG, Ambakelle - 1982**

**Experiment 5.2.1: Programme for the improvement in nut size and nut number in the Isolated Seed Garden.**

The pollination programme on selected palms (cf. CRI, 1991) commenced in December 1991 was carried out successfully during the year. The first harvest of seed nuts (around 100-115) was done in early January 1993. The progress of the pollination programme during the year is summarized in Table 6.

The success of pollinations carried out in the previous year and the number of nuts harvested from those pollination are given in Table 7.

**Experiment 5.2.2: Crossing of selected palms at ISG with promising germplasm accessions.**

Analysis of the vegetative data of the progeny of selected crosses of fields 1 and 2 at the Isolated Seed Garden (ISG) have shown that the genetic gain due to crossing was very low i.e.  $H^2_b$  was 0.15 (CRI, 1992). It would appear that response to further selection is therefore limited by the narrow genetic base that exists in the parent population at ISG. Hence it was thought imperative to test the potential combining ability of seed palms at ISG with different pollen sources, which would also broaden the genetic base of the resulting progeny. Furthermore the crop figures at ISG had shown considerable fluctuation during the past decade with a sharp drop in yield in some years. Therefore it would be of utmost importance to breed material which are less susceptible to such yield fluctuations. Every attempt was taken to select the parental material which had shown the least yield fluctuation whilst producing at their optimum. The pollen parents were selected with the dual objectives of (a) testing the drought tolerance of the material in a cross and (b) testing the yield potential of a cross depending on its wideness [pollen parents consist of 50 randomly selected palms from populations Moorock, St. Annes, Debarayaya and 25 palms from Kasagala; these populations have shown their distinctiveness in multivariate discriminant analysis using the accession data] (CRI, 1992).

**Origin of populations selected as male parents**

- Moorock:** The population represented an extent of about 40 acres planted in 1975 which consisted of palms of the 3rd generation selection from the same population for high husked nut weights.
- St. Annes:** The population represented the entire extent of this estate. Selection has been made for high yield, both for number of nuts and husked nut weight.
- Debarayaya:** Selected as a germplasm accession in 1988 from the southern region of the Island for drought tolerance. The population represented the selected palms which had withstood the adversities of a severe drought during the period 1987 to 1989.

**Table 5.** *The temporal change in flowering from four years (48 months) onwards, in each cultivar in the Evaluation of Cultivars trial at Suriyapura Estate.*

Cultivar	Time after field planting (yrs)					
	4 89 Dec	5 90 Dec	6 91 Dec	7 92 Dec	8 93 June	9 93 Dec
<i>DG x T</i>	18	41	57	59	59 (96.70%)	59 (97%)
<i>DY x T</i>	11	22	44	50	61 (98.30%)	61 (98%)
<i>T x T</i>	00	00	06	22	52 (78.78%)	52 (79%)
M.T	00	00	09	18	45 (76.27%)	48 (81%)
P.P.T	00	00	05	19	41 (77.35%)	44 (83%)

*R R A Peries, J M D T Everard, W M U Fernando & J D J Abayasekera.*

**Table 6.** *The progress of the pollination programme in field No. 4 of the ISG for improvement of nut size and nut number in coconut during 1993.*

Month	Number of palms pollinated	Number of inflorescences emasculated	Number of buttons pollinated	Number of button developing after	
				3 months	6 months
Jan	52	53	900	161	142
Feb	56	63	1130	248	231
Mar	52	63	1374	241	211
Apr	56	74	1604	293	243
May	56	89	2146	657	545
Jun	56	77	1993	711	583
Jul	55	83	2197	530	-
Aug	54	73	1835	376	-
Sep	55	66	1523	270	-
Oct	53	60	1370	-	-
Nov	50	59	1276	-	-
Dec	24	24	478	-	-
<b>Total</b>	<b>56</b>	<b>784</b>	<b>17826</b>	<b>3487</b>	<b>1955</b>

(Note: The pollination programme continues on 56 selected parent palms with 16 pollen parents.)

*R R A Peries, J M D T Everard & M H L Padmasiri.*

**Table 7.** *Success of pollination in the nut size improvement experiment, field number 04 of the ISG during 1993.*

Month of pollination	Nuts developing after		Nuts harvested during 1993
	3 months	6 months	
Jan	239	218	208
Feb	257	246	212
Mar	287	264	227
Apr	253	232	208
May	361	329	274
Jun	282	246	207
Jul	371	326	276
Aug	334	269	216
Sep	227	188	143
Oct	155	127	115
Nov	261	229	207
Dec	282	270	245
<b>Total</b>	<b>3309</b>	<b>2944</b>	<b>2538</b>

**Kasagala:** The population represented 25 palms selected for their drought tolerance from the southern region. Fifty palms were randomly selected from each of the said populations at Moorock, St Anne's and Debarayaya on the basis of the palms that had open inflorescences of the correct stage of maturity for pollen collection at the time of visiting. At Kasagala spikelets were collected from all 25 palms which was a biased sample.

#### **Method of selection of female parents**

Female parents were selected from the *Tall* palm population of field No. 4, ISG based on 5 years (1987-1991) yield data. The selection criteria used were as follows.

- 1) **Number of nuts/palm/year**
  - i) Mean over 5 years  $> / 100$
  - ii) Minimum number of nuts/palm/year not less than 60 in each year

2) **Husked and split nut weight**

- i) Mean over 5 years > / 400gms
- ii) Minimum not less than 350 g/nut in each year.

3) **Stability of production**

Palms selected on the basis of (1) and (2) were short listed for the lowest standard deviation values. A final screening on the agronomic characters of the palms were adopted. Forty palms were selected out of a total of 1648 and were randomly allocated into 4 subgroups. Palms of each subgroup were pollinated by pollen of a certain population during a period of one month and were used in rotation. Pollinations were continued for another month to replace the crosses which had either low or no setting. The three month setting percentages of palms on a population basis are given in Table 8. Very high setting percentages (from artificial pollinations) have been achieved with all pollen sources with a maximum of 40% with pollen from St. Annes estate. The nuts would be ready for harvesting from April 1994.

**Table 8.** *Details of the crossing programme of selected tall palms of field No. 4, ISG with pollen from putative drought tolerant accessions.*

Month	Moorrock			Debarayaya			Kasagala			St. Annes			Total Setting			(%)	
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C		
Apr	9	171	34	8	181	38	8	237	41	6	124	32	31	713	145	20%	
May	12	273	118	13	260	91	14	303	137	16	350	166	55	1186	512	43%	
Jun	14	258	112	12	246	117	13	257	115	15	294	128	54	1055	472	45%	
Jul	12	273	95	18	374	152	14	287	108	11	240	89	55	1174	444	38%	
Aug	11	230	70	7	164	56	8	167	69	10	221	75	36	782	270	35%	
Sep	2	29	13	3	58	17	4	86	30	2	38	23	11	211	083	39%	
<b>Total</b>	<b>60</b>	<b>1234</b>	<b>442</b>	<b>61</b>	<b>1283</b>	<b>471</b>	<b>61</b>	<b>1337</b>	<b>500</b>	<b>60</b>	<b>1267</b>	<b>513</b>	<b>242</b>	<b>5121</b>	<b>1926</b>		
<b>Setting percentage</b>		<b>35.8%</b>			<b>36.7%</b>			<b>37.3%</b>			<b>40.0%</b>			<b>38.0%</b>			

(A: inflorescences; B: Female flowers; C: Female flowers at 3 months from pollinations)

*W M U Fernando, A A L Perera M H L Padmasiri & J D J Abayasekera.*

**Experiment 5.2.3: Selfing of F2 palms at Bandirippuwa Estate**

A self pollination programme was initiated on 22 F2 palms (originating from selfed F1, obtained by crossing *Dwarf* and *Tall* palms) at field No 7C of Bandirippuwa Estate (earlier field 15) from February 1993. The objectives of

the study were to follow the segregation patterns of useful characters of the palm and the possibility of combining such characters as short stature, and inbreeding behaviour with typical characters of the *Tall* nature. An opportunity of studying the consequences of selfing was also expected.

Two palms out of the total 22 had an inbreeding nature with overlapping male and female phases. The morphological characters of the two palms showed typical *Tall* characters with a large bole and a well packed crown. *Tall* palms with nuts of the unique shape of *dwarfs* were also found. This draws evidence that characters such as stature, breeding behaviour and high female flower count segregate independently and are most probably controlled by different sets of genes.

Except for the two palms which were found to be natural selfs, all other palms were artificially hand pollinated with processed pollen from the same inflorescence. Alternative inflorescences were allowed to be open pollinated to obtain nuts as controls. Controlled self pollination was followed for the two palms (natural selfs). Details of the pollinations are given in Table 9. Nuts would be ready for harvesting from May 1994.

**Table 9.** *Details of the pollinations of F<sub>2</sub> (2nd generation) palms at Bandirippuwa estate.*

	Number of inflorescences	Number of buttons	Number of buttons 3 months after pollinations
Artificial selfed pollinations	79	1896	373
Self pollinations (natural selfs)	11	351	53
Open pollinations	82	1970	339
<b>Total</b>	<b>172</b>	<b>4217</b>	<b>765</b>

*W M U Fernando, M H L Padmasiri & G K Ekanayake*

**Experiment 5.4.1.1:** Trial at Bandirippuwa Estate, Lunuwila, (50-acre block for the evaluation of progeny - 1986

**Experiment 5.4.1.2:** Trial at Rathmalagara Estate, Madampe, (Field no. 2) for the evaluation of progeny - 1986

**Experiment 5.4.1.3:** Trial at NLDB Andigama Farm, Giriulla (Mudalihamy block) for the evaluation of progeny - 1986

**Experiment 5.4.1.4:** Trail at JEDB Mangala Eliya Estate, Puttalam for the for the evaluation of progeny - 1987

The four trials were maintained satisfactorily during the year. The trials at Bandirippuwa and Ratmalagara have now completed seven and a half years from planting and the application of differential fertilizer treatments were commenced from June 1993. The 3 fertilizer levels (recommended dosage- T1, half the recommended dosage - T2 and one and a half times the recommended dosage - T3) were applied in a split plot design. The trials at Mangala Eliya and Andigama (Mudalihamy block) were treated with the Adult palm fertilizer at a dosage of 1.5 Kg/palm twice during the year. Recording of growth measurements have been completed in all 4 trials and the final results have been presented (CRI, 1991;1992).

The total number of palms in flower at the end of seven and a half years at Bandirippuwa and Ratmalagara are presented in Tables 10 and 11 respectively. With the exception of T x T at Ratmalagara approximately 80% flowering have been recorded in all cultivars at both sites. The flowering percentage was best in T x DG at all 4 sites. A higher total percentage of palms were in flower at Mangala Eliya (60%) than at Andigama (46%) (Mudalihamy block) (Tables 12 and 13).

**Table 10.** *Cumulative number of palms in flower in the three types of progeny T x DG, T x T, T x SR at Bandirippuwa (1986).*

Progeny	Years after planting				
	3.5	4.5	5.5	6.5	7.5
<i>T x DG</i>	50	69	88 (100%)	88 (100%)	88 (100%)
<i>T x T</i>	00	02	41 (047%)	51 (059%)	74 (082%)
<i>T x SR</i>	00	05	37 (042%)	50 (056%)	72 (080%)

**Table 11.** *Cumulative number of palms in flower in the three types of progeny T x DG, T x T, T x SR at Ratmalagara (1986).*

Progeny	Years after planting				
	3.5	4.5	5.5	6.5	7.5
<i>T x DG</i>	10	38	58 (64%)	61 (67%)	85 (94%)
<i>T x T</i>	00	02	03 (03%)	08 (09%)	27 (30%)
<i>T x SR</i>	01	01	10 (11%)	23 (26%)	70 (78%)

**Table 12.** *Cumulative number of palms in flower in the three types of progeny T x DG, T x T, T x SR at Andigama (Mudalihamy Block 1986)*

Progeny	Years after planting				
	3	4	5	6	7
<i>T x DG</i>	1	5	43	53 (60%)	77 (89%)
<i>T x T</i>	0	0	0	01 (01%)	16 (20%)
<i>T x SR</i>	0	0	2	03 (03%)	25 (30%)

**Table 13.** *Cumulative number of palms in flower in the three types of progeny T x T, T x SR, T x DG and T (OP) at Mangala Eliya (1987).*

Progeny	Years after planting			
	3.5	4.5	5.5	6.5
<i>T x DG</i>	1	22	56	75 (94%)
<i>T x T</i>	0	0	6	30 (36%)
<i>T x SR</i>	0	0	3	39 (46%)
<i>T (OP)</i>	0	0	9	60 (60%)

(DG, dwarf green; T, tall; SR, San Ramon; T(OP), tall open pollinated)

**Experiment 5.4.2:**           **Combination 2. Ambakelle Special and selected Dwarf Green seed palms using tall, Dwarf Green and San Ramon pollen from palms selected for high and stable yield.**

**Experiment 5.4.2.1:**       **Trial at NLDB Andigama Farm, Giriulla (Puras Block), for the evaluation of progeny - 1987**

**Experiment 5.4.2.2:**       **Trial at JEDB Daisy Valley Estate, Mawathagama for the evaluation of progeny - 1987**

The progenies evaluated in these two trials are  $T \times DG$ ,  $T \times T$ ,  $T \times SR$  and  $DG \times SR$ . The trial at Daisy Valley estate in addition has a  $DG \times T$  progeny included for evaluation. The results of the analysis of growth parameters at 60 months from planting at Andigama (Puras) are presented in Table 14 whilst the cumulative number of palms in flower at the site appear in Table 15.

Highly significant differences ( $P < 0.0001$ ) between varieties for all 3 vegetative characters were observed at the Puras Block, Andigama. T-tests for pair-wise comparisons between varieties indicated significant differences between all comparisons (not indicated in Table) for the vegetative characters (Table 14). The cultivar  $T \times SR$  performed significantly better than  $T \times T$  for all characters analyzed. The highest percentage flowering was recorded in  $DG \times SR$ , with 73% flowering at the end of the sixth year (Table 15).

The analysis of variance procedure for all growth parameters indicated highly significant differences ( $P < 0.0001$ ) between varieties at the Daisy Valley site (Table 16). The 3 cultivars involving Dwarf Green as the parent performed better than  $T \times T$  and  $T \times SR$  whilst  $DG \times T$  was the most vigorous. Percentages exceeding 85 were recorded to have flowered in  $DG \times T$ ,  $T \times DG$  and  $DG \times SR$  at the end of the sixth year after planting (Table 17). Significant differences between the reciprocal crosses  $T \times DG$  and  $DG \times T$  were present for total leaves at 60 months and leaf number up to 60 months from planting. Significant block effects were shown for all 3 vegetative characters indicating variation in block performance at the Daisy Valley site.

**Experiment 5.4.3:**           **Combination 3 Ambakelle Special, selected Dwarf Green and Dwarf Yellow seed palms using Tall, Dwarf Green, San Ramon and Dwarf Yellow pollen from palms selected for high and stable yield - 1986**

The progeny trials arising from the above crosses are as follows:

**Experiment 5.4.3.1:** Trial at Sri Lanka State Plantation Corporation Sirikandura Estate, Dodanduwa, for the evaluation of progeny - 1989.

**Experiment 5.4.3.2:** Observation trial at Ratmalagara Estate, Madampe for the evaluation of progeny - 1989

The progeny subjected to evaluation at the Sirikandura Estate are  $T \times DG$ ,  $T \times DY$ ,  $T \times T$  and  $T \times SR$ . The objective of the Ratmalagara trial was to evaluate the hybrid progenies  $DG \times T$ ,  $DY \times T$ ,  $DG \times SR$  and  $DY \times SR$ .

The results of the growth parameters at sites Sirikandura and Ratmalagara appear in Tables 18 and 19 respectively. Highly significant differences were observed between varieties for all growth parameters at Sirikandura site. Except for leaf increase there was no significant difference between  $T \times DG$  and  $T \times DY$  for total leaves at 48 months and leaf number to 48 months at Sirikandura. The cross  $T \times SR$  was significantly better than  $T \times T$  for all parameters analyzed. Significant differences were observed between varieties only for leaf number to 36 months at the Ratmalagara observation trial.

**Table 14.** Total leaf production, leaf number at 60 months and the increase in leaf number of four types of progeny  $T \times DG$ ,  $T \times T$ ,  $T \times SR$  and  $DG \times SR$  at Andigama (Puras Block) (1987)

	Mean	SD	LSD at 5% level
Total leaf production to 60 months			
$T \times DG$	42.38	5.79	1.03
$T \times T$	35.76	3.73	
$T \times SR$	37.97	3.83	
$DG \times SR$	44.95	5.32	
Increase in leaf number (48 - 60 months)			
$T \times DG$	8.24	1.93	0.55
$T \times T$	6.78	1.53	
$T \times SR$	7.41	1.49	
$DG \times SR$	9.16	1.63	
Total leaf number at 60 months			
$T \times DG$	10.94	2.93	0.68
$T \times T$	8.29	2.07	
$T \times SR$	9.92	2.28	
$DG \times SR$	12.14	2.50	

(*DG, Dwarf Green; T, Tall; SR, San Ramon;*  
LSD: Least significant difference; SD: Standard deviation)

**Table 15.** *Cumulative number of palms in flower in the three types of progeny T x DG, T x T, T x SR, and DG x SR at Andigama (Puras Block) (1987).*

Progeny	Years after planting			
	3	4	5	6
<i>T x DG</i>	0	2	3	5 (63%)
<i>T x T</i>	0	0	0	2 (02%)
<i>T x SR</i>	0	0	1	8 (09%)
<i>DG x SR</i>	1	19	23	62 (73%)

**Table 16.** *Total leaf production, leaf number at 60 months and the increase in leaf number of five types of progeny, T x DG, T x T, T x SR, DG x SR and DG x T at Daisy Valley estate (1987).*

	Mean	SD	LSD at the 5% level
Total leaf production to 60 months			
<i>T x DG</i>	48.67	7.41	0.87
<i>T x T</i>	39.08	7.06	
<i>T x SR</i>	41.49	7.09	
<i>DG x SR</i>	48.71	5.78	
<i>DG x T</i>	51.00	6.42	
Increase in leaf number (48 - 60 months)			
<i>T x DG</i>	8.45	1.90	0.58
<i>T x T</i>	6.66	2.04	
<i>T x SR</i>	7.18	2.12	
<i>DG x SR</i>	8.53	1.99	
<i>DG x T</i>	8.79	1.80	
Total leaf number at 60 months			
<i>T x DG</i>	15.99	4.04	0.94
<i>T x T</i>	12.29	3.71	
<i>T x SR</i>	12.91	4.21	
<i>DG x SR</i>	16.33	3.88	
<i>DG x T</i>	17.36	3.71	

(*DG*, Dwarf Green; *DY*, *T*, Tall; *SR*, San Ramon)

LSD: Least significant difference at the 5% level, SD: Standard deviation)

**Table 17.** *Cumulative number of palms in flower in the three types of progeny, T x DG, T x T, T x SR, DG x SR and DG x T at Daisy Valley estate (1987).*

Progeny	Years after planting			
	3	4	5	6
<i>T x DG</i>	1	26	54	78 (90%)
<i>T x T</i>	0	2	02	11 (13%)
<i>T x SR</i>	0	0	05	33 (40%)
<i>DG x SR</i>	2	20	43	76 (85%)
<i>DG x T</i>	2	26	54	76 (87%)

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**Table 18.** *Total leaf production, leaf number at 48 months and the increase in leaf number of four types of progeny, T x DG, T x T, T x SR and T x DY at the Sirikandura Estate (1989).*

	Mean	SD	LSD at the 5% level
Total leaf production to 48 months			
<i>T x DG</i>	35.73	4.21	0.87
<i>T x T</i>	30.22	3.18	
<i>T x SR</i>	32.68	3.52	
<i>T x DY</i>	35.06	3.75	
Increase in leaf number (36 - 48 months)			
<i>T x DG</i>	5.35	1.21	0.40
<i>T x T</i>	3.94	0.83	
<i>T x SR</i>	4.60	1.13	
<i>T x DY</i>	4.81	1.15	
Total leaf number at 48 months			
<i>T x DG</i>	11.20	2.64	0.65
<i>T x T</i>	9.52	1.36	
<i>T x SR</i>	10.58	1.92	
<i>T x DY</i>	11.03	2.26	

*(DG, Dwarf Green: DY, Dwarf Yellow: T, Tall: SR, San Ramon, LSD, Least significant difference (LSD 5% = LSD (P < 0.05)), SD, Standard deviation).*

**Table 19.** *Girth, height, total leaves, leaf number and the increase in leaf number of four types of progeny, DG x SR, DG x T, DY x SR and DY x T at Ratmalagara Estate (1989).*

	Mean	SD	LSD at the 5% level
<b>Girth at 24 months (cm)</b>			
<i>DG x SR</i>	40.62	5.82	7.30
<i>DG x T</i>	48.5	12.76	
<i>DY x SR</i>	41.73	8.93	
<i>DY x T</i>	42.70	13.05	
<b>Height at 24 months (cm)</b>			
<i>DG x SR</i>	280.43	43.34	28.46
<i>DG x T</i>	304.72	46.14	
<i>DY x SR</i>	280.20	50.68	
<i>DY x T</i>	290.76	58.16	
<b>Leaf number at 36 months</b>			
<i>DG x SR</i>	31.31	3.57	3.43
<i>DG x T</i>	36.61	3.33	
<i>DY x SR</i>	31.27	4.98	
<i>DY x T</i>	30.06	4.68	
<b>Total Leaves at 36 months</b>			
<i>DG x SR</i>	10.68	1.54	1.45
<i>DG x T</i>	11.33	1.61	
<i>DY x SR</i>	10.93	2.54	
<i>DY x T</i>	9.65	2.40	
<b>Increase in leaf number (24 - 36 months)</b>			
<i>DG x SR</i>	10.75	1.73	1.03
<i>DY x SR</i>	11.27	1.49	
<i>DG x T</i>	10.73	2.60	
<i>DY x T</i>	9.88	2.02	

(*DG*, Dwarf green: *DY*, Dwarf Yellow: *T*, Tall: *SR*, San Ramon, LSD, Least significant difference (LSD 5% = LSD (P < 0.05)), SD, Standard deviation)

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**Experiment 5.4.5.1: Progeny trial for testing of putative drought tolerant palms by the performance of their progeny at ISG**

The trial was maintained satisfactorily during the year. The final growth measurements were recorded at 60 months after planting in December 1993. A total of 80 (39%) palms had flowered by the end of the 5th year. Superior male and female parents were identified on the basis of the precocity of flowering of their progenies (50% or more progenies have flowered by the end of the 5th year) (Table 20). Palm No's 1.28 (6881), 1.31 (6935) had performed best as female parents and 1.10 (6916), 2.47 (271) and 2.60 (413) as best male parents.

**Table 20.** *Percentages of progenies in flower arising from female and male parents of the progeny trial for testing of putative drought tolerant palms by the performance of their progeny at ISG.*

Parent palm No.	Percentage of progeny in flowering	
	as female parent	as male parent
1.02	45	-
1.04	-	-
1.05	-	50
1.07	30	-
1.09	33	-
1.10	33	60
1.12	24	33
1.13	-	40
1.20	-	40
1.21	2	8
1.28	55	-
1.31	50	-
1.34	-	-
2.01	-	-
2.13	-	50
2.37	33	-
2.39	-	33
2.44	43	-
2.47	-	53
2.57	44	-
2.60	-	57

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**Experiment 5.4.5.2: Comparative evaluation of DG x Tall hybrid progeny of parents of the first and second generation palms at the ISG for yield and physiological drought tolerance.**

A new trial was established at the Nariyampotta block of the Andigama National Livestock Development Board Farm, Giriulla to evaluate the performance of the hybrid progeny arising from first and second generation Dwarf Green palms at the mini-seed garden, ISG. The aim of the study is to improve the water use efficiency of the DG x Tall hybrid while retaining its precocity and high yield. The trial also comprises of CRIC65 and Ambakelle Special as controls.

Nuts harvested from the second pick of ISG (March 1993) from first generation Dwarf Green palms (3339, 3569, 3677, 3714 and 3715), second generation Dwarf Green palms (6, 9, 16, 19, 55, 60, 63, 64, 65, 67, 86, 103, 109, 157, 172, 179 and 244), ten randomly picked Dwarf Green palms at Field 09 (CRIC65) and ten randomly picked Ambakelle Special palms at ISG were laid in the Bandirippuwa nursery. The seedlings were transferred and raised in polybags immediately after germination.

The NLDB agreed to provide about 10 ha in the Nariyampotta block of Andigama farm which they had already earmarked for replanting in 1993 for planting this trial. The entire block was lined for 26 ft x 26 ft x 26 ft triangular planting. Immediately after holing was completed the field was blocked according to the variations in the soil. The trial was planted in a completely randomized block design with 8 blocks. The plot size was kept at 8 because three of the varieties being evaluated are DG x T hybrids. Each plot was surrounded by a guard row of Ambakelle Special. Planting was carried out during the period from 3 to 10 December.

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**Experiment 5.5: Establishment of germplasm collections - 1983**

**Experiment 5.5.1: New variety block or crop museum, at Block no. 5, Bandirippuwa Estate, Lunuwila - 1983**

This plantation was maintained satisfactorily during the year. Fertilizer was applied twice during the year in June and October. The status of the crop museum as at end of the year is summarized in Table 21.

**Table 21.** *The status of the new variety block or crop museum*

Variety	Number of Vacancies palms		Bearing palms	Palms in flower	Young palms	Total palms
Dwarf Yellow	07	-	07	-	-	07
Dwarf Green	07	-	07	-	-	07
Dwarf Red	05	02	05	-	-	07
King Coconut	07	-	07	-	-	07
Ratharan Thambili	05	02	04	-	01	07
San Ramon (Russet)	07	-	07	-	-	07
San Ramon (Green)	07	-	03	02	02	07
Kamandala	07	-	06	-	01	07
Gon Thambili	07	-	04	01	02	07
Nawasi	07	-	04	01	02	07
Bodiri	07	-	06	01	-	07
Pora pol	03	04	-	-	03	07
Ran Thambili	07	-	03	-	04	07
Dikiri	07	-	02	-	05	07
Nawasi Thambili	-	07	-	-	-	07
<i>DG x T</i>	07	-	04	-	03	07
<i>DY x T</i>	06	01	01	-	05	07

**Experiment 5.5.2: Purification of local (indigenous) germplasm, Bandirippuwa Estate, Lunuwila - 1984**

The hand pollination programme launched last year on local varieties was terminated at the beginning of the year. A total of 218 hand pollinated seed nuts resulting from last years pollinations comprising 13 Gon-thembili, 75 Nawasi, 17 Nawasi-Thambili, 10 Bodiri, 32 Kamandala, 17 Ran-Thambili and 43 Pora-Pol were collected during the year and laid at the Bandirippuwa Research nursery.

This plantation was satisfactorily maintained. During the year a total of 66 vacancies and new planting points comprising 02 *Gon Thambili*, 19 *Pora-Pol*, 09 *Nawasi*, 31 *Bodiri*, 01 *Kamandala* and 11 *Ran-thambili* were planted. However, a few casualties were also reported from the new seedlings during establishment. The current status of the indigenous germplasm conservation block at B/E is shown in Table 22.

**Table 22.** *The status (in numbers) of the local germplasm collection at Bandirippuwa as at 31 December.*

Status of collection	Type (form) of coconut						
	Bodiri	Gon Thambili	Pora Pol	Ran Thambili	Nawasi	Dikiri Pol	Kamandala
Established	80	69	57	38	36	03	06
Vacancies	12	15	06	11	-	01	01
Young palms	10	11	28	10	08	02	02
In flower	01	04	01	-	01	-	03
In bearing	34	33	03	04	01	-	-
Seedlings	23	06	19	13	26	-	-

Total number of standing palms = Young palms + Seedlings + In flower + In bearing. During the year observations were made on the inflorescences of 03 Bodiri palms (CRI, 1992), in order to confirm their breeding behavior. It had been observed that there was no consistent breeding habit in the form Bodiri. Of the 03 palms observed, 01 showed signs of male and female phases of almost all the inflorescences overlapping, while in the other 02 palms male and female phase of only some inflorescence overlapped. Similar observations were also made on the forms Pora Pol and the Brazilian Green Dwarf.

**Experiment 5.5.3: Conservation of San Ramon - 1986**

This plantation was maintained satisfactorily during the year. Twenty nine (29) palms were in bearing as at 31 December and 6 casualties were reported. The status of the San Ramon conservation block at Bandirippuwa as at 31 December is summarized in Table 23.

**Experiment 5.5.4: Establishment of "field gene bank" for dwarf palms at Bandirippuwa Estate, Lunuwila - 1987**

A self pollination programme launched last year resulted in a total of 57 seed nuts comprising 45 *Dwarf Green* and 12 *Dwarf Yellow* (Table 24).

The balance seed nuts of the Dwarf Yellow will be harvested during 1994. During the year, a total of 43 dwarf seedlings comprising 07 *Dwarf Red* and 35 *Dwarf Green* were planted in the field gene bank.

**Table 23.** *The status of the San Ramon conservation block at Bandirippuwa estate.*

Status	Number
Total number established	162
Vacancies	07
seedlings	01
young palms	66
Palms in flower	37
Palms in bearing	51

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**Table 24.** *Summary of the pollination on "dwarfs" in the "field gene bank".*

Form/Var	Number of inflorescences handled	Number of Female flowers pollinated	Number of buttons after 3 months	Number of buttons after 6 months	Number of nuts harvested
<i>Dwarf Green</i>	-	-	-	-	45
<i>Dwarf Yellow</i>	37	926	193	132	12
<i>Dwarf Red</i>	-	-	-	-	-

**Experiment 5.5.5:** **Germplasm from other countries - 1985**

**Experiment 5.5.5.1:** **Import of exotic material**

Import of exotic germplasm has been suspended until such time that techniques for the safe movement of germplasm are perfected. Work on these aspects are in progress with the intervention of the International Plant Genetic Resources Institute (IPGRI: formerly IBPGR) and the Coconut Genetic Resource Network (COGENT).

**Experiment 5.5.5.2:** **Purification and multiplication of exotic material already available Cameroon Red Dwarf (CRD); Brazilian Green Dwarf (BGD)**

The self pollination programme launched for *Cameroon Red Dwarf*

(CRD) resulted in 24 seed nuts and these were laid down at Bandirippuwa research nursery. Since enough seed nuts had been collected and a sufficient number of seedlings had been obtained to raise a conservation block at PRS, the hand pollination programme on CRD was terminated this year. The hand pollination programme was continued this year also on BGD and 20 seed nuts were collected from pollinations done during last year. Due to the poor nut set and low germination it has not yet been possible to raise a sufficient number of seedlings for conservation. Apart from this 46 open pollinated BGD seed nuts were also collected and laid at Bandirippuwa Research nursery.

CRD pollen bank was established late this year for a proposed crossing programme with selected Ambakelle Tall.

The details of the pollination programme on BGD variety is summarized in Table 25.

**Table 25.** *Details of the pollination programme of BGD*

Month	Number of inflorescence	Number of buttons selfed	Number of buttons 3 months	Number of buttons after 6months	Nuts harvested
<b><i>Brazilian Green Dwarf</i></b>					
Jan	-	-	-	-	10
Feb	03	52	01	01	04
Mar	02	47	-	-	06
Apr	02	52	03	03	
May	02	47	12	12	
Jun	03	98	08	06	
Jul	02	70	06	-	
Aug	03	63	14	-	
Sep	01	09	02	-	
Oct	02	39	-	-	
Nov	03	51	-	-	
Dec	02	22	-	-	

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**Experiment 5.5.6:** To survey, collect, evaluate and utilize coconut germplasm (1986)

**Experiment 5.5.6.1: Collection of germplasm of the commercial *tall* variety (*Typica typica*)**

Five estates, namely Suwarnamali Estate, Dambulla; Dehigahalanda Estate, Ambalantota; Chithragala Estate, Ambalantota; Andigama Estate, Giriulla and Raddegoda Estate, Delwita were identified as sources of elite germplasm, but palm selection and nut collection was postponed to 1994, due to the limited budget in 1993.

The palm selection and nut collection of the estates which were previously identified as sources of elite germplasm (Shakerly Estate, Ambakote; Marandawila Estate, Bingiriya; Wilhelmina Estate, Puttalam and Mirishena Estate, Bulathsinhala) were also not carried out due to budget limitations.

**Andigama Farm, Giriulla**

This estate belongs to the National Livestock Development Board (NLDB). Hybrid seed nut production (*T x D*) had been carried out in this estate since 1953 in order to produce their own hybrid seedling requirement which had been planted in the estate and are now bearing profusely. Selected tall palms from the estate had been used as female parents, pollinated by Dwarf Green pollen from CRI. *Tall x Tall* crosses had also been carried out with prepotent pollen issued from CRI. The tall palms which had been selected on the basis of morphological characters and yield could be now traced and seed nuts from those palms will be collected next year (biased collection).

**Dehigahalanda Estate, Ambalantota**

This is a 25 acre private estate, which had been identified as a source of seed nuts (Plus palms) for the national replanting programme due to its high productivity despite the low soil water availability. Palm selection and nut collection will be done in 1994 from 100 palms randomly selected.

**Chithragala Estate, Ambalantota**

This is also a private estate, 147 acres in extent, situated in Ambalantota, where severe soil water deficit is experienced during most of the year-round. This estate belongs to Lanka Estate Plantations (Ltd.), Colombo. This estate had also been identified as a source of seed nuts for the national replanting programme due to its high productivity despite frequent soil water deficit. A total of 100 palms will be selected randomly for conservation purposes during 1994.

**Raddegoda Estate, Delwita**

This is also a private estate, first visited in response to a request to select "mother palms" for their own replanting programme. Few fields in the estate, about 50-60 years in age, showed apparent physiological adaptation and yielded

heavily despite very low external inputs over a long period of time. While mother palms are selected, it was felt useful to identify a set of palms to be conserved both in-situ and ex-situ. Work on this will be undertaken in 1994.

#### Assembly and evaluation of collected material

Yield and the nut component data were recorded on the selected palms at Maliboda Estate during the year aiming to select parent palms for breeding purposes. However, due to theft, the yield data were not accurate and hence only the fruit component data (over 6 picks) are presented in Table 26.

**Table 26.** *Fruit component analysis carried out at the Maliboda Estate, Deraniyagala.*

	Mean	CV%	Lowest	Highest
Fruit weight	2596.86	23.61	982	4910
Husked nut weight	1122.82	22.42	553	1975
Split nut weight	797.98	16.54	446	1280

#### Conservation Block - Poththukulama Research Station (PRS)

This plantation was maintained satisfactorily during the year. Growth measurements were recorded twice, in May and November and fertilizer was applied in two stages in June and October. The germplasm accessions introduced during the year are summarized in Table 27.

**Table 27.** *The germplasm accessions introduced during the year into the PRS conservation block.*

Date of planting	Accession	Number of seedlings established	Number of mother palms
05/93	<i>Dwarf Brown (OP)</i>	89	05
05/93	<i>Keenakelle</i>	86	100
05/93	<i>Maliboda</i>	87	100
05/93	<i>Horakelle</i>	83	100
05/93	Drought screened palms (Embryo cultured)	19	-
10/93	<i>Wellawa</i>	79	07
10/93	<i>Walalapitiya</i>	85	100

Several vacancies that occurred during the year (03 *Palugaswewa*; 15 *Ambakelle Special*; 05 *St. Anne's*; 16 *Kundasale Dwarf*; 05 *Melsiripura*; 07 *Goyambokka*; 15 *Cameroon Red Dwarf*; 03 *Kasagala*; 04 *Goluwapokuna*; 03 *Debarayaya*; 03 *Mangala Eliya*; 05 *Maliboda* and 04 *Horakelle*) were supplied in the conservation block while 136 *Ambakelle Special* seedlings were supplied on the guard rows.

In addition, 21 new seed holes were supplied with *Cameroon Red Dwarf* seedlings and the following seedlings were handed over to the superintendent/PRS for planting in 1994.

03 *Dwarf Brown* (OP); 03 *Horakelle*; 08 *Goluwapokuna*; 01 *Mangala Eliya*; 02 *Kundasale Dwarf*; 40 *Cameroon Red Dwarf*.

#### **Conservation Block- Bandirippuwa Estate**

This block was maintained satisfactorily during the year. Growth parameters were recorded twice this year in April and October. Fertilizer was given in two split applications in June and October.

In addition, 01 *Wellawa*; 01 *Clovis*; 06 *Pitiyakanda*; 16 *Moorock*; 12 *Debarayaya*; 02 *Ambakelle Special* and 18 *Palugaswewa* seedlings were supplied in the planting blocks while 64 *Ambakelle Special* seedling were supplied on the guard rows. Frequent damage to seedlings was observed during the dry weather from rats and porcupine.

In addition to this, 12 *Cameroon Red Dwarf* seedlings were planted at the Research nursery premises at the Bandirippuwa Estate.

#### **Experiment 5.5.6.2: Collection of germplasm of different forms of coconut (a) San Ramon (b) Dwarf forms (c) Indigenous tall form and (d) Others**

(a) **San Ramon:** Collection from Uhumiya Estate was satisfactorily maintained at BE and PRS.

#### **(b) Dwarf forms:**

(i) **Kundasale Farm:** Eighty five seedlings of DG, Dy and DR forms of Kundasale dwarf were planted at PRS and were satisfactorily maintained.

#### **(ii) Mirishena Estate, Bulathsinhala:**

It was not possible to visit the estate this year due to the lack of funds and poor cooperation from the estate administration.

**(iii) Brown (Russet) Dwarf:**

The self pollination programme that commenced last year on the Madampe (01), Kirimatiyana (02), Marawila (01) and Nattandiya (01) palms were continued this year. The summary of the selfing programme is presented in Table 28.

As a sufficient number of selfed seed nuts could be obtained from the number of buttons remaining after 6 months, the selfing programme was terminated in October. A total of 118 selfed seed nuts were also collected from pollinations of last year and laid at the Bandirippuwa Research Nursery.

Apart from this, a single Yellow Dwarf palm was observed at St. John's vicarage, Panadura which was established from seed nuts originally imported from Malaysia. Twenty seven (27) seed nuts were collected from this palm during the year and were laid at Bandirippuwa Research Nursery.

Observation was also made on three (03) Reddish Brown Dwarf like palms which were said to have been imported from Malaysia at premises number 04, 3rd lane, Hansagiri road, Gampaha. The estate belongs to Mr. D. P. Samarasinha.

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**Table 28.** *Summary of the self - pollination programme on Brown Dwarfs*

Month	Number of palms	Number of inflorescences	Number of buttons selfed	Number of buttons after 3 months	Number of buttons after 6 months
Jan	04	04	102	46	42
Feb	05	06	221	74	74
Mar	05	10	574	135	124
Apr	05	10	816	122	110
May	04	06	714	71	53
Jun	04	06	388	67	35
Jul	04	08	485	91	32
Aug	04	04	234	28	-
Sep	03	06	176	31	-

**Suwarnamali Estate, Dambulla**

This is an isolated 50 acre private estate situated in Thittawelgolla, Dambulla. Personal communication revealed that some of the palms in the estate had

been imported from overseas and planted in the estate nearly 50 years ago. Few phenotypically distinct reddish brown colour tall palms and a few dwarf Green, Dwarf Yellow and Dwarf Red palms were also observed in the estate. Detailed survey on these palms will be done in early January 1994.

#### Mahena Estate

The pollination programme for the purification of material was continued this year. The number of emasculated inflorescences and the number of female flowers pollinated are shown in Table 29. The number of button nuts of the different crosses developing after 3 months of pollination are shown in Table 30.

**Table 29.** *Total number of inflorescence emasculated, female flowers pollinated and the number of buttons remaining after 3 months at Razeena Estate, Akuressa.*

Month	Number of palms pollinated	Number of inflorescences emasculated	Number of buttons pollinated	Number of buttons after 3 months pollination
Jan	07	07	79	19
Feb	07	08	90	16
Mar	06	07	62	12
Apr	07	08	96	23
May	07	09	133	32
Jun	07	08	101	23
Jul	06	87	35	-
<b>Total</b>	<b>07</b>	<b>53</b>	<b>648</b>	<b>160</b>

**Table 30.** *Number of button nuts remaining on the inflorescence after 3 months of pollination in the different crosses at Razeena (Mahahena) Estate, Akuressa.*

Female parent	Male parent					
	T-2	T-4	T-5	T-6	T-7	T-8
T-2	-	02	07	03	07	08
T-4	-	-	01	06	01	03
T-5	-	06	-	07	07	02
T-6	01	05	05	-	05	05
T-7	08	-	09	10	-	01
T-8	-	08	09	05	10	-
D-2	02	02	05	01	05	04

A total of 91 seed nuts were collected this year as a result of the last year pollinations and laid at the Bandirippuwa Research Nursery. Another 05 nuts are to be picked in early January as a result of hand pollinations carried out in December 1992. The summary of harvested nuts according to their crosses are summarized in Table 31.

**Table 31.** *The number of nuts harvested from each of the different crosses during the year at Razeena Estate, Akuressa.*

Female	Male parent						D-2	Nuts harvested	Nuts to be harvested
	T-2	T-4	T-5	T-6	T-7	T-8			
T-2	-	08	-	-	-	03	-	11	-
T-4	06	-	02	-	2(2)	02	-	12	02
T-5	-	06	-	02	03	-	-	11	-
T-6	3(1)	03	02	-	01	04	-	13	01
T-7	5(1)	04	01	01	-	04	-	15	01
T-8	07	6(1)	04	04	-	-	-	21	01
D-2	-	-	02	03	-	03	-	08	-

(The figures in parenthesis are nuts to be harvested)

*R R A Peries, A A L Perera & M H L Padmasiri*

#### Collection of Drought tolerant germplasm

No new selections were made during the year.

#### Evaluation and utilization of Germplasm

A systematic field evaluation of nine promising germ plasm accessions (*Moorock, San Ramon, St. Annes, Maliboda, Walahapitiya, Margaret, Debarayaya, Ambakelle Tall and Ambakelle Special*) was commenced this year. Five open pollinated progenies from 15 randomly selected palms (of the selected lot for conservation) were collected during the year to represent each population. The objective of this experiment was to evaluate and characterize the available germplasm for future use and to estimate genetic parameters to develop suitable collection strategies. Seed nuts collected were laid at the Bandirippuwa Research Nursery and sprouted nuts were transplanted to polybags which were subsequently placed in a fully randomized design similar to that in the field. Preliminary data (growth parameters and physiological parameters) are being collected now in the nursery to evaluate the material at the nursery stage. The seedlings will be planted at the Nariyanpotta Division, Andigama Farm, Giriulla during May 1994.

A crossing programme was commenced in November this year to investigate the combining ability of the Cameroon Red Dwarf (CRD) with selected Ambakelle Tall (selected on the basis of yield, stability, and agronomic characters) in field No. 04, of the Isolated Seed Garden. Pollen from 40 Ambakelle Tall palms were collected and mixed pollen was used for the crossing programme.

A crossing programme was also commenced from May this year on Dwarf Green palms in field 05 (plantation established with a selfed progeny of dwarf palms which had survived the severe effects of drought over several years) of the ISG, with selected palms of Debarayaya Estate (Putative drought tolerant accession) aiming to obtain a superior cross to CRIC 65 in relation to drought tolerance. Initially 20 inflorescences, one from each of 20 palms (palm numbers 6, 9, 16, 19, 55, 64, 65, 67, 86, 98, 102, 103, 109, 112, 114, 126, 157, 199, 207, 244) selected were emasculated and only 10 inflorescence of randomly selected 10 palms were crossed (hand pollinated) with selected Debarayaya pollen while the other 10 inflorescence of remaining palms were allowed to naturally pollinate (open pollinate) with progeny of the Ambakelle Special palms in the periphery of the mini seed garden. The same procedure was repeated with the next inflorescence of each palm, the other way around. The procedure described was repeated until the required number of nuts were obtained. The details of the crossing programme are summarized in Table 32.

## **PROJECT 6 PRODUCTION OF HIGH QUALITY SEEDS AND SEEDLINGS**

### **3. Miscellaneous Research**

#### **3.1 Improvement of nursery techniques**

**Raising coconut seedlings in polybags with sand-based potting mixtures with and without fertilizer application - 1991.**

The study was concluded and a research paper was prepared for publication.

*A A L Perera, R R A Peries & R Jayatilaka.*

**Table 32.** *Details of the DG x Debarayaya crossing programme*

Palm No.	Hand pollinated Dwarf x Debarayaya		Open pollinated Dwarf x Ambakelle Special	
	No. of female flowers	No. of buttons after 3 months	No. of female flowers	No. buttons after 3 months
06	109	23	82	32
09	74	20	46	12
16	113	28	60	25
19	58	15	63	15
55	93	15	76	22
64	109	21	86	22
65	81	18	90	19
67	48	20	45	32
86	67	21	60	14
98	22	02	62	06
102	39	15	62	21
103	61	06	132	50
109	60	12	64	17
112	41	10	55	13
114	37	08	53	09
126	56	09	93	30
157	50	14	53	08
199	75	12	31	10
207	74	14	80	28
244	23	04	63	13

*A A L Perera, R R A Peries, J D J Abeyasekera & R B Attanayake.*

### 3.2 Variety Evaluation trials

**Evaluation of the performance of Tall x Tall, Dwarf x Tall and Moorock Tall in Dry Zone, Minneriya - 1983.**

Due to logistical problems the Board decided to hand over the station to the Coconut Cultivation Board. The trial had therefore to be terminated.

**Evaluation of performance of Tall x Tall, Dwarf x Tall, San Ramon and Dwarf x San Ramon at Dambuwa Mukalana Demonstration Farm (dry intermediate zone Tabbowa, Nattandiya - 1991.**

**Table 33.** *Comparison of fruit components of Tall x Tall; Dwarf x Tall, Dwarf x San Ramon and San Ramon at Dambuwa Mukalana demonstration farm, Nattandiya 1992.*

Variety	Mean nut yield per palm (kg)	Mean fruit wt. (g)	Mean husked nut wt. (g)	Mean split nut wt. (g)	Estimated copra wt. per palm (kg)
SR	56.40	2276.38	1255.86	836.01	22.6
D x SR	69.18	1701.18	840.19	591.26	18.6
D x T	66.00	1716.52	1009.16	656.40	21.3
T x T	99.96	1430.06	708.68	523.49	22.6
Sig	***	***	***	***	
CV%	89.9	23.04	46.05	23.01	

Collection of yield data was continued during the year and fruit component analysis was carried out on 2 nuts per palm randomly selected at each pick.

This is purely an observation trial, with no proper statistical design. The three year data (1991-1993) shows the same pattern as reported in the Annual Report of 1992 (Table 33). The combining ability of Dwarf x SR was apparently inferior to that of Dwarf x Tall, even though pure SR stands out markedly in all the fruit components studied. Between SR and T x T, there was no apparent difference. Whether the introduction of SR into the current breeding programme would yield significant results is a matter of serious concern. Conflicting results have so far been shown in the use of San Ramon, in this study as well as in the progeny trials involving San Ramon.

*R R A Peries & A A L Perera.*

#### 4. Seed Gardens

##### 4.1 The Isolated Seed Garden at Ambakelle

###### 4.1.1 Rainfall

The amount and distribution of rainfall for 1992 is shown in Table 34 along with the values for the previous year and the 10 year average (1984-1993). The total rainfall for the year (1296 mm) was 400 mm lower than that of the

previous year. Despite the fact that there were no rain-free months during the year, there was little effective rain in January, February, June, July and August. The month of June was particularly dry compared to the previous year as well as to the long term rainfall pattern at ISG.

The excessive rain in November and December, again caused temporary water stagnation in several fields (1, 2, 4, 8, 11b and 14) resulting in slight yellowing of both adult and young palms. Part of the nut size improvement experiment planted in field no. 14 also showed yellowing. The balance planting of this field was therefore postponed to 1994.

**Table 34.** *The amount and distribution of rainfall for 1991 and 1992 and the 10 year average (1983-1992) for comparison at ISG.*

Month	1992			1993			10 year (1984-93) average		
	A	B	C	A	B	C	A	B	C
Jan	0	0	0	9.4	2	2	53.73	4.4	4.3
Feb	0	0	0	2.0	1	1	54.55	3.3	3.1
Mar	0	0	0	53.5	6	5	76.17	5.6	5.3
Apr	217.8	9	9	164.0	9	9	205.09	9.7	9.3
May	207.3	11	11	136.3	13	12	130.84	9.0	8.7
Jun	239.5	8	8	2.4	2	1	97.09	9.0	8.6
Jul	116.9	7	6	35.0	5	5	55.59	5.8	5.0
Aug	28.4	5	5	17.5	5	4	23.48	3.9	3.6
Sep	62.3	7	6	89.3	11	10	107.34	8.8	8.1
Oct	342.3	10	10	239.6	22	22	236.93	15.1	14.9
Nov	406.0	22	20	242.8	17	17	263.21	14.3	14.0
Dec	75.9	8	7	304.5	14	14	89.32	6.7	6.6
Total	1696.4	87	82	1296.3	107	102	1393.34	95.6	91.5

(A: rainfall amount in mm; B: number of rainy days; C: number of wet days (rainfall > 1 mm))

#### 4.1.2 Nut yields

Total crop figures for 1992 and 1993 are shown in Table 35 with the 10 year average (1984-1993). The nut yields of *Talls* and *Dwarfs* are shown separately in Table 36. There was a marginal increase in the number of nuts per palm in the tall (from 82 to 87 per palm). In the dwarfs, the reported decrease (81 to 66:-Table 36) due to the castration carried out in field number 14, as the demand

for D x T was low. However towards the latter part of the year, it was again decided to resume emasculation, since CCB was willing to accommodate the total production of D x T seed nuts from the ISG.

In both the Talls and Dwarfs the peak crop was harvested in May/June, whereas in 1992, it was in March/April. This clearly shows, that the cropping pattern at ISG is very different from year to year, and is strongly influenced by the agro-ecology of the region. The classification of palms (census) as at 31 December is shown in Table 37.

**Table 35.** *Total nut yields at ISG from the six picks of the year*

Pick	1992	1993	10 year (84-93) average
01	123985	133337	112505
02	254460	175793	148356
03	234640	316316	183226
04	244565	259653	163330
05	162206	226801	149661
06	160604	154919	122738
Total	1180460	1266819	879816
Number of bearing palms	14451	15193	
Average number of nuts per palm	82	83	

**Table 36.** *Nut yields from the Tall and Dwarf palms at ISG during the year.*

Pick	1992	1993	5 year (89-93) average
<b>For Tall Crop</b>			
01	101377	103985	96078
02	219274	142355	131516
03	197158	276556	155463
04	184865	234017	139216
05	120027	199645	119526
06	119758	132809	99025
Total	942459	1089367	740823
Number of palms in bearing*	11527	12494	
Number of nuts/palm	82	87	

**Table 36.** (Contd.)

Pick	1992	1993	5 year (89-93) average
<b>For Dwarf (D x T) Crop</b>			
01	22608	29352	23357
02	35186	33438	30447
03	37482	39760	31834
04	59700	25636	28530
05	42179	27156	27721
06	40846	22110	22300
Total	238001	177452	164190
Number of palms in bearing	2924	2699	
Number of nuts per palm	81	66	

(\* Of this total, 527 palms were adversely affected by drought)

**4.1.3 Emasculation of Dwarf palms for the production of CRIC 65 hybrid nuts**

Details of the emasculation programme are shown in Table 38. A total of 3002 Dwarf palms comprising 1840 Dwarf Green and 1162 Dwarf Yellow forms were emasculated during the year.

**Table 38.** Emasculation of Dwarf palms for the production of CRIC 65 seed nuts

Field number	Number of palms emasculated		Number of inflorescences emasculated		Number of button nuts at emasculation	
	DG	DY	DG	DY	DG	DY
05	157	-	1026	-	18329	-
09	559	-	2216	-	27736	-
10A	88	836	1161	13505	12490	226960
10B	306	326	4399	5614	71010	77699
14	730	-	5790	-	69924	-
<b>Total</b>	<b>1840</b>	<b>1162</b>	<b>14592</b>	<b>19119</b>	<b>199489</b>	<b>304659</b>

#### 4.1.4 Controlled pollination

**Tall:** Controlled pollinations were continued in field number 4 (improvement of nut size project). Pollination also commenced on 40 selected palm in field no. 4, with pollen from putative drought tolerant germplasm accessions (See section 5.2.2).

*R R A Peries, M H L Padmasiri, W B S Fernando & J D J Abayasekara*

#### 4.2 Makandura Seed Garden

No selection work was undertaken during the year.

#### 4.3 Maduru Oya Seed Garden

At the request of the Manager (Estates) a four-member team from the GPB Division carried out a palm survey at the Maduru Oya Seed Garden to identify weak palms for culling from the parent population of seed palms. The team surveyed the first four fields of the seed garden and furnished a detailed report to Manager (Estates) including maps of the four fields with palms numbered sequentially starting from the first palm of the Field 1. Due to lack of information on infillings made at the seed garden from time to time, the team was unable to select weak palms on the basis of time taken for flowering. However, palms showing poor agronomic characters and those with freak characters were identified for culling.

Further to the survey of palms the Division was also involved in planting a section of the Field 04 at MOSG with hand pollinated *Tall x Tall* material from Ambakelle. The details of planting including a map of planting points and the parentage of each seedling have been prepared.

*R R A Peries and J M D T Everard*

#### 5. Seed Production

A committee comprising CRI and CCB Officials were appointed to monitor the seed palm and seed nut selection programme. The Committee met twice and discussed the re-selection programme of plus palm and the modalities of the future selection programmes. However, no palm selection or re-selection was undertaken during the year.

Several requests were also received during the year from private growers to select mother palms on their estates for their own replanting programme as well as to set up commercial nurseries. The yield data on the estates were studied during the year and palm selection on these estates will commence in early 1994.

Due to a dispute in the pricing of seed nuts, and issue of seed nuts to the CCB, re-selection work could not be undertaken in estates managed by Wayamba Plantations (Pvt) Ltd, despite a decision taken to carry out this work earlier during the year at a meeting with the representatives of the plantation management companies.

*R R A Peries & W M U Fernando*

## **6. Pollen and Pollination**

### **6.1 Pollen collection and issue**

Details of pollen collection and issue are summarized in Table 39. Pollen of the typica variety was collected during the year from 69 inflorescences from 15 selected palms in field 4 of the ISG. A total of 677 ampoules of unadulterated pollen and 80 ampoules of mixed pollen were sealed. Pollen of the typica variety was collected from 05 inflorescences from 06 selected palms from Razeena Estate, Akuressa ('Mahahena') and 216 of such ampoules of pollen were sealed. Small quantities of pollen were sealed in ampoules in order to avoid the wastage of pollen.

Pollen of the typica variety was collected from 20 selected palms from Kasagala Estate, 48 selected palms from Debarayaya Estate, 50 selected palms from Moorock Estate and 50 selected palms from St. Annes Estate. A total of 75 ampoules each of mixed pollen were sealed from Kasagala, Moorock and St. Annes accessions. Another 100 ampoules from Debarayaya were also processed.

Pollen of Brazilian Green Dwarf from the exotic collection at Bandirippuwa estate was collected from 05 inflorescences from 02 palms. a total of 44 ampoules were sealed. Pollen of Cameroon Red Dwarf from the exotic collection at Bandirippuwa Estate was collected from 07 inflorescences, from 06 palms. A total of 80 ampoules of mixed pollen (adulterated with Lycopodium) were sealed.

Pollen of F<sub>2</sub> palms (second generation of hybrid crosses) was collected from 18 inflorescences from 21 selected palms in field 15 B/E. A total of 329 ampoules were sealed.

## **7. Research Nursery**

### **7.1 Bandirippuwa Research Nursery**

Tables 40, 41 and 42 summarizes the data on seed nuts laid,

seedlings issued and the availability of seedlings as at 31 December. Seedlings from the germplasm conservation programme were used throughout the year for infilling vacancies and/or establishing new blocks in the B/E and PRS germplasm fields.

*R R A Peries, A A L Perera, R Jayatilaka, J D J Abeyasekera & W B S Fernando.*

**Table 39. Pollen collection and issue during the year**

	No. of ampoules		Tall					Variety palms (BE)	BGD (BE)	CRD (BE)	F2 palms (BE)
	ISG (Mahahena)		(K)	(D)	(M)	(S)					
<b>Carried over from 1991</b>											
Pollen from individual palms	491	296	-	-	-	-	17	-	-	-	-
<b>Sealed in 1993</b>											
Pollen from individual palms	677	216	-	-	-	-	-	44	-	-	329
Mixed pollen	80	-	75	100	75	75	-	-	-	-	-
Mixed pollen adulterated with lycopodium	-	-	-	-	-	-	-	-	80	-	-
<b>Issued for pollination programmes</b>											
<b>Pollen from individual palms</b>											
1. At ISG	623	-	-	-	-	-	-	-	-	-	-
2. At Akuressa	-	150	-	-	-	-	-	-	-	-	-
3. At BE	-	-	-	-	-	-	-	28	-	-	83
<b>Mixed pollen</b>											
1. At ISG	-	-	50	75	50	50	-	-	-	-	-
2. At BE	02	-	-	-	-	-	-	-	-	-	-
<b>Other uses (Viability tests, demonstrations, breakages etc.)</b>											
Pollen from individual palms	55	-	10	15	10	10	-	-	-	-	30
<b>No viability /Low viability</b>											
Pollen from individual palms	250	150	-	-	-	-	17	-	-	-	-
<b>Balance as at 31 December 1993</b>											
Pollen from individual palms	240	212	-	-	-	-	-	16	-	-	216
Mixed pollen	78	-	-	-	-	-	-	-	-	-	-
Mixed pollen adulterated with lycopodium	-	-	-	-	-	-	-	-	72	-	-

*W B S Fernando*

**Table 40.** *Seed nuts laid in the Bandirippuwa Nursery during the year*

Variety	Source	Number of seed nuts		
		In beds	In polybags	In pre nursery Total
<b>Hand pollinated nuts</b>				
Akuressa	Razeena estate	-	-	302 302
Cameroon Red Dwarf	Old nursery B/E	-	24	- 24
Brazilian Green Dwarf	Old nursery B/E	-	20	46 66
Pora Pol	Old variety block	-	43	- 43
Bodiri	Old variety block	-	10	- 10
Nawasi	Old variety block	-	75	10 85
Ran Thambili	Old variety block	-	17	- 17
Dwarf Green	New variety block	-	45	- 45
Dwarf Yellow	New variety block	-	12	- 12
Nawasi Thambili	B/E	-	17	- 17
Gon Thambili	B/E	-	13	- 13
Kamandala	Old variety block	-	32	- 32
<b>Germplasm Collections</b>				
Debarayaya	Debarayaya	-	-	149 149
Dwarf Russette	Kirimetiyan Temple	-	13	41 54
Dwarf Russette	Madampe	-	55	- 55
Dwarf Russette	Marawilla	-	0	10 16
Dwarf Russette	Ninamadama	-	24	55
Walahapitiya	Nattandiya	-	-	120 120
Maliboda	Daraniyagalla	-	-	141 141
Clovis	Clovis Estate	-	-	150 150
Moorock	Moorock Estate	-	-	149 149
St. Annes	St. Annes Estate	-	-	145 145
Magret	Magret Estate	-	-	147 147
Pallama	Pallama	-	05	- 05
Dwarf yellow	Panadura	-	07	20 27
<b>Other</b>				
Ambakelle Special	ISG	-	-	1587 1587
DG x T	ISG	-	-	1604 1604
Ambakelle Tall	ISG	-	-	150 150
<b>Total</b>		-	425	4795 5220

**Table 41.** *Seedling issues from the Bandirippuwa Research Nursery during the year*

Variety/ Accession	G & PBD		Other Divisions		Other purposes		Commercial issues		Total
	A	B	A	B	A	B	A	B	
DxT	-	193	303	-	-	-	591	-	1087
AS	-	725	261	424	-	-	395	44	1849
Cameroon Red Dwarf	-	88	-	-	-	-	-	-	88
Moorock tall	-	16	-	-	-	-	-	-	16
St. Anne's	-	05	-	-	-	-	-	-	05
Kundasale	-	18	-	-	-	-	-	-	18
Clovis	-	01	-	-	-	-	-	-	01
Palugaswewa	-	21	-	-	-	-	-	-	21
Pitiyakanda	-	06	-	-	-	-	-	-	06
Debarayaya	-	12	-	-	-	-	-	-	12
Goyambokka	-	05	-	-	-	-	-	35	40
Mangala Eliya	-	04	-	-	-	-	-	55	59
Melsiripura	-	04	-	-	-	-	-	34	38
Goluwapokuna	-	12	-	-	-	-	-	-	12
Walahapitiya	-	85	-	-	-	-	-	57	142
Keenakele	-	86	-	-	-	-	-	-	86
Horakelle	-	90	-	-	-	-	-	31	121
Maliboda	-	92	-	-	-	-	-	15	107
Dwarf Brown	-	92	-	-	-	-	-	-	92
Wellawa	-	80	-	-	-	-	-	-	80
Kamandala	-	01	-	-	-	-	-	-	01
Ran Thambili	-	11	-	-	-	-	-	-	11
Nawasi	-	10	-	-	-	-	-	-	10
Bodiri	-	31	-	-	-	-	-	-	31
Pora Pol	-	19	-	-	-	-	-	-	19
Gon Thambili	-	02	-	-	-	-	-	-	02
DR	-	07	-	-	-	-	-	-	07
DG	-	35	-	-	-	-	-	-	35
Kasagala	-	03	-	-	-	-	-	-	03
<b>Total</b>		<b>-1754</b>	<b>564</b>	<b>424</b>	<b>-</b>	<b>-</b>	<b>986</b>	<b>271</b>	<b>3999</b>

(A and B are seedlings from conventional seed beds and polybags respectively.)

**Table 42.** *Availability of planting material at Bandirippuwa Research Nursery as at 31 December*

Variety	Seedlings over 5 months in age		Total
	In seed beds	In polybags	
<b>Germplasm collections</b>			
Moorock	-	04	04
Dwarf Russet (Madampe)	-	10	10
Dwarf Russet (Marawila)	-	05	05
Goluwapokuna	-	66	66
Weralugama	-	06	06
Cameroon Red Dwarf	-	40	40
Brazilian Green Dwarf	-	53	53
Bodiri	-	42	42
Akuressa	-	266	266
Kamandala	-	08	08
Nawasi	-	12	12
Pora Pol	-	05	05
Wilhelmina	-	04	04
Dikpitiya	-	03	03
Dwarf yellow (Panadura)	-	10	10
Mahawewa	-	11	11
<b>Other</b>			
Pallama	-	01	01
Ambakelle Special (husked)	-	13	13
Ambakelle Special	-	181	181
Sirikandura	-	144	144
Poththukulama	-	38	38
DG x T	-	191	191
<b>Total</b>	-	<b>1111</b>	<b>1111</b>

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# REPORT OF THE SOILS AND PLANT NUTRITION DIVISION

Head - Dr M N Fernandopulle, Ph D

## 1. GENERAL

Eleven field experiments and nine laboratory/glasshouse studies on nutritional, soil physical and water use aspects of coconut were continued. A new experiment on the effect of chloride nutrition on yield of coconut was commenced.

Studies on nutrient mapping showed that about 50% of the coconut plantations were deficient in potassium (K) and magnesium (Mg). However, data indicate an improvement in Mg nutrition in coconut with the increased use of dolomite in coconut in response to CRI recommendations under Differential Fertilizer Recommendation and Adult Coconut fertilizer mixture. Nutritional deficiencies of sulphur (S), chlorine (Cl), and sodium (Na) in several coconut estates were provided with corrective fertilizer recommendations.

### 1.2 Grants

A new CARP project grant was given to Mr L P Vidhana Arachchi, Assistant Soil Scientist, to continue his studies at the University of Sri Jayawardanapura, Nugegoda to undertake a Ph.D. programme titled "Characterization of physical properties of coconut soils and studies on development of coconut roots " to study the soil physical aspects under the land suitability project.

## 2. LABORATORY AND GLASSHOUSE STUDIES

### 2.1 Effect of different types of organic matter on the availability of Mg from dolomite

A glass house experiment was carried out to study the magnesium availability of dolomite with added organic matter. *Gliricidia*, layer litter and cow dung were added to a sandy loam soil (Madampe Series) with an equal amount of dolomite and a sub sample was taken for an incubation study while the rest was filled (1½ kg per pot) in pots with three replicates in each treatment. Green Panic (*Panicum maximum*) was used as an indicator plant and the dry weight gain with different treatments is given in Table 1.

**Table 1.** *Effect of different types of organic matter and dolomite on the dry weight (g) gain of Green Panic - after 30 days*

Treatment	Without dolomite	With dolomite
Soil	5.54	5.80
Soil + Gliricidia	7.38	9.02
Soil + Layer litter	8.80	9.92
Soil + Cow dung	8.23	9.24
LSD (P= 5%)	0.64	

Incubation results also indicates similar trend on the availability of Mg from dolomite (Table 2).

**Table 2** *Effect of different types of organic matter on the availability of Mg from dolomite.*

Treatment	Soil Magnesium (me/100 g soil)			LSD (P=5%)
	0 day	30 day	60 day	
Soil + Gliricidia	1.38	2.44	2.18	
Gliridia + Dolomite	2.68	5.54	6.08	1.41
Soil + Layerlitter	5.12	5.61	6.19	
Soil + Layerlitter + Dolomite	6.34	10.21	10.82	1.50
Soil + Cowdung	5.01	5.82	6.12	
Soil + Dolomite + Cowdung	6.31	9.89	10.68	1.47

*I Wickramananda & M N Fernandopulle*

## 2.2 Effect of different types of organic matter treatments on soil properties

Soil samples were collected from the Experiment 7.12.1 at the Ratmalagara Research Station for the analyses of chemical and physical properties. Results are given below (Tables 3 and 4)

**Table 3.** *Effect of different types of organic matter treatments on the N concentration of soil.*

Treatment	Nitrogen concentration (%)
Control (AMP)	176.4
Gliricidia (G)	379.6
Pueraria (P)	400.7
Pueraria + Gliricidia	395.6
LSD (P=5%)	28.3

**Table 4.** *Effect of different types of organic matter treatments on the physical properties of soil*

Treatment	Organic matter (%)	Bulk density (g/cm <sup>3</sup> )
Control (AMP)	0.63	1.69
Gliricidia (G)	0.84	1.53
Pueraria (P)	0.85	1.50
Pueraria + Gliricidia	0.87	1.51
LSD (P=5%)	0.17	0.11

Results indicate that in situ cultivation of organic matter improves the nitrogen level of the soil. At the same time this has an added advantage as it improves the soil porosity by decreasing the soil bulk density. The organic matter content has an improvement with in situ cultivation of nitrogen fixing trees in a coconut plantation.

*M N Fernandopulle*

### 3. RESEARCH PROJECTS

#### PROJECT 1: STUDIES ON THE IMPROVEMENT OF SOIL ORGANIC MATTER STATUS AND WATER HOLDING CAPACITY

**Experiment 1.5.2: Effect of coir dust on the physical condition of the soil. Marichchikattiya Estate, Madurankuliya - 1984 ; Modified 1987.**

Yield records were maintained and manuring was completed in October. Since there was no significant yield increase with applied treatments, the experiment was terminated at the end of 1993

*K S Jayasekara*

#### **PROJECT 4: FIELD MANAGEMENT SYSTEMS**

**Experiment 4.5: Evaluation of input balance in coconut plantations under different agro-climatic conditions, Bandirippuwa Estate, Lunuwila - 1990**

Studies on rain-water interception by the coconut canopy was continued during the rainy period. Nutrient levels in the ground water table at Bandirippuwa Estate were monitored by chemical analysis of water in a total of twelve wells/streams during the year. Studies are in progress to ascertain the degree of nutrient recycling due to rain-water interception by coconut and its mechanisms.

*K S Jayasekara, C Jayasekara (Plant Physiology Division),  
E M A T Banda & U S S Perera*

#### **PROJECT 7: STUDIES ON THE NUTRIENT REQUIREMENT OF COCONUT**

**Experiment 7.7: Nutrient requirement of coconut based on leaf and soil analysis.**

##### ***Differential Fertilizer Recommendation (DFR)***

The computer model for the Differential Fertilizer Recommendation (DFR) was further refined to include soil type and agro-climate as input variables for better fertilizer use efficiency in the DFR package.

During the year, DFR service was provided to 215 large coconut estates (> 50 ac) covering an area of about 7100 ha. Total of 723 leaf (14th) samples, collected from these estates were analyzed for N, P, K, Mg, Ca.

*K S Jayasekara, T W Fernando, S Periyathamby & G D George.*

**Experiment 7.12.1: Effect of green manure on the nitrogen status of coconut palms. Ratmalagara Estate, Madampe - 1988**

This experiment is conducted in collaboration with the Agronomy Division. Hence details are given in the Agronomy Division Report.

*D N S Fernando (Agronomy Division) & M N Fernandopulle.*

**Experiment 7.13: Evaluation of nutrient status in coconut growing soils ("Nutrient Mapping")**

Soil samples were collected under the DFR programme were analyzed for mineral nutrient levels. For comparison, the soil analytical data collected in 1982/83 period under the FAO

FAO Fertilizer Demonstration Project were also collated into frequency histograms similar to that of leaf analytical data, in-order to study the nutrient status of soils in coconut lands.

*K S Jayasekara, D T Mathes & L L W Somasiri.*

**Experiment 7.15.1: Effects of N, K, and Mg on the performance of coconut seedlings (TxT). Ratmalagara Estate, Madampe - 1991**

Detail of the experiment was given in the Annual Report for 1991. The first differential manuring was done in May.

Growth measurements of the different treatments were taken in every three months.

*M N Fernandopulle*

**Experiment 7.15.2: Effects of phosphorous nutrition on the performance of coconut seedlings (TxT). Ratmalagara Estate, Madampe - 1991**

Details of the experiment were given in the Annual Report for 1991. The first differential P-manuring was done in May, with NKMg (2-0-2-1) fertilizer mixture as the basal dressing with rates similar to that of YPM.

Growth measurements of the different treatments were taken in every three months.

*M N Fernandopulle.*

## **PROJECT 24: STUDIES ON IRRIGATION OF COCONUT**

**Experiment 24.2: Effect of size of the irrigation zone on the growth and water relations of coconut seedlings and its nutrient balance. Bandirippuwa Estate, Lunuwila - 1987**

Differential irrigation treatments were imposed and palms were fertilized with YPM (13-12-17) fertilizer mixture at the rate of 2 kg/seedling in June and in November, and dolomite at 1 kg per seedling in July. Leaf number and palm height were monitored. Leaf water status and rate of photosynthesis were also monitored. The trial is in progress.

*K S Jayasekara, C Jayasekara & D P Panditharatne.*

**Experiment 24.3: Studies on irrigation systems for coconut plantations**

**(a) Ratmalagara Estate, Madampe (1990)**

The new "Screw Dripper" developed (Annual Report for 1991, Experiment 24.3) and fixed in the prototype irrigation system installed at Ratmalagara Estate is functioning well without blockages. Dripping rate of water was adjusted to different rates to supply the water requirement of coconut and intercrops in the system (coconut- 5 l/h, citrus- 2 l/h, coffee- 2 l/h, pepper- 1 l/h and banana- 4 l/h).

Mr D P Panditharatna, Technical Assistant developed a new low-cost "Ball-tap" to be used in irrigation and other water reticulation systems. Ball-tap is made up of a PVC tube with a spherical ball (ie: glass marble) inside as the valve which could be pushed in to open the tap for water. Because of the weight of the ball and pressure of water, the ball gets pressed down and closes the tap. The Ball-tap is free of leaks as no parts for wear and tare. It could be easily prepared locally and may be used in irrigation and water distribution systems.

**(b) Bandirippuwa Estate, Lunuwila (1991)**

The screw dripper installed at Bandirippuwa Estate is also functioning without significant changes in dripping rates. Conduit pipes used, instead of PVC pipes, in the reticulation system installed at Bandirippuwa Estate did not show any signs of decay even buried in soil under field conditions.

Water use of coconut, *Gliricidia*, ipil ipil and *Pueraria decumbens* under field conditions were monitored using a neutron probe. Studies are in progress.

*K S Jayasekara & D P Panditharatne.*

**PROJECT 26: STUDIES ON WATER RELATIONS OF COCONUT AND INTERCROPS**

**Experiment 26.1: Studies on water balance of coconut under different soil landscapes, agro-climates and management practices (CARP funded)**

- (a) Bandirippuwa Estate, Lunuwila (1990)
- (b) Thammenna Estate, Puttalam (1991)
- (c) Ratmalagara Estate, Madampe (1992)
- (d) Isolated Seed Garden (ISG), Rajakadaluwa (1992)

The research project on "Studies on water balance of coconut under different soil landscapes, agro-climates and management practices" was awarded by the CARP and the on-going project 26.1 and 26.4 (Annual Report for 1990 and 1991) on water balance of coconut conducted at Bandirippuwa Estate and Thammenna Estate are similar. Hence all three experiments will be reported under one experiment.

Soil water depletion of different coconut cultivars was monitored using a neutron probe at Bandirippuwa Estate, Thammenna Estate and Isolated Seed Garden. A total of 46 Al-access tubes (3 m long) per palm were installed at different distances away from the base of the palm along the row and diagonally.

Preliminary results showed that with the on-set of rain-free period, root water uptake was initially confined to the top 0-50 cm layer of soil. After 2-3 weeks, coconut roots extracted water mainly from soil layers below 1 m depth.

Three research discussions were held related to the project with Vidya Jyothi Dr C R Panabokke.

The experiment is in progress.

*K S Jayasekara, C Jayasekara (Plant Physiology Division), K R R A Peries (Genetics and Plant Breeding Division), W M P B Wahala, K G D Priyantha & C L Tennakoon.*

**Experiment 26.2:** Studies on the resistance to water flow in coconut and intercrops. Bandirippuwa Estate, Lunuwila - 1990

Studies on the vascular system of root, stem, petiole and ekel of the coconut palm were continued. Differences in root axial resistances/conductances were observed in roots of Leaf Scorch Decline (LSD) palms. Studies on the nutrient translocation in stem and at leaf axils are in progress.

*K S Jayasekara, C Jayasekara (Plant Physiology Division) & S Periathamby.*

**Experiment 26.3:** Studies on water balance of coconut and intercrops, Ratmalagara Estate, Madampe - 1991

Differential irrigation treatments were given to intercrops (citrus, coffee, pepper and banana). Plant growth parameters were monitored. Water use by different intercrops under rain-fed and irrigated conditions will be monitored with the on-set of drought.

*K S Jayasekara, H A J Gunathilake (Agronomy Division) & D P Panditharatne.*

#### **PROJECT 29: STUDIES ON FERTILIZER USE**

**Experiment 29.1:** Efficiency of Differential Fertilizer Recommendations (DFR) based on leaf/soil nutrient and present/"potential/target" productivity of coconut.

The experiment is sited at the following locations:

Bandirippuwa Estate, Lunuwila (1989)  
Ratmalagara Estate, Madampe (1989)  
Pothukulama Research Station, Pallama (1989)  
Isolated Seed Garden, Rajakadaluwa (1990)  
Walpita Estate, Walpita (1990)  
Makandura Seed Garden, Makandura (1990)  
Maduru Oya Seed Garden, Maduru Oya (1990)

Differential Fertilizer Recommendation (DFR) packages were applied in all seven estates of the CRI provides the average leaf nutrient levels with time.

*K S Jayasekara, T W Fernando, A A Fernando & B C E Perera*

**Experiment 29.2:** Studies on the localized application of fertilizer in coconut. Ratmalagara Estate, Madampe - 1991.

Yield records were monitored regularly. Differential application of fertilizer was completed in October. The experiment is in progress.

*K S Jayasekara, D N S Fernando (Agronomy Division) & B C E Perera.*

**Experiment 29.3:** "Axil Feeding" of fertilizers in coconut. Bandirippuwa Estate, Lunuwila - 1991.

Plant growth parameters (leaf number and plant height) were measured. Differential fertilizer treatments were applied in May and November. Leaf samples were taken to study the nutrient translocation in relation to vascular system of coconut. The experiment is in progress.

*K S Jayasekara, C Jayasekara, T W Fernando & A A Fernando*

#### **4. MISCELLANEOUS STUDIES**

##### **4.1 Land suitability mapping project**

The field work of soil mapping in the Puttalam Kurunegala and Gampaha Districts was continued from 1st January to the end of May 1993. During this period, the areas covered by following one inch sheets were surveyed.

- (1) Wariyapola
- (2) Kurunegala
- (3) Nalanda
- (4) Gampaha.

For the soil survey, soil series was considered as the basic mapping unit, land form units were identified by areal photo interpretation and the relationship between different kinds of soils and different land form units was then established. These relationships were used for mapping of the soil series. The soil boundaries were then checked in the field by making use of soil bore observations and burrow pits.

There were three widely spread soil series in the Wariyapola 1" sheet area; viz Wariyapola series, Maho series and Andigama series. Being a deep, imperfectly drained, loam to sandy clay loam soils, the Wariyapola series was identified as a productive coconut soil falling into suitability class S3 lands which possess production potential of 10000 12500 nuts/ha/year. Both the Maho and Andigama series were moderately deep, well drained loam to sandy clay loam soils

and found to be moderately productive. Coconut soils classified into suitability class S4 lands that possess production potential of 5000-10000 nuts ha year are classified into S4. A considerable extent of highly productive alluvial soils (Suitability class S2) were also found in the Daduru Oya flood plain. There were three widely spread soil series in the Kurunegala 1" sheet area; Viz Kuliypitiya series, Kurunegala series and Melsiripura series. The Kurunegala series was deep, imperfectly drained and loamy textured and the Melsiripura series was very deep, well drained loamy textured. Both series were found to be highly productive coconut soils and were classified into suitability class S2. Lands having production potential of 12500-15000 nuts/ha/year are classified into S2. The Kuliypitiya series was a moderately deep, well drained sandy clay loam soil and found to be moderately productive and classified into S4. Steep terrain (slope exceeding 30%) was considered as not suitable for coconut.

In the Gampaha 1" sheet area, the Boralu series and the Pallama series were found to be widely spread. The Boralu series was confined to the mid slope and the upper part of the undulating terrain and the Pallama series was found in the gently undulating or flat terrain in the lower part of the terrain. The Pallama series consists of deep, imperfectly drained, loam soils and were found to be highly productive and classified into suitability class S2. The Boralu series consists of moderately deep, well drained, sandy clay loam and gravelly sandy clay loam which were found to be moderately productive and therefore was classified into S4. The Nelundeniya series which was found to be associated with the rolling terrain (slope between 16-30%) was only marginally productive and classified into S5. In addition some highly productive alluvial soils were also found within the flood plain of Ma-Oya.

Soil maps of 1:63 360 scale indicating soil series of the area covered by 1" sheets of Kalpitiya, Puttalam, Battulu-oya, Chilaw, Negombo, Wariyapola, Dandagamuwa, Gampaha, Nalanda and Kurunegala were prepared. There were about 70 soil series within the survey area. Based on the potential coconut yield of each soil series, soil characteristics and agro-ecological regions in which each soil series occur, soil series were categorized into five suitability classes and two non suitable classes as indicated below.

Class	Potential yield(nuts/ha/yr)
S <sub>1</sub> Highly suitable	more than 15,000
S <sub>2</sub> Suitable to highly suitable	12,500 - 15,000
S <sub>3</sub> Suitable	10,000 - 15,000
S <sub>4</sub> Moderately suitable	5,000 - 10,000
S <sub>5</sub> Marginally suitable	2,500 - 5,000
N <sub>1</sub> Currently unsuitable	less than 2,500
N <sub>2</sub> Permanently unsuitable	

Land suitability maps for coconut were also prepared on the same scale as soil maps (1:63,360). A seminar on land suitability studies was held at the Mahaweli Centre, Colombo on 27 August, 1994.

Arrangement was also made for printing land suitability maps (in colour) and soil maps (in black and white). A report on land suitability studies was also prepared for the benefit of the users of land suitability maps.

*L L W Somasiri, N Nadarajah, L Amarasinghe  
D S Wijetunga & K L Ranasinghe*

#### 4.2 Evaluation of ion-exchange resin method for soil phosphorus estimation (M. Phil research work, Mrs D M D I Wijebandara).

A pot experiment was established for evaluation of soil P status of various soil types using *Pueraria phasioloides* and Panicum grass as indicator plants. Ten different soil series were used for the experiment. The response to applied P in each soil series was assessed using the chaminade index.

The soil P status of each soil series was also estimated in the laboratory by different standard soil P testing methods, including ion exchange resin methods.

A field experiment was also established in five different soil series using *Pueraria phaseoloides* as the indicator plant with the objective of assessing the soil P status by the Chaminade index under field conditions.

Several standard soil testing methods were tested with Chaminade Index. It was found that Bray and Kurtz method, Olsen's bicarbonate method and

the Vanderpaaw method (water extraction) correlated satisfactorily with the Chaminade Index

*D M D I Wijebandara & L L W Somasiri*

#### 4.3 Land suitability mapping project (soil physical aspects)

Mr L P Vidhana Arachchi continued his studies at the University of Sri Jayawardanapura, Nugegoda to undertake a Ph.D. programme titled "Characterization of physical properties of coconut soils and studies on development of coconut roots " to study the soil physical aspects under the land suitability project.

This study will evaluate the effect of varying physical and moisture stress of different coconut soils on root development of coconut seedlings.

The *Andigama* soil series was selected to compare with the *Madampe* soil series to identify the major physical barriers that affect root growth of coconut seedlings. Combined effect of moisture stress and physical stress on physiological aspects of coconut seedlings will be evaluated for this study.

Sites for the experiments have already been selected at Rathmalagara Estate and at Bandirippuwa Estate to represent *Andigama* and *Madampe* series, respectively. Description of soil profiles and some preliminary studies were completed.

*L P Vidhana Arachchi & K R E M Fernando*

#### ACKNOWLEDGEMENT

Encouragement and co-operation rendered by the Coconut Research Board are gratefully acknowledged. Thanks are due to Mr M Jeganathan, ARP-Project Coordinator for the assistance on CARP projects. Assistance given by the Heads and staff of other Research and Services Divisions of the Coconut Research Institute is sincerely appreciated. Services rendered by Mr Senerath, Head/Land Use Division of the Irrigation Department under the CARP Project (Land suitability Study) is gratefully acknowledged. Co-operation from National Livestock Development Board (NLDB) and Wayamba Plantations (Pvt) Ltd. in the conduct of the field experiments in their plantations and the encouraging response from the coconut growers/public are also acknowledged.

Contribution by former members of the Division is duly recognized. All members in the Division worked with dedication throughout the year to achieve the success of the research programme.

## REPORT OF THE CROP PROTECTION DIVISION

Head - C N K Rajapakse, M Sc

### 1. GENERAL

The research programme of the Division progressed satisfactorily. Emphasis was given to Integrated Pest Management Programmes. A new recommendation was made for termite control. Studies were carried out to evaluate conventional methods in termite control. The Division also undertook the evaluation of a fumigant for coir dust at the request of Finlay's Chemicals & Dyes (Pvt) Ltd.

Assistance was provided to growers on the identification and control of insect pests and diseases.

### 2. RESEARCH PROJECTS

#### PROJECT 9: EVALUATION OF SYSTEMIC INSECTICIDES FOR THE CONTROL OF FOLIAR PESTS OF COCONUT

Experiment 9.4: Evaluation of four insecticides for the control of black beetle (*Oryctes rhinoceros*), Madampe - 1992

The procedure and the design of this experiment are given in the Annual Report for 1992. The experiment at Kumbukwewa Estate was discontinued due to poor management of the seedlings by the owner.

Results obtained at Ratmalagara Estate indicated a marked reduction of the total damage in the experimental area after application of treatments (Fig 1). However it was not possible to observe a significant difference in the damage between different treatments so far.

This experiment is in progress.

*P A C R Perera, I R Wickramananda, C N K Rajapakse & D C L Pathirana.*

#### MISCELLANEOUS INVESTIGATIONS

Experiment 1: Evaluation of two methods of application and four concentrations of chlorpyrifos for termite control in coconut nurseries - 1992

The objective of this experiment was to identify an effective method

the application of chlorpyrifos and to find out a suitable concentration for termite control in coconut nurseries.

The treatments consisted of two application methods described below and four concentration levels for each application method. Treatments were replicated four times. The two methods were: dipping seednuts in different chlorpyrifos solutions before laying in the nursery and spraying (drenching) the nursery with insecticide solutions after laying the seednuts.

For the dipping method, each seednut was dipped for 3 minutes in the respective insecticide solution, before laying in the nursery. The insecticide concentrations tested were; 0.4 g, a.i., 0.6 g, a.i., 0.8 g, a.i. and 1.0 g, a.i. per liter. Drenching was carried out by applying 15 liters of each spray solution per plot (3 m<sup>2</sup>). Mortality of seedlings due to termite attack was recorded weekly. These concentrations were tested on termites in a laboratory bioassay in 1992 and found that 0.6 g, a.i to 1.0 g, a.i per liter could be effectively used in termite control (CRI Annual Report 1992).

The results obtained from the present study confirmed that concentrations of chlorpyrifos between 0.6 g, a.i and 1.0 g, a.i /L were effective in controlling termites in coconut nurseries (Table 1). The results also revealed that the dipping of seednuts in recommended concentrations prior to planting is significantly more effective than the drenching method to control termites (Table 2).

*C N K Rajapakse, I R Wickramananda & S P Manohar.*

#### **Experiment 2:                   Effect of plant extracts against termites under laboratory conditions - 1992**

The objective of this experiment was to study the effectiveness of various plant extracts to control termites.

Plants and plant parts that were used to prepare extracts were; rhizomes of turmeric (*Cucurma domestica*) and ginger (*Zingiber officinale*), corms of *Alocacia*. and seeds of Castor (*Ricinus communis*). Extractions were made by blending 200 g of each material with 200 ml of water. One percent solutions were prepared from each extract. Soil filled containers were sprayed with each solution and mixed thoroughly. Twenty healthy termites were introduced into each container. Fungal colonies which were grown in termite mounds were provided as food for termites. Each extract was replicated five times. Mortality of termites were observed 24 hrs and 48 hrs after treatment. The control used for the experiment was 15 ml of distilled water. Highest mortality of termites was observed in castor seed

extraction at 24 hrs after treatment (Table 3). All plant extracts tested showed high mortality rates except *Alocacia* extract, at 48 hrs after treatments.

*C N K Rajapakse, P A C R Perera & L C P Fernando*

**Table 1.** *Percentage termite attack on seedlings in different concentrations of chlorpyrifos.*

Treatment a.i.(g)/l*	Termite attack(%)	
	Transformed values	Detransformed values
1.0	11.92	4.3
0.8	16.72	8.3
0.6	12.75	4.9
0.4	22.78	15.0
control	63.35	79.8
LSD	10.75	
Significance	*	

\* a.i(g)/l - Active ingredient of chlorpyrifos g/l & p < 0.05)

**Table 2.** *Percentage termite attack on seedlings with different methods of insecticide application.*

Application methods	Termite attack (%)	
	Transformed values	De transformed values
Drenching	29.74	23.9
Dipping	21.26	13.1
LSD	6.80	
Significance	***	

(p < 0.001)

**Table 3** *Percentage mortality\* of termites in different plant extracts.*

Treatments (plant extract)	% mortality at hrs post treatment	
	24	48
Turmeric	39	77
Ginger	43	75
Castor	51	82
Alocacia	37	48

\*Corrected percentage mortality using Abbott's formula.

**Experiment No 3: Effect of nutrient content of coconut leaves in relation to susceptibility to black beetle - 1992**

This experiment was carried out in an estate with heavy black beetle infestation at Pallanchena. Although most palms were heavily damaged by black beetle there were some palms which were not attacked. Therefore this experiment was conducted to find out whether the nutrient content of the palm as assessed by leaf analysis has any effect on susceptibility to black beetle attack.

Palms damaged by black beetle and palms without damage were divided into two categories according to their age. Seedling and young palm categories comprised of palms up to 4 years old and up to 10 years old respectively. Five palms were selected from each category. Leaf samples were taken from 1st and 3rd fronds of each palm and were analyzed for N, P, K, Ca and Mg contents.

Results revealed that there was no significant relationship between damage by black beetle and the age of the palm (two categories of palms). Study of the nutrient content of leaf and black beetle attack showed that N and Mg contents of the damaged palms were significantly ( $p < 0.05$ ) lower than that of the undamaged palms (Table 4).

No significant difference in the levels of the other nutrients studied were seen between attacked and unattacked palms.

*C N K Rajapakse, P A C R Perera & K F G Perera.*

**Table 4.** *Nutrient content of black beetle damaged and undamaged palms.*

Type of palm	Nutrient content (%)				
	N	P	K	Mg	Ca
Damaged	1.51	0.17	2.10	0.24	0.35
Undamaged	1.72	0.15	2.08	0.28	0.37
LSD	0.19	0.02	0.29	0.03	0.05
Significance	*	NS	NS	*	NS

( $p < 0.05$ )

**Experiment 4: Effectiveness of Dazomet (Basamid granular) for fumigation of coir dust - 1992.**

The objective of this experiment was to study the effectiveness of Dazomet for fumigation of coir dust. Two types of coir dust (old & new) and three concentrations of Dazomet (150, 200 and 250 g-m<sup>3</sup>) were tested, 150 and 200 g-m<sup>3</sup> of Dazomet for new coir dust and 200 and 250g-m<sup>3</sup> for old coir dust were used. The experiments were carried out separately under laboratory and field conditions. Each treatment was replicated four times.

Treated coir dust was packed into 58 cm diameter gusseted polythene bags up to a height of 60 cm (0.16m<sup>3</sup>) for laboratory study and heaps of 1 m<sup>3</sup> (1m x 1m x 1m), covered with 500 gauge polythene sheets were used for the field study. Bags and heaps of untreated coir dust were used as controls.

Samples were collected, at weekly intervals, at depths of 0.1, 0.3 & 0.5 m and 0.2, 0.4, 0.6, 0.8 & 1m from the bags and heaps respectively. Seed germination tests using cowpea and mustard, isolation of micro-organisms and nematode assays were carried out in these samples.

Observations on micro-organisms indicated that treatment with Dazomet reduced fungal colonies to very low levels (Table 5 & 6), but bacterial colonies were less affected. With either grade of coir dust, the two concentrations of Dazomet used were equally effective in controlling fungi.

Germination tests indicated that the evolved gases were toxic to cowpea seeds for a period of 3 - 5 weeks, and a much longer period for mustard seeds irrespective of the coir dust type. Treatment with Dazomet killed nematodes

in both coir dust types, but after three weeks new nematode colonies were developed, possibly from unaffected eggs (Table 7).

*P A C R Perera, H T R Wijesekara, & S P Manohar*

**Table 5.** *Fungal colony counts in cultures developed from Basamid treated new coir dust under field conditions.*

Type of coir dust	Colonies/0.1 ml of suspension Time after treatment (weeks)			
	1	2	3	4
Treated	3.0	4.0	15.0	5.0
Untreated	67.0	43.0	30.0	45.0
LSD	12.7	14.4	8.5	11.4
Significance	*	*	*	*

(P < 0.05)

**Table 6.** *Fungal colony counts in cultures developed from Dazomet treated old coir dust under field conditions.*

Type of coir dust	Colonies/0.1 ml of suspension Time after treatment (weeks)			
	1	2	3	4
Treated	7.0	26.0	17.0	39.0
Untreated	39.0	75.0	93.0	45.0
LSD	12.4	28.4	68.6	27.8
Significance	*	*	*	NS

(P < 0.05)

**Table 7.** *Nematode counts of Dazomet treated coir dust under laboratory conditions.*

Treatment	Nematodes/0.2 ml of suspension Time after treatment (weeks)							
	1	2	3	4	5	6	7	8
NT 1	0	0	0	8	18	-	-	-
NT 2	0	0	0	3	10	-	-	-
NC	25	27	31	43	54	-	-	-
OT 1	0	0	0	6	12	15	17	20
OT 2	0	0	0	2	8	10	11	16
OC	51	62	65	68	62	69	71	60

NT 1 = New coir dust 150g Dazomet; NT 2 = New coir dust 200g Dazomet  
 NC = New coir dust control; OT 1 = Old coir dust 200g Dazomet  
 OT 2 = Old coir dust 250g Dazomet OC = Old coir dust control

**Experiment 5: Studies on pre - mating duration of three parasitoids of coconut caterpillar - 1993**

Pre-mating durations of *Bracon hebetor*, *Eriborus trochanteratus* and *Brachymeria nephantidis* were studied in the laboratory. Soon after emergence 30 females of each species were individually confined with males of approximately same age and observed for mating. *B. hebetor*, *E. trochanteratus* and *B. nephantidis* had pre-mating durations of  $78.43 \pm 2.57$ ,  $15.1 \pm 0.72$  and  $70.7 \pm 0.9$  min  $\pm$  S.E. respectively.

*L.C.P Fernando, K.A.S Chandrasiri & D.C.L Pathirana.*

**Experiment 6: Ovarian status of three parasitoids of coconut caterpillar at emergence - 1993**

Thirty females of each of *Bracon hebetor*, *Eriborus trochanteratus* and *Brachymeria nephantidis* were dissected soon after their emergence to study the number of different types of ovarian eggs (very mature, mature, immature and newly developed). The results are presented in Table 8. Females of all the species were not ready to deposit eggs immediately upon emergence.

*L C P Fernando, K A S Chandrasiri & D C L Pathirana.*

**Experiment 7:                    A new trap design for adult red weevil**

It was observed that adult red weevils are able to escape from the trap described in CRI Advisory leaflet No.50. Hence 4 new trap designs were tested in the field. All 4 new trap designs were found to be comparatively more effective than the old design. However, the new traps cost approximately Rs.600/= each and work is now in progress to redesign a trap costing less than 150/= while incorporating the principle features of the new red weevil trap.

*P A C R Perera & D M Jayakody*

**PROJECT:                    STUDIES ON COCONUT SCALE AND ITS NATURAL ENEMY COMPLEX.**

**Experiment 1:                    Role of wind in dissemination of crawlers of scale insects in coconut - 1993.**

A preliminary experiment was conducted in a scale infested estate at Bingiriya to investigate the role of wind in dissemination of crawlers of scale insects. Ten rows of plastic sticky traps (each consisting of six 34 x 17 cm traps) were hung between crowns of palms heavily infested with scale insects (producing crawlers), facing north, south, east and west directions. The traps were held in position for 4 hours. All the rows of traps caught crawlers irrespective of the direction they were positioned. The number of crawlers trapped in each trap varied from 0-43.

*L C P Fernando, S P Manohar & W E A Fernando.*

**Experiment 2:                    Studies on a new species of *Aphytis* parasitizing coconut scale - 1993**

High levels of parasitism by *Aphytis* was recorded during certain periods of several outbreaks of coconut scale. Observations revealed that a species of *Aphytis* morphologically distinguishable from *Aphytis chrysomphali* in pupal and adult characters is parasitizing coconut scale. This is a new record for Sri Lanka. Preliminary identification showed that this species belongs to the *lingnanensis* group of the genus *Aphytis*. Preparations for its specific identification and studies on its prevalence and distribution in coconut growing areas is in progress. The study also cast doubt upon the species status of *A. chrysomphali* parasitizing coconut scale in Sri Lanka.

*L C P Fernando, D C L Pathirana & P H A P Siriwardena*

**Table 8.** Mean number ( $\pm$ S.E.) of very mature, mature, immature and newly developed eggs that females of *Bracon hebetor*, *Eriborus trochanteratus* and *Brachymeria nephantidis* carry at emergence.

Parasitoid species	Very mature	Mature	Immature	Newly developed
<i>B. hebetor</i>	2.0 $\pm$ 0.27(3) <i>0-3</i>	2.1 $\pm$ 0.09(10) <i>1-3</i>	3.5 $\pm$ 0.07(29) <i>0-8</i>	13.3 $\pm$ 0.18(30) <i>4-27</i>
<i>E. trochanteratus</i>	0	16.6 $\pm$ 0.21(30) <i>0-29</i>	16.0 $\pm$ 0.29(30) <i>8-50</i>	69.9 $\pm$ 1.07(30) <i>42-147</i>
<i>B. nephantidis</i>	0	0	1(1)	18.3 $\pm$ 0.16(30) <i>7-26</i>

\* The number of females carrying each type of eggs.  
The range of the number of each type of eggs is in *italics*.

**PROJECT: DISEASES AND DISORDERS OF COCONUT**

**Experiment:** Evaluation of three systemic fungicides; Carbendazim, Tridemorph and Tubuconazole against root rot disease in coconut caused by *Ganoderma boninense* - 1993.

This experiment was conducted at Sitrakala estate, Ambalantota and was a complete randomized design comprised of three blocks, four treatments including a control with two replicates per treatment and eight palms per replicate. Blocking was done according to the severity of disease symptoms which were graded as slight, moderate and heavy. Fungicides were injected into the trunks of the experimental palms. Tested concentrations of fungicides were: Carbendazim (Bavistin); 10 ml per palm of a solution of 2g Carbendazim in 1 liter of water, Tridemorph (Calixin); 10 ml per palm, (undiluted), Tubuconazole (Folicur); 2ml mixed with 8 ml of water per palm, control 10 ml of water per palm.

The number of fronds per palm, bunches harvested per palm per pick, female flowers per bunch, deformed nuts and weight of nuts per palm and the number of palms with live fungus were recorded before treatment and at bimonthly intervals after treatment.

This experiment is in progress.

*H T R Wijesekara, P A C R Perera, K F G Perera & D M Jayakody.*

**PROJECT: BEEKEEPING UNDER COCONUT**

**Experiment: Effect of establishing Honey bee (*Apis cerana*) on fruit set and yield of coconut Bandirippuwa and Walpita estates - 1992**

The objective of this experiment was to evaluate the effect of honey bee activity on the yield of coconut and the economics of bee-keeping in coconut plantations.

Ten hives of *Apis cerana* were established and maintained in a ten acre block. Forty palms were selected and grouped according to the yield. Newly opened inflorescences of 20 palms were emasculated and bagged using 2 mm nylon nettings to prevent pollination by bees and large insects. The other 20 inflorescences were left open after emasculation. Number of female flowers in the inflorescences at opening and the number of buttons after 2 months were recorded. Yield data are being recorded. The colonies at Bandirippuwa were heavily attacked by wax moth (*Galleria mellonella*) in the dry season, decreasing the performance of colonies. Colonies at Walpita Estate are performing better than those at Bandirippuwa.

This experiment is in progress.

*I R Wickramananda, P A C R Perera & W N Fernando.*

**PROJECT: EARTHWORM STUDIES**

**Experiment: Studies on the effect of agronomic practices on earthworm populations in coconut lands**

This experiment was initiated with the objective of studying the effect of different agronomic practices on earthworm populations in coconut lands. The selected agronomic practices were husk burying, mulching, organic manuring, cover crops and inorganic fertilizers.

Coconut lands were selected to represent three major climatic zones. Samples for earthworm counts were taken using a 50cm x 50cm grid. Samples were taken both in manure circle and centre of square at two depths i.e. 0-15 cm, 15-30 cm. Soils were analyzed to find out the moisture content and bulk density.

This experiment is in progress.

*I R Wickramananda, P A C R Perera & H T R Wijesekara.*

### 3. INCIDENCE OF INSECT AND DISEASE PESTS

During the year 1993, eighty six reported pest incidences (Table 9) were investigated and appropriate control measures were recommended. Black beetle was observed to cause more damage in the North Western Province and the Western Province as compared to the previous year. An outbreak of *Ganoderma* root rot disease was recorded from an estate in Southern province with over 200 palms being infected. Experiments to control the disease application of a systemic fungicides are in progress. Highest number of severe Scale infestations were recorded in the North Western province.

Table 9. *Report of pests and diseases*

Pest/Disease	Number of reports	Province					
		EP	WP	NWP	SP	CP	NCP
Black beetle	28	-	7	20	1	-	-
Red Weevil	8	1	3	3	1	-	-
Coconut caterpillar	14	3	1	2	8	-	-
Coconut scale	15	-	-	14	1	-	-
Minor pests	7	-	-	6	-	1	-
Termites	4	-	-	4	-	-	-
Leaf blight	1	-	-	1	-	-	-
Leaf scorch	5	-	2	3	-	-	-
Bud rot	3	-	1	1	1	-	-
Other	1	-	-	1	-	-	-
Total	86	4	14	55	12	1	-

### 4. CROP PROTECTION SERVICE

#### 4.1. Biological control

**Insect Pests:** Laboratory bred parasitoids for the control of coconut caterpillar were released in infested areas (Table 10). Most of the Coconut Scale infestations reported during the year were found to be adequately controlled by natural enemies. No further control measures were needed in many cases.

Thirty two consignments of laboratory cultured *Baculovirus oryctes* were issued as polythene packs to growers for the control of Black beetle in North Western province.

**Weeds:** Many requests from coconut growers were received for the supply of *Pareuchaetes pseudoinsulata* for the control of the common weed "Podisinghomaran" (*Chromolaena odorata*). Several consignments of 25375 larvae and 2070 adults were issued for release on estates in North Western, Western and Central provinces.

#### 4.2. Chemical control

A total of 1825 palms were treated with the insecticide Monocrotophos 60% for the control of Coconut Caterpillar. The number of palms treated to control Nettle grub and Coconut Scale were 685 and 650 respectively.

Trunk injection of systemic fungicides for the control of Bud rot and Ganoderma root rot disease were done on 128 and 250 palms respectively.

**Table 10.** *Parsitoid release for coconut caterpillar control*

Province	P <sub>1</sub>	P <sub>2</sub>	P <sub>3</sub>	P <sub>4</sub>	P <sub>5</sub>	Total
Western	9300	80750	24000	92500	2,300	2,08,850
N. Western	2425	16000	9500	37500	1350	66775
Southern	14550	33750	8250	24500	3650	84700
Total	26275	130500	41750	154500	7300	360325

(P<sub>1</sub> - *Eriborus trochanteratus*; P<sub>2</sub> - *Bracon hebetor*; P<sub>3</sub> - *Goniozus nephantidis*; P<sub>4</sub> - *Trichospilus pupivora*; P<sub>5</sub> - *Brachymeria nephantidis*)

#### 5. TRAINING AND EXTENSION ACTIVITIES

The following lectures/demonstrations were conducted:

Dr. P A C R Perera, Mrs. C N K Rajapakse & Mr. H T R Wijesekara on "Insect and disease pests of coconut and their control" to middle level management staff of coconut estates on 22 March.

Dr. P A C R Perera on "Termite control" and Mrs. C N K Rajapakse on "Control of coconut pests" to officers of C. C. B on 21 May and 24 June.

Mrs. C N K Rajapakse and Mr. H T R Wijesekara on "Insect and disease pests of field crops" to teacher instructors on 21 June.

Mrs. C N K Rajapakse, Dr. P A C R Perera, and Mr. H T R Wijesekara on "Principles of crop protection", "Insect pests and diseases of coconut" to N I P M students of the Affiliated Universities of Makandura & Rahangala on 9 July and 6 August.

Mrs. C N K Rajapakse on "Classification of insecticides & their toxicological effects" and Mr. I R Wickramananda on "Spray equipments" to coconut development officers on 19 March, 15 October and 12 November.

Mrs. C N K Rajapakse on "Insecticides and fungicides use in coconut lands" to A.D.A assistant directors on 15 December.

Mr. D M Jayakody, Mr. K F G Perera, Mr. K A S Chandrasiri and Mr. W E A Fernando, on insect pests, diseases and control measures to several groups of C.C.B officers, University students, and coconut growers.

## **6. ACKNOWLEDGEMENTS**

The co-operation and assistance given by the staff of the Crop Protection Division in conducting the experiments and in the preparation of this report are gratefully acknowledged. Thanks are due to the Head and Staff of the Biometry Division for assistance with design of experiments and analysis of data; Soils and Plant Nutrition for analysis of leaf samples.

## **REPORT OF THE BIOMETRY DIVISION**

**Head - D T Mathes, FIS**

### **1. GENERAL**

**Computerization:** The computer facilities in the Institute were further increased with additional computers being commissioned in the Estate Management and Accounts Divisions.

### **2. BIOMETRICAL ASSISTANCE**

Assistance to the research staff was provided by way of statistical designs, selection of land, layout of experimental plots, analysis of data and interpretation of results.

Special assistance was provided to Mr. H P S Jayasundara, Asst. Agronomist for his Ph.D programme. Assistance was extended to number of undergraduate and postgraduate students from different Universities.

### **3. RESEARCH PROJECTS**

#### **PROJECT 19: APPLICATION OF BIOMETRY IN COCONUT RESEARCH**

**Experiment 19.3: Calibration trial at Walpita Estate (Wet Zone) - 1984**

The bimonthly recording of vegetative and yield characters were continued without interruption. Variation of yield parameters between the six picks of 1991 and 1992 is given in Tables 1 and 2. The total number of bunches for the year showed a substantial decrease of 25.8% over 1992. The first four picks recorded a drastic reduction of number of nuts per palm compared to that recorded in 1992. On the whole the year showed a 54.0% drop in number of nuts per palm compared to the previous year. The number of nuts per hectare too showed a similar pattern. The recorded yield was 6945 nuts/ha compared to 15083 nuts/ha in 1992. The year showed a decrease in yield by 54.0% over 1992. The copra yield per hectare was 1632.3 Kg/ha which is a drop of 43.3% over 1992. On the whole the year 1993 showed a very poor crop year compared to 1992.

## Two monthly vs. monthly harvesting

Since the beginning of 1990, the palms in the calibration trial were divided into two groups of 50 palms each and harvesting was carried out at bimonthly intervals for one group and at monthly intervals for the other group. The number of nuts and number of bunches per 50 palms recorded prior to 1990 and after 1990 for the two groups are shown in Tables 3 and 4 . Analysis of data indicate that an increased yields for monthly harvesting for the years 1990 to 1993. The year 1993 being a poor crop year has shown a marked difference in the number of nuts and bunches for monthly harvesting against bi-monthly harvesting. The percentage difference between monthly harvest and bimonthly harvest was 28.4% for number of nuts. The number of bunches too showed a similar difference. The results suggest that there appears to be an arrest in the fall of number of nuts due to frequent picking.

(The observations prior to 1990 shown in the Table 3 indicate that the status of the two groups before the different frequency of harvesting was identical).

**Table 1.** *Average yield components in 1993 (Expt. 19.3)*

Pick Number	Number of bunches/palm	Number of nuts/palm	Number of nuts/ha	Number of nuts/bunch
1	1.3 (2.0)	2.6 (15.9)	413 (2509)	2.0 (7.9)
2	2.6 (3.0)	4.9 (30.6)	774 (4841)	1.9 (10.3)
3	1.8 (2.6)	9.5 (21.2)	1507 (3357)	5.3 (8.2)
4	1.5 (1.9)	10.7 (13.1)	1693 (2064)	7.1 (6.8)
5	1.4 (1.9)	9.9 (8.4)	1558 (1334)	7.2 (4.5)
6	1.2 (1.8)	6.3 (6.2)	1000 (978)	5.2 (3.4)
Total	9.8 (13.2)	43.9 (95.4)	6945 (15083)	

(Figures in parenthesis are those recorded in 1992)

**Table 2.** *Average weight of husked nut and copra yield in 1993 (Expt. 19.3)*

Pick	Weight of husked nut (g)		Copra (kg/ha)	
	1993	1992	1993	1992
1	640	684	84.58	549.17
2	781	627	193.44	971.30
3	821	611	395.92	656.36
4	669	556	362.44	367.23
5	694	444	346.00	189.53
6	781	459	249.92	143.65
<b>Total/Ave.</b>	<b>736</b>	<b>592</b>	<b>1632.30</b>	<b>2877.24</b>

**Table 3.** *Number of nuts per 50 palms*

Frequency of harvesting	--- Prior to 1990 --- 87-89 (Ave.)		----- 1990 and thereafter -----			
	1989	1989	1990	1991	1992	1993
Monthly	4689	5745	4976	5354	5023	2499
Two monthly	4492	5617	4348	4910	4654	1947
<b>Difference</b>						
Number	197	128	628	444	369	552
%	4.4	2.3	14.4	9.0	7.9	28.4

**Table 4.** *Number of bunches per 50 palms*

Frequency of harvesting	--- Prior to 1990 ---		----- 1990 and thereafter -----			
	87-89 (Ave.)	1989	1990	1991	1992	1993
Monthly	639	642	711	630	691	579
Two monthly	614	629	653	598	643	410
<b>Difference</b>						
No	25	13	58	32	48	169
%	4.1	2.1	8.9	5.4	7.5	41.2

*D T Mathes, Ranjith Fernando, W M L G Fernando,  
Kingsley Herath & P Fernando.*

#### 4. MISCELLANEOUS STUDIES

##### 4.1 A technique for the selection of superior coconut palms for high yields, low variability and adaptability: A non replicated situation

Harvesting of nuts is generally done at two monthly intervals, thus making 6 harvests within a given year. Since a bunch matures every month and if harvesting is done monthly then there will be 12 harvests within a given year. Total of these 6 or 12 harvests as the case may be, is considered as total yield in a given year.

Yield of coconut palms vary greatly from location to location and season to season. One major cause of this variation in yield may be due to the interaction with the environment. The existence of genotype-environment interaction may mean that the best performing palm in one environment is not the best in another environment. The difficulties of evaluating selected palms in the presence of such an interaction could be overcome to some degree by the use of regression techniques, which will help the comparison of the performance of each genotype over a range of environments (Finlay and Wilkinson 1963).

It is expected that the presence of an interaction between genotypes and environment has to be first established through statistical analysis. The genotype-environment interaction indicates significant variation due to the response of the genotype to changes in environment, measured by the slope "b" of the regression line, thus these "b" values obtained for the individual genotypes could be

used in the interpretation of the genotype adaptation to the natural environments. The essential ingredient for such a statistical analysis, is the replication of the genotype. However in the case of coconut palms the non existence of replication poses a difficulty. This leads to the difficulty of the use of "b" values without establishing statistically the presence of a genotype-environment interaction.

This difficulty could be overcome by the use of a simple and direct technique, namely the statistics between year and between harvests within year variation (CV) and the average yields could be used in concurrence in selecting palms for high yields, low variability and general adaptation. The palms could be categorized as greater than average yield with less than average, between and within year variation. The selection could thus be done accordingly.

This could be further refined through the use of "b" values having evaluated, ignoring establishing statistically, the existence of any interaction.

*D T Mathes*

#### **4.2 Estimation of solar radiation at the Bandirippuwa Estate, Lunuwila**

A simple model was developed to estimate the solar radiation at Bandirippuwa Estate, Lunuwila using sunshine duration data. This method is more flexible than the existing method of Angstrom formula which was developed using world geographical relationship in 1924. The model was statistically tested and found that the values obtained from the new method and the Angstrom formula for the period from 1976 to 1992 were almost the same. The monthly distribution of solar radiation (MJ/M<sup>2</sup>/d), averaged for a seventeen year period is shown in Figure 1. Similar models to other Research Stations in Sri Lanka (Colombo, Girandurukotte, and Bombuwela) are being investigated.

*T S G Peiris*

#### **5. COMPUTER FACILITY**

- (a) Assistance was provided in compiling the Management Information System and Programme Budgeting in respect of the CRI, for the Council for Agricultural Research Policy (CARP).

*T S G Peiris & H P De Zoysa*

- (b) A basic training on the use and application of, some statistical methodologies, SAS and Word Processing packages were provided on an individual basis, to the research officers who went abroad on post-graduate training.

*D T Mathes & H P De Zoysa.*

- (c) Computerization of the data collected from the experiments continued throughout the year.

*W E R C Fernando, K Herath & D T Mathes*

- (d) Computerization of the meteorological data and providing such information weekly to Meteorology Department and other Institutions continued throughout the year.

*Protus Fernando, H P De Zoysa & D T Mathes.*

- (e) Assistance was provided to all Research Divisions on the use/application of data base packages and statistical packages.

*H P De Zoysa & D T Mathes*

- (f) The Division continued to assist in computerizing information of the Medical Aid Scheme.

*T S G Peiris.*

- (g) Participated as a resource person for the refresher course on Management Information Systems and Program Budgeting Systems (MIS/PBS) organised by the Sri Lanka Council for Agricultural Research Policy.

*T S G Peiris*

- (h) Assistance to other Divisions in maintenance of computers

The following services were provided throughout the year to all Research Divisions, Accounts Division, Establishment, Estate Management and the Library.

- \* Installation of computers and new application packages
- \* Maintenance of hardware and software.

*H P De Zoysa*

- (i) Some technical assistance in computer software was provided to Regional Agricultural Research Centre, Makandura.

*H P De Zoysa*

## 6. YIELD RECORDING

The recording of yield data of experiments conducted by the Research Divisions at the following estates was continued satisfactorily.

I	Bandirippuwa	V	Pothukulama
II	Ratmalagara	VI	Saddhatissa
III	Magaret Estate	VII	Walpita
IV	Sirikandura		

## 7. EXTENSION ACTIVITIES

Lectures were provided to trainees attending courses conducted by the Coconut Research Institute and National Institute of Plantation Management.

Trainees from the National Apprentice Board were given training from time to time. Visitors and students from Universities were briefed on the work of the division.

## 8. AGRO METEOROLOGY

The three meteorological stations at Bandirippuwa Estate, Ratmalagara Estate and Isolated Seed Garden were maintained satisfactorily. Daily recordings were taken throughout the year on rainfall, temperature, evaporation, humidity, and soil temperature.

### 8.1 Bandirippuwa Estate

(a) **Rainfall:** All the months recorded a rainfall with January recording a low rainfall of 3.8 mm. Heavy rainfall was recorded for the months September, October, November and December with a total of 1064.8 as against 1778.8 the total rainfall for the year. Though the total rainfall for the year was lower than the recorded rainfall of 2053.7 for the year of 1992. The distribution through-out the year was better than 1992. As a result an increase in yield for the year 1994 could be expected (see Table 5)

(b) **Temperature:** The monthly maximum temperature ranged from 29.5 to 32.8 °C. The monthly minimum temperature ranged from 21.0 to 25.9 °C (see Table 6).

(c) **Sunshine:** Longer sunshine hours were observed during the early part of the year. The average for the year was 7.0 h. The sunshine hours recorded for the year was similar to that of 1992 (see Table 6).

(d) **Soil temperature:** The average temperatures recorded at depths 5, 10, 20, 30, 60 and 120 cm during the morning were 27.9, 28.1, 28.5, 29.0, 30.0, 30.2 °C while those for the afternoon were 32.6, 31.6, 30.0, 29.6, 29.9, 30.2 °C respectively (see Table 7).

### 8.2 Ratmalagara Estate (Table 8)

Rainfall was recorded for the three months January, February and March as compared to 1992, where there had not been a drop of rainfall for the respective months. The total rainfall recorded for the year was 1763.6 mm. This is second highest since 1985. The highest been in 1992. However the distribution in 1993 was better than in 1992. The four months September, October, November and December recorded a total rainfall of 1070.8

### 8.3 Isolated Seed Garden (Table 9)

The three months January, February and March recorded rainfall as compared to no rainfall recorded for the year 1992. The total rainfall for the year was 1296.4 mm. as compared to 1696.4 recorded in the months April, May June and July observed good rain. The month of December recorded a rainfall of 304.5 mm which is the highest recorded since 1984. A good distribution of rainfall during the year is indicated.

Solar radiation (MJ/m<sup>2</sup>/d)

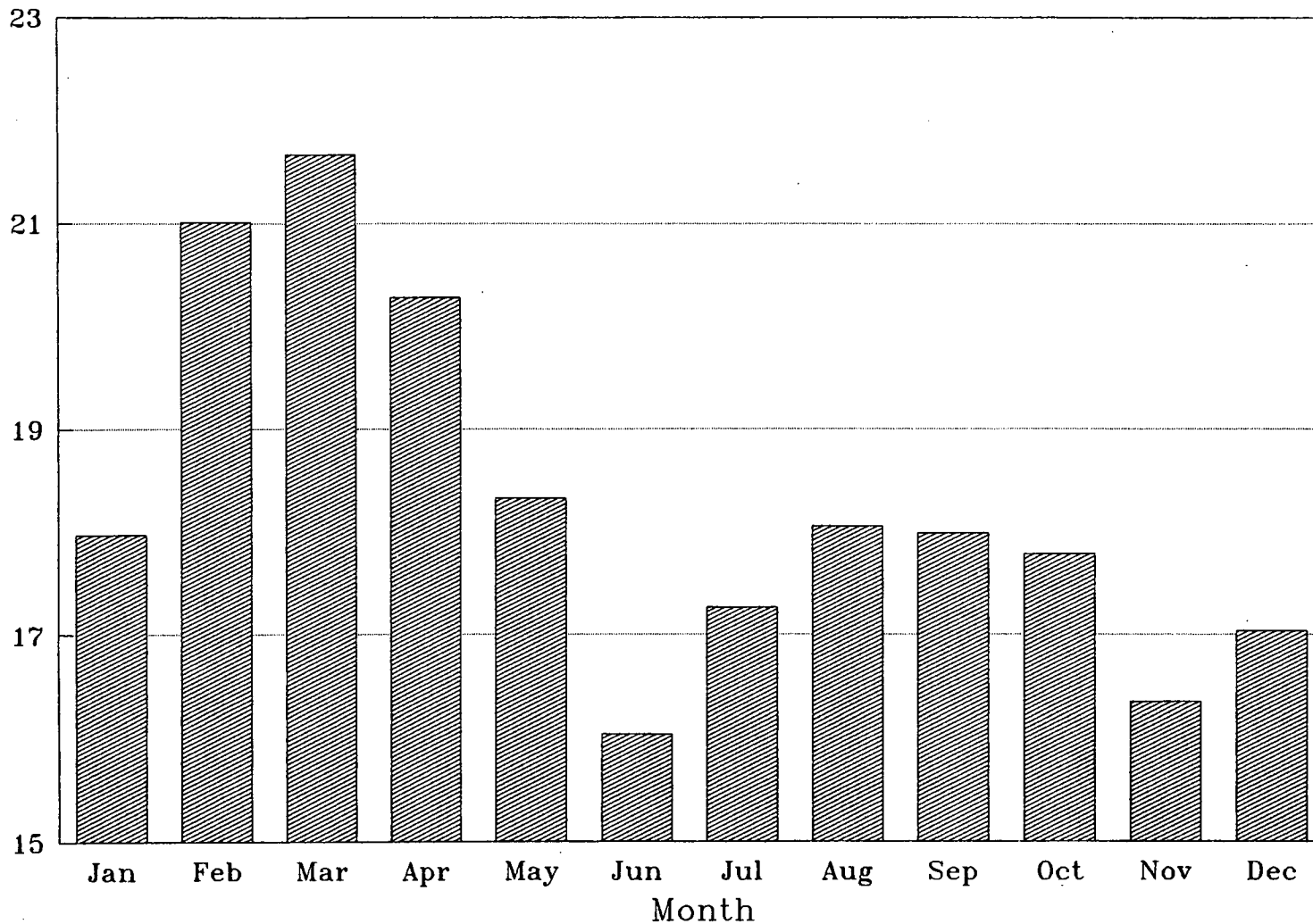


Figure 1. Distribution of mean monthly solar radiation at the CRI

Table 5.

*Rainfall(mm) for the last 10 years and in 1993 (Bandirippuwa Estate)*

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	Ave	1993
Jan	0.0	197.9	13.0	61.7	31.2	0.0	25.4	201.8	37.7	5.3	57.4	3.8
Feb	0.0	106.9	189.0	35.0	0.0	111.4	0.0	16.8	12.2	0.0	47.1	20.6
Mar	0.0	145.5	228.9	62.0	118.3	87.4	65.7	84.3	97.5	0.0	89.0	63.5
Apr	219.7	425.2	103.9	60.2	237.6	283.0	234.9	74.8	90.3	54.5	178.4	191.4
May	322.1	297.7	275.3	284.7	187.2	109.9	52.3	227.7	481.5	413.5	265.2	255.2
Jun	138.4	115.1	291.3	44.7	61.6	255.8	153.4	29.0	269.4	260.2	161.9	49.2
Jul	79.7	111.0	14.5	33.5	6.4	151.8	99.0	156.3	105.8	78.0	83.6	73.6
Aug	120.6	0.5	139.9	77.2	156.5	105.2	20.4	0.3	22.6	57.3	70.1	56.7
Sep	242.1	129.3	168.4	94.7	410.7	303.4	222.1	11.9	59.3	362.6	200.5	200.9
Oct	50.0	121.9	195.6	224.3	579.3	88.8	395.9	395.1	309.2	443.7	280.4	324.7
Nov	159.0	239.8	306.3	149.4	194.7	370.7	379.4	623.3	161.4	317.9	290.2	301.6
Dec	141.0	83.0	63.7	63.5	79.9	19.1	50.3	90.2	29.1	60.7	68.1	237.6
<b>Total</b>	<b>1472.6</b>	<b>1973.8</b>	<b>1989.8</b>	<b>1190.9</b>	<b>2063.4</b>	<b>1886.5</b>	<b>1698.8</b>	<b>1911.5</b>	<b>1676.0</b>	<b>2053.7</b>	<b>1791.9</b>	<b>1778.8</b>

Table 6.

*Summary of meteorological observation in 1993 (Bandirippuwa Estate)*

Month	Temperature (°C)		Evaporation (mm) per day	Relative humidity (%)		Sunshine (hrs)
	max	min		a.m.	p.m.	
Jan	31.36	21.02	4.65	77	56	8.1
Feb	32.35	21.82	5.13	72	56	9.6
Mar	32.76	22.88	5.16	76	61	9.0
Apr	32.13	23.83	4.68	78	68	8.3
May	31.25	25.08	4.39	82	75	6.6
Jun	30.27	25.86	3.96	81	76	6.9
Jul	29.50	25.38	4.52	83	75	6.0
Aug	30.30	25.48	4.99	81	73	7.8
Sep	30.20	24.62	4.35	80	74	6.6
Oct	30.03	23.93	3.72	85	78	5.7
Nov	30.09	23.41	2.78	85	81	4.8
Dec	29.70	23.34	2.86	86	75	4.8
<b>Average</b>	30.82	23.90	4.28	81	71	7.0

Table 7.

*Soil temperature (°C) at different depths (Bandirippuwa Eatate)*

Month	Morning						Afternoon					
	5 cm	10 cm	20 cm	30 cm	60 cm	120 cm	5 cm	10 cm	20 cm	30 cm	60 cm	120 cm
Jan	25.6	26.0	26.5	27.1	28.3	-	30.9	29.9	28.4	27.9	28.2	-
Feb	27.6	27.8	28.5	29.2	29.8	-	35.7	33.5	31.0	29.8	29.8	-
Mar	28.9	29.1	29.6	30.4	31.1	-	37.0	35.0	32.1	31.2	31.1	-
Apr	29.4	29.7	30.0	30.8	31.8	31.4	35.9	34.4	32.2	31.5	31.7	31.4
May	29.0	29.1	29.3	29.8	30.8	31.3	32.4	31.7	30.6	30.3	30.7	31.3
Jun	28.4	28.6	28.8	29.2	30.1	30.4	31.8	30.9	30.0	29.7	30.1	30.4
Jul	27.7	28.0	28.2	28.7	29.8	29.9	31.2	30.1	29.2	28.9	29.7	29.9
Aug	28.7	29.1	29.6	30.1	30.9	30.8	34.0	33.0	31.2	30.8	30.9	30.7
Sep	28.3	28.7	29.1	29.6	30.6	30.5	33.4	32.6	30.9	30.3	30.4	30.5
Oct	27.6	27.7	27.8	28.2	29.2	29.4	30.6	29.7	28.7	28.5	29.2	29.3
Nov	27.0	27.1	27.3	27.7	28.8	28.9	29.8	29.6	28.6	28.4	28.9	28.9
Dec	26.4	26.6	26.7	27.3	28.3	-	28.7	28.3	27.5	27.4	28.2	-
Average	27.9	28.1	28.5	29.0	30.0	30.2	32.6	31.6	30.0	29.6	29.9	30.2

**Table 8.***Rainfall(mm) for the last 10 years and in 1993 (Ratmalagara Estate)*

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	Ave	1993
Jan	0.0	132.9	16.6	64.8	13.6	0.0	77.7	185.5	36.2	0.0	52.7	17.5
Feb	0.0	166.2	122.1	54.3	0.0	101.3	0.0	8.3	12.2	0.0	46.4	22.9
Mar	0.0	168.6	158.3	74.7	72.0	53.3	117.4	96.2	88.8	0.0	82.9	85.1
Apr	109.2	703.6	208.3	143.4	120.4	231.4	204.2	37.7	104.4	236.9	210.0	278.9
May	145.3	282.4	82.3	246.1	141.5	68.0	54.2	114.6	375.7	275.2	178.5	216.4
Jun	80.9	39.1	126.0	50.9	65.1	221.9	126.5	12.6	264.2	191.2	117.8	23.5
Jul	55.6	88.6	39.1	22.6	16.9	57.9	124.2	92.7	38.1	71.5	60.7	25.8
Aug	74.9	2.0	13.3	85.9	139.5	158.1	10.0	0.0	16.1	11.5	51.1	22.7
Sep	109.9	132.8	84.2	26.4	190.0	259.7	161.4	17.4	43.0	192.8	121.8	198.3
Oct	79.5	109.3	209.9	153.0	502.8	58.0	238.9	389.2	211.3	326.9	227.9	281.4
Nov	163.6	472.8	319.0	228.4	195.9	230.1	298.7	434.6	175.8	505.5	302.4	393.5
Dec	216.3	95.9	104.4	95.9	53.2	88.8	24.4	76.7	82.2	56.4	89.4	197.6
<b>Total</b>	1035.2	2394.2	1483.5	1246.4	1510.9	1528.5	1437.6	1465.5	1448.0	1867.9	1541.6	1763.6

Table 9.

*Rainfall(mm) for the last 10 years and in 1993 (Isolated Seed Estate)*

Month	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	Ave	1993
Jan	0.0	96.9	38.3	59.1	5.9	3.3	58.4	221.6	44.0	0.0	52.7	9.4
Feb	2.1	228.9	113.4	65.8	0.0	135.0	0.0	0.0	0.0	0.0	54.5	2.0
Mar	1.6	279.7	94.6	55.3	21.7	77.4	29.5	34.0	116.0	0.0	71.0	53.5
Apr	52.8	821.4	100.0	104.9	141.1	233.3	81.7	38.8	147.9	217.8	194.0	164.0
May	248.8	155.5	171.4	121.9	100.2	71.7	16.0	145.6	182.5	207.3	142.1	136.3
Jun	73.4	29.7	88.8	74.5	49.8	129.7	112.2	8.4	236.5	239.5	104.3	2.4
Jul	26.4	117.0	17.9	4.2	4.5	91.4	72.1	67.7	29.2	116.9	54.7	35.0
Aug	78.0	3.8	10.7	47.4	48.1	60.1	1.7	0.0	17.1	28.4	29.5	17.5
Sep	89.4	164.7	107.4	37.4	270.8	272.2	34.0	9.5	25.8	62.3	107.4	89.3
Oct	105.7	227.3	108.7	199.9	467.6	61.3	221.9	288.6	221.6	342.3	224.5	239.6
Nov	199.3	210.6	334.8	236.1	143.2	319.5	214.7	306.7	208.1	406.0	257.9	242.8
Dec	331.4	53.6	118.6	7.6	49.5	64.8	8.0	59.2	151.5	75.9	92.0	304.5
<b>Total</b>	<b>1208.9</b>	<b>2389.1</b>	<b>1304.6</b>	<b>1014.1</b>	<b>1302.4</b>	<b>1519.7</b>	<b>850.2</b>	<b>1180.1</b>	<b>1380.2</b>	<b>1696.4</b>	<b>1384.6</b>	<b>1296.3</b>

## REPORT OF THE TISSUE CULTURE DIVISION

Officer in Charge - S C Fernando, M Sc

### 1. GENERAL

During the year emphasis was placed on improving the conditions of shoot formation from somatic embryos derived from immature zygotic embryos and leaf explants of coconut. Inconsistent results obtained was considered as a major problem of inconsistent results was considered a major problem.

The Tissue Culture programme was reviewed in June by a panel of scientists appointed for the periodic evaluation of the progress in coconut tissue culture.

### 2. RESEARCH PROJECTS

#### PROJECT 18: STUDIES ON THE VEGETATIVE PROPAGATION OF COCONUT

Experiment 18.1: *In vitro* culture of embryos of local varieties and forms of coconut - 1984

Experiments were carried out to evaluate the growth performance of embryo cultured plantlets which were raised using fertilizer grade KCl and household sugar instead of Analar grade KCl and sucrose. Zygotic embryo germination, shoot and root growth of plantlets in the presence of these low cost chemicals were observed.

The initial results appear to suggest that there is a possibility of the substitution of Analar grade KCl and sucrose in the embryo culture medium with fertilizer grade KCl and household sugar. Since the coefficients of variation of some parameters were too high, this experiment will be repeated with increased number of replicates. Propagation of *Dikiri Pol* was continued using the embryo culture technique. Table 1 shows the success in collection and germination of true *Dikiri* during this year.

**Table 1.** *The progress in selection of true Dikiri and their germination during the year 1993*

Month	Total number of nuts collected	Number of true <i>Dikiri</i> nuts	Number of germinated <i>Dikiri</i> embryos	Number of obtained plantlets
May	42	33 (79%)	23 (70%)	15 (65%)
July	42	37 (88%)	30 (81%)	23 (77%)
September	29	25 (86%)	14 (56%)	05 (36%)

As a result of collecting dehusked nuts, the success in selection of true *Dikiri* nuts was higher in this year (79-88%) compared to the year 1992 (49-77%).

*S C Fernando, C Gamage & S Santha.*

**Experiment 18.1.1:** *Application of embryo culture technology to select drought tolerant coconut germplasm - 1986*

The comparative study on the response of Ambakelle Special mother palms and their open pollinated progeny to water deficit conditions induced by NaCl was continued using zygotic embryo cultures.

Fifteen seedlings that survived different water stress conditions were planted in the germplasm block of Pothukulama Research Station (PRS) for evaluation of their performance under field conditions.

Four out of five seedlings that survived different water stress conditions caused by NaCl and planted at PRS in 1991 are growing satisfactorily. One died due to black beetle attack.

*V Vidhanaarachchi & S Santha.*

**Experiment 18.1.2:** *In vitro culture of immature zygotic embryos of coconut - 1986*

Investigations on development of a technique for clonal propagation of improved cultivar, Tall X Tall were continued using immature zygotic embryo

explants. Consistent callogenesis of embryos, somatic embryogenesis and shoot formation were accomplished. Difficulties in shoot formation from callus and further development of shoots are still observed from time to time.

In an effort to improve shoot formation and further growth, different carbohydrates, their concentrations, organic nitrogen sources and hormone application methods were tested.

*S C Fernando % C Gamage*

**Experiment 18.3:** Culture of vegetative tissues of coconut in vitro - 1983

**Experiment 18.3.1:** Culture of shoot explants

Investigations on optimized rhysogenesis of clonal shoots were continued using shoot tip cultures. Effect of salt (NaCl) and hormone (auxin) on rhysogenesis was studied during the year. Table 2 summarizes the obtained results.

The results show that plant growth hormones particularly auxin promotes rooting. Better rooting was obtained when the shoots were dipped in a concentrated auxin solution for a few days and then subcultured into a medium free of auxin. The presence of cytokinin in the sub-cultured medium improved rhysogenesis.

Preliminary investigations were also carried out to find the effect of lighting conditions, carbohydrate sources and different auxins on rhysogenesis.

*S C Fernando*

**Experiment 18.3.2:** Culture of leaf explants

Investigations were continued using tender leaves of coconut seedlings. Leaf explants were subjected to various treatments in order to increase somatic embryo formation. The number of somatic embryos formed could be increased using an appropriate ratio of auxin to cytokinin in the medium. In an effort to induce germination of the somatic embryos, callus formation was observed. This callus grew further and resulted in either fussed shoots or haustorial type tissues.

*S C Fernando & S Santha.*

**Experiment 18.3.3:** Culture of root explants

Experiments on root tip culture were continued. Root explants were

derived only from embryo cultured plantlets in order to avoid high contamination. Several media were tested on callogenesis of root explants.

*V Vidhanaarachchi.*

**Table 2.** *Effect of salt and hormone on rhysoogenesis*

Treatments	Number of shoots with roots	Total number of roots per treatment
<b>SALT STRESS</b>		
- BM + Salt (solid)	None	-
- BM + Salt (liquid)	None	-
- Dip in Salt then BM - salt (solid)	2/9	5
- Dip in Salt then BM - Salt (liquid)	None	-
<b>HORMONE STRESS</b>		
- BM + High Auxin (solid)	None	-
- Dip in Auxin then BM - Auxin + Cytokinin (solid)	20/28	32 roots + 39 root initials
- Dip in Auxin then BM - Auxin - Cytokinin (solid)	14/23	28 roots + 24 root initials

(BM: basal medium)

### 3. ACKNOWLEDGEMENTS

The services of Dr R R A Peries, Head/Genetics and Plant Breeding Division as the Officer in Charge of the Tissue Culture Division from July 1991 to August 1993 is gratefully acknowledged. The assistance given by the staff of the Tissue Culture Division in conducting the experiments and in preparation of this report is gratefully acknowledged.

# REPORT OF THE PLANT PHYSIOLOGY DIVISION

Head - C Jayasekara, Ph D

## 1. GENERAL

The research programme of the Division was focussed mainly on physiology and biochemistry of the coconut palm to explore their applicability to solve ecophysiological problems in order to achieve a sustainable high productivity. Hence, the main emphasis was placed on utilization of atmospheric carbon and water for efficient photosynthetic productivity and growth. Studies were further extended to understand the responses of the coconut palm to changing environmental conditions and "stress" factors (water deficit, high temperature and low light) and their physiological adaptation and growth under such conditions. Preliminary studies indicate that stomata play the key role in controlling excessive loss of water and carbon gain in coconut under water deficit conditions.

Basic research conducted on the stable carbon isotope discrimination of coconut genotypes have generated beneficial practical applications which could be used by the Genetics and Plant Breeding Division. Coconut genotypes selected for high water-use efficiency by this technique could be utilized for mass production of progenies which will give satisfactory yield even under water limiting environments. The International Atomic Energy Agency (IAEA), Vienna continued to support this study.

The Division played a major role in the multidisciplinary research projects, namely "Immature nutfall and premature decline of the coconut palm" and the Council for Agricultural Research Policy (CARP) funded research project on "Water balance of coconut under different soil landscapes, agroclimates, and management practices" (CARP/12/104/89). In spite of the sustained difficulties faced with the shortage of research staff, the Division achieved considerable research progress during the year. However, this has become a major set back to the Division and had led to the suspension of some experiments until the situation is reversed.

## 2. RESEARCH PROJECTS

### PROJECT 16: STUDIES ON THE PHYSIOLOGY OF THE COCONUT PALM

Experiment 16.3: Identification of physiological and biochemical characters of putative drought tolerant tall (Ambakelle Special) palms, Isolated Seed Garden, Ambakelle (1987)

Water relation measurements viz. rate of transpiration, stomatal diffusive resistance and leaf water potential were collected during a two-year period for thirty three putative drought tolerant palms in field Nos. 2 and 4 at the Isolated Seed Garden, Ambakelle. Statistical analysis was carried out to determine the stability of studied physiological parameters to changing environmental conditions. Results revealed that out of 33 putative drought tolerant palms 11 palms have shown "physiological drought tolerance" under changing environmental conditions. This study will not be further continued as carbon isotope discrimination technique has been found to be more suitable to select coconut palms for high water-use efficiency.

*C Jayasekara, A Nainanayaka, R D N Premasiri & L R S Silva.*

**Experiment 16.4: Studies on heritability of drought tolerant characters into open pollinated seedlings from selected drought tolerant palms. Glass house study - 1987**

After renovation of the roof of the plant house, a new pot experiment was commenced. Seed nuts were obtained from the selected parents for drought tolerance at ISG in field Nos 2 and 4. Nine replicate seedlings from each parent were transferred into 50 l plastic buckets. This experiment will be further used to determine the water-use efficiency (WUE) of those coconut seedlings and also to investigate the relationship between carbon isotope discrimination and WUE.

The experiment is progressing satisfactorily.

*C Jayasekara, A Nainanayake & R D N Premasiri.*

**Experiment 16.7: Studies on the physiology and biochemistry of different varieties and forms of coconut - 1989**

All the basic requirement and planting material are now ready and the experiment will commence in early next year.

*C Jayasekara & P S A De Saram.*

**Experiment 16.9: Studies on vegetative growth and physiology of Ambakelle Special seedlings grown under field conditions - 1988**

This trial was in its sixth year from field planting and was satisfactorily maintained. Vegetative growth measurements and estimation of total area of the canopy were continued at half yearly intervals as reported in the Annual Report for 1992. Photosynthetic and water relations measurements of two types of

seedlings were continued at quarter yearly intervals. One Ambakelle Special seedling came into flowering at the latter part of the year. The experiment is in progress.

*A Nainanayake, C Jayasekara, P S A De Saram & R D N Premasiri.*

**Experiment 16.10:           Studies on the effect of canopy and root modification on yield of coconut - 1990**

This experiment has completed its third year. Maintenance of canopy size and root volume according to the treatments and recording of data at bimonthly intervals were continued with satisfactory progress. The female flowers and button nut data collected during the years 1991 & 1992 were analyzed. Preliminary results revealed that pruning of 50% of the leaflets from the proximal end of the fronds in 60% of the total canopy area does not show a significant effect on nut setting and final yield. Except at the highest root pruning treatment (1/4 of the manure circle area up to 0.5 m depth), all the other treatments have not shown significant effect on nut setting and final yield. It is necessary to continue the experiment at least for a further three years to obtain conclusive results to provide practical recommendations.

*C Jayasekara, A Nainanayake & L R S Silva.*

**Experiment 16.11:           Evaluation of field performance of embryo-cultured seedling - 1987**

Fifty percent of the young embryo-cultured palms are now flowering, including six palms of Yellow Dwarfs and one palm each of, Red and Green Dwarfs and an Open Pollinated Tall. The Open Pollinated tall palm has taken seven years to initiate flowering. None of the flowering palms showed abnormal reproductive characters due to hormonal treatments during the initial *in vitro* growth of excised embryos. The experiment is being continued.

*C Jayasekara & R D N Premasiri*

**Experiment 16.12:           Studies on assimilate partitioning pattern of seedlings and bearing young coconut palms with the use of  $^{14}\text{CO}_2$ .**

Labelling of a second year bearing coconut palm was carried out during the second expert mission of Dr G D Bowen in February 1993. A seven-year-old bearing coconut palm at Bandirippuwa Estate was selected for this study. One m ci of  $\text{NaH}^{14}\text{CO}_3$  was used to label the eighth frond from the youngest open leaf. The dosage of  $\text{NaH}^{14}\text{CO}_3$  used for this experiment was not sufficient to detect

the activity in the stem and roots. Therefore, nuts and fronds were analyzed to determine the distribution of activity 1, 3, and 5 days after labelling. As observed in the previous labelling (Annual Report for 1992) the highest proportion of labelled assimilate was partitioned into the developing nuts in the fourth bunch (Table 1). The developing nuts in the second and third bunches were at the early stages of endosperm cavity formation. The total amount of labelled assimilate partitioned into those developing bunches were found to be very low compared to the fourth and fifth bunches.

**Table 1.** *<sup>14</sup>C total activity of nut water (DPM) at harvest of one, three and five days after labelling*

Bunch No.	17/02/93	19/02/93	22/02/93
3	191.22	8965.32	19472.74
4	321.08	9173.27	36237.00
5	230.49	1540.06	3911.94
6	352.94	487.37	660.24

*C Jayasekara, K S Jayasekara & A Nainanayake.*

**Experiment 16.13:** **Studies on water-use efficiency of different ecotypes of coconut in relation to the stable carbon isotope discrimination - 1992**

The experiments to determine water-use efficiency of different genotypes of coconut were continued with progress. *In situ* photosynthesis measurements of young coconut palms were carried out using the LI-COR 6500 portable photosynthesis meter. Photosynthesis measurements and leaf sampling were carried out for middle leaflets of the third or fourth frond. Dried and finely ground leaf samples were submitted to the Auckland Institute of Technology, New Zealand through IAEA for stable carbon isotope composition analysis. Photosynthesis measurements and leaf sampling were completed for most of the ecotypes planted at Poththukulama and Bandirippuwa germplasm conservation trials and also open pollinated population of the progeny trial at Mangalaeliya Estate conducted by the Genetics and Plant Breeding Division.

From the relationship between the ratio of intercellular to ambient partial pressure of CO<sub>2</sub> ( $P_i/P_a$ ) and (<sup>13</sup>C) stable carbon isotope discrimination and

ranking them with other parameters adopted for selection, palms will be selected for high water-use efficiency.

*C Jayasekara.*

## **PROJECT 25: ESTABLISHMENT AND FURTHER GROWTH OF AMPUTATED POLY-BAGGED SEEDLINGS**

**Experiment 25.4: Field performance of amputated poly-bagged seedling - 1989**

Vegetative growth measurements viz. girth, height and rate of leaf production were recorded at quarter yearly intervals. Both types of seedlings were received young palm mixture (YPM) as split applications. The experiment is being continued.

*C Jayasekara, A Nainanayake & L R S Silva.*

### **4. EXTENSION ACTIVITIES**

The Plant Physiology Division actively participated in training programmes for Plantation Management Diploma Courses conducted for students in University Colleges. Estate owners and middle level management staff of coconut estates were briefed on research activities and findings of the Division.

### **5. ACKNOWLEDGEMENTS**

The assistance of the Staff of the Plant Physiology Division in conducting experiments and the preparation of this report is gratefully acknowledged.

Thanks are due to Dr K S Jayasekara and Soil Physics Staff for routine neutron probe measurements and soil core sampling; Head/ Soils and Plant Nutrition Division for helping to analyse nut water samples, Head/Genetics and Plant Breeding Division for allowing us to use their field experiments for water-use efficiency studies and Mr D T Mathes and Staff for statistical analysis of data.

## MULTI- DISCIPLINARY PROJECTS

### PROJECT 17: PREMATURE DECLINE OF PALMS

(Project leader - C Jayasekara, Ph D )

**Participating Divisions:** Plant Physiology Division  
Agronomy Division  
Soil and Plant Nutrition Division

#### General Remarks

All the experiments conducted to determine possible cause/s for Leaf Scorch Decline (LSD) were not continued during this year. The Crop Protection Division discontinued the experiment on effect of Black Ants (Kadiya) on LSD of coconut. Two experiments conducted by the Plant Physiology Division were temporarily suspended due to the shortage of research staff. Studies on root growth, regeneration and root activity with special reference to LSD were continued. A new experiment was commenced at Poththukulama Research Station to determine the effect of applied Cytokinin on canopy vigor of LSD palms. Rehabilitation of LSD palms by incorporation of organic matter into soil was continued at Walpita Estate. The status of LSD palms were reassessed after a three-year treatment period.

**Experiment 17.1:** Studies on internal water relations of Leaf Scorch Decline (LSD) palms - 1987

The experiment was temporarily suspended due to the shortage of research staff in the division.

*C Jayasekara & N P A D Nainanayake*

**Experiment 17.2:** Studies on the root system of Leaf Scorch Decline (LSD) palms - 1987

Root density and the number of live and dead roots of healthy and LSD palms at different status of severity symptoms were studied taking soil core samples along a transect up to a distances of 3 m away from the bole and down to a depth of 2 m, in collaboration with the Soils and Plant Nutrition Division. Compared with healthy palms, the number of active live roots were significantly low ( $p < 0.05$ ) in LSD palms. The number of live roots decreased with increasing the status of symptoms the the distance from the bole as given in the Table 1.

Same soil cores were refilled with soil and investigated after 6-9 months to determine the root generation pattern of healthy and LSD affected palms. Number of live roots in the same soil cores were found to be very low. Diameter of the soil cores were increased up to 4" as it was difficult to sample the same cores.

Three replicated palms from each status of LSD symptoms (incipient, mild and moderate LSD) were selected at the Poththukulama Research Station. Based on the hypothesis reported in the Annual Report for 1992 each palm was given hundred ml of 100 ppm cytokinin solution by stem injection. Same dose was repeated at monthly intervals for two months. Visual observations of palm canopy were recorded to determine the effect of cytokinin on leaf vigor. The experiment is being continued.

**Table 1.** *Live and dead root density of healthy and LSD palms (mg dry wt/cm<sup>3</sup>)*

Distance (m)	0.5		1.0		1.5		2.0	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead
Healthy	12.35	3.21	4.85	0.52	1.72	0.24	1.06	0.09
Incipient	9.99	0.46	3.15	0.17	1.36	0.80	0.39	0.15
Mild	13.05	1.12	2.69	0.19	1.65	0.10	0.79	0.23
Moderate	6.17	0.44	3.12	0.19	1.44	0.32	0.76	0.17
Severe	4.84	0.76	1.00	0.34	1.02	0.19	0.39	0.10

*N P A D Nainanayake, C Jayasekara & L R S Silva.*

**Experiment 17.3: Determination of net assimilation rate, foliar organic and inorganic nutrients in LSD palms - 1987**

This experiment was temporarily suspended due to shortage of research staf.

*C Jayasekara & N P A D Nainanayake.*

**Experiment 17.4: Studies on the effect of root pruning and incorporation of organic manure on LSD palms -1989**

During the year yield records were maintained and data on size and shape of nuts were collected at alternative picks.

The severity of LSD symptoms of treatment palms was reassessed to determine the treatment effects after a three-year period. The results indicate that treatments have no effect on LSD at incipient and mild stages of symptoms.

*D N S Fernando, M Bastian & A Nainanayake.*

**PROJECT 28: IMMATURE NUTFALL**

**(Project Leader - C Jayasekara, Ph D)**

**Participating Divisions:** Soils and Plant Nutrition Division  
Plant Physiology Division

**General Remarks:**

The research programme carried out under this project achieved satisfactory progress during the year. As reported in the previous year Annual Report, the main emphasis was placed on assimilation of carbon and partitioning pattern of assimilate into developing nuts under changing weather conditions.

Net assimilation of carbon in coconut leaves decreased with increasing leaf age. To ascertain whether this behaviour is either due to self shading effect from upper leaves or reduced photosynthetic activity of leaves with ageing, activity of major photosynthetic enzyme RuBP carboxylase and dark respiration was investigated.

Two experiments conducted to determine the effect of biotic factors on nut setting were terminated. The results of these experiments are reported in the Annual Report.

**Experiment 28.2: Studies on nutrient and water relations in immature nutfall of coconut - 1990**

Studies on the water extraction pattern of coconut roots with the use of neutron probe and canopy evapotranspiration were continued. The results show

that in deep sandy loam soils water extraction takes place from the effective root zone within the first 1 m depth up to a period of 20-25 days and then roots tend to absorb from deeper layers. When the available soil water became limiting palms responded concomitantly by mid day closure of stomata and maintenance of stomatal conductance at a lower level throughout the day Fig 1a & b . Hence, rate of transpiration and net assimilation were reduced during dry periods by affecting overall productivity of palms.

*C Jayasekara, K S Jayasekara, C S Ranasinghe, R D N Premasiri & L R S Silva.*

**Experiment 28.3:** Studies on insects associated with the coconut inflorescence, their relative abundance and seasonal distribution within the coconut triangle - 1991

The experiment was terminated.

Results of this experiment was given in the Annual Report for 1992.

**Experiment 28.3.1:** Preliminary studies on immature nutfall in relation to damage by pests and diseases; Bandiruppuwa - 1992

The experiment was terminated.

Results of this experiment was given in the Annual Report for 1992.

*C N K Rajapakse, R Wijesekara & A H Norman.*

**Experiment 28.4:** Dry matter production in leaves and specific mass transfer into developing bunches - 1990

In situ measurement of net photosynthesis of individual fronds was continued at monthly intervals. The average total canopy photosynthesis for each month was estimated based on individual frond measurements. As given in the Fig. 2 canopy net photosynthesis was decreased vary significantly during the rain free period.

Further, dark respiratory losses of carbon was studied for different leaves in the canopy. The results showed that except in the first 3-4 recently opened leaves, others maintained similar rate of dark respiration through-out their life span. However, net photosynthesis of leaves decreased with increasing age (Fig. 3). The results further revealed that assimilated carbon in old leaves of the lowest whorl is

sufficient for the maintenance respiration and some times they may be parasitic from active leaves in the upper whorls. With regard to assimilate supply these finding clearly show that lower most leaves virtually have no contribution to the developing nuts.

These studies are being continued with satisfactory progress.

*C Jayasekara, A Nainanayake, K S Jayasekara & W P K K Fernando.*

**Experiment 28.5:            Development of nuts in relation to climatic factors.**

As reported previously the aim of this study is to determine the intrinsic biochemical, physiological and physical changes within nuts in relation to external environmental stress conditions. Nut development pattern in relation to climatic conditions was studied during this year by sampling developing nuts from same bunches at monthly intervals. A similar pattern of dry weight increase was observed in developing nuts during wet and dry periods as given in Fig.4 . Nevertheless, the total number of nuts remaining in bunches decreased during the dry period due to immature fall of nuts. From these results it was evident that when lesser amount of assimilate was available for developing bunches, it was compensated for by shedding off of developing nuts without altering normal pattern of nut development.

*C Jayasekara, A Nainanayake & W P K K Fernando.*

## **REPORT OF THE INFORMATION SERVICES DIVISION**

**Head - P A H NIMAL APPUHAMY, M Sc**

### **1. GENERAL**

The work programme and the activities of the Division continued with satisfactory progress. Providing advisory assistance to the coconut sector was continued, with estate inspections, field demonstrations, lectures, training, etc. Training programmes were continued as scheduled.

Audio-visual equipment was also used in technology transfer. Research extension dialogues between the Research Staff of the CRI and the Extension Staff of the Coconut Cultivation Board were organized and conducted. Constraints and problems of the coconut growers as well as those of the Extension Officers were identified and feed back collected.

### **2. PUBLICATIONS**

**2.1 Technical Publications**  
Nil.

**2.2 Extension Publications**

Pol Pawath Volume 14 Nos. 1/2 was in print. Coconut Bulletin Volume 8 Nos. 1/2 was in print.

thousand copies of the book on Coconut Cultivation was reprinted due to heavy demand.

**2.3 Advisory Circulars**

Advisory Circular No. A4 on fertilizer was under revision.

### **3. ADVISORY ACTIVITIES**

The Division was active in the transfer of technology on coconut, based upon the research recommendations of the CRI, to the coconut sector.

A number of estate visits were made at the request of coconut growers.

Advisory Circulars were in heavy demand by growers, teachers and students, and every effort was made to accommodate their requests.

## **4. TRAINING PROGRAMMES AND STUDY TOURS**

### **4.1 Training Programmes**

The following training programmes were conducted during the year.

- (i) Attachment training for 05 students from the National Apprenticeship Board from 25 January - 31 December.
- (ii) A training programme on Development of Coconut Cultivation for private sector estate owners, managers and field officers organized by the National Institute of Plantation Management (NIPM) from 15 to 23 March. The trainees were awarded certificates of participation at the end of the programme.
- (iii) Training programme on coconut cultivation for private sector participants organized by the NIPM 01 to 10 October. The trainees were awarded certificates of participation at the end of the programme.
- (iv) The CRI component of the two year National Diploma in Plantation Management.  
Affiliated University College, Makandura 28 June to 16 July.  
Affiliated University College, Rahangala 26 July to 13 August.
- (v) Some students from Universities and Colleges of higher education were assisted in collecting data on coconut for compilation of their reports.
- (vi) Six one day workshops on coconut cultivation for coconut estate owners and managers were conducted during the year as follows:

#### ***Programme 1 - 30 March***

Effective use of organic and inorganic fertilizer for coconut. Conducted at the CRI, Bandirippuwa Estate, Lunuwila.

#### ***Programme 2 - 05 April***

Intercropping under coconut conducted at the CRI Walpita Estate, Walpita.

#### ***Programme 3 - 07 June***

Soil moisture conservation in coconut lands. Conducted at the CRI, Ratmalagara Estate, Madampe.

#### ***Programme 4 - 16 August***

Replanting of coconut. Replacing low yielding palms with high yielding planting materials. Conducted at the CRI B/E Lunuwila.

#### ***Programme 5 - 20 September***

Pests and Diseases of coconut, identification and control. Conducted at the CRI Bandirippuwa Estate, Lunuwila.

#### ***Programme 6 - 15 October***

Rehabilitation of low yielding coconut lands-conducted at the CRI Ratmalagara Estate, Madampe.

These one day programmes were well attended and the participants showed keen interest during both lectures and field demonstrations. All subsequent enquiries made by the participants were also attended to.

## **4.2 Study Tours**

Tours were organized for the following:

- (i) A group of students from the Kundasale on 08 January.
- (ii) A group of Russian Visitors on 23 February.
- (iii) A group of 60 second year agriculture students from the Technical College, Kuliyaipitiya on 24 March.
- (iv) A group of 50 agriculture students from the Technical College Kuliyaipitiya on 28 May.
- (v) A group of 50 final year Agriculture Diploma students from Aquinas College of Higher Education, Colombo on 18 June.
- (vi) A group of 40 teacher trainees from Distant Education Centre, Matale on 21 June.
- (vii) A group of journalists from China on 23 June.
- (viii) A group of students undertaking the advanced course in Plantation Crop Protection from the Faculty of Agriculture, Peradeniya University on 07 July.

- (ix) A group of 20 teacher trainees from Chilaw, Nattandiya and Wennappuwa education offices on 16 July.
- (x) A group of 40 teacher trainees from the Distant Educational Centre, Hanguranketha on 01 October.
- (xi) A group of 30 teacher trainees from Distant Teacher Training Centre, Kuliyaipitiya on 15 November.
- (xii) A group of 20 members from Karaliyadda, Hanguranketha Village Development Society on 18 November.
- (xiii) A group of 70 teacher trainees from Agriculture Training School, Dambadeniya on 25 November.

## **5. SEMINARS/LECTURES/FIELD DAYS/EXHIBITIONS**

The following services were provided:

- (i) The Division provided exhibits and participated in a seminar organized by the Ministry of Coconut Industries and Crop Diversification to offer assistance to coconut growers of moderate size holdings, held at the Mahaweli Centre, Colombo 29 July.
- (ii) The Division also provided exhibits and participated in the soil suitability seminar organized by the CRI and held at the Mahaweli Centre, Colombo 27 August.
- (iii) A series of informal discussions amongst the Research Divisions on the latest recommendations and research highlights was organized.
- (iv) Field days: At the request of the Wayamba Plantations Ltd, two field days were organized for the management staff of the Wayamba Plantations Ltd. The first of these was held at the Isolated Seed Garden, Ambakelle on 20 August, and the second at the CRI, Bandirippuwa Estate, Lunuwila on 14 October.
- (v) A three day workshop on scientific and technical writing conducted by Prof. P G Cooray was held in the CRI Auditorium, for the CRI Research Staff from 27 to 29 March.
- (vi) For the first time, the Division organized and conducted two Research Extension Dialogues among the CRI Research Staff and the Extension Staff

of the Coconut Cultivation Board. The first of these was held at the Department of Agriculture, Kurunegala on 24 May, and the second on 24 June at the Centre for Technology Transfer, Morrana, Gampaha.

### **Exhibitions**

The Division participated in the following exhibitions.

- (i) Mahaweli Week Exhibition at Embilipitiya from 26 February to 01 March.
- (ii) Wasanthaya Udawa Exhibition at Elpitiya from 03 April to 10 April.

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- (iii) NARESA Silver Jubilee Exhibition in Colombo from 01 - 05 December.
- (iv) The Institute assisted by supplying some exhibits for St. Peters' College exhibition Negombo.
- (v) The Institute supplied exhibits for the exhibition train of the Railway Department.
- (vi) The Institute produced a video documentary on coconut plantations named 'Kapruka Surakimu' which was telecast over "Rupavahini" on 14 December.

### **6. PHOTOGRAPHY**

Transparencies and photographs required for Audio-Visual equipment were made available for lectures and during training programmes. A new slide projector and video cassette recorder were purchased.

### **7. MUSEUM**

The museum was maintained satisfactorily and colour transparencies were made to equip the museum wooden - glass display wall cupboards. Two models on planting of coconut seedlings were also fixed.

### **8. AUDITORIUM**

The auditorium was maintained satisfactorily and improved with the addition of heavy furniture (conference tables, etc.) and lighting systems.

Coconut Research Board Meetings and CRI Research Committee Meetings have since been held in the auditorium.

# **REPORT OF THE LIBRARY & COCONUT INFORMATION CENTRE**

**Head - Library Services/Project Leader - M J C Perera, ALA**

## **1. GENERAL**

The Library and the Coconut Information Centre functioned smoothly, throughout the year. Information needs of the Institutes' Staff and outside clients were satisfactorily fulfilled using resources within and outside the Library. In certain instances foreign resources were also utilized.

A considerable number of journals not in use were donated to other libraries and the periodical section was reorganized.

## **2. ACQUISITIONS**

Eight seven (87) new books were accessed to the Library during the year and the stock recorded four thousand eight hundred and eighty seven (4887) as at 31-12-93.

Eight five (85) periodical titles and thirteen (13) Annual Reports were received during the year. Of these twenty seven (27) titles were on subscription and the rest on exchange and complimentary basis.

Five hundred and sixty (560) new references were added to the coconut database of which four hundred and two (402) articles were added to the collection. Thirty five (35) requests covering around Hundred and twenty five (125) articles were made to outside resources and the response had been not very encouraging. Five hundred and thirty five (535) items on coconut literature were microfiched for the microfiche collection.

## **3. SERVICES**

### **3.1 Routine Services**

Reference, lending, interlibrary loan (ILL), literature alert and new book announcement services were provided regularly to the research staff. Eighty seven (87) new books received during the year were processed and made available to the staff. Thirty one requests for literature searches were received from the Institute's Staff and outsiders both local and foreign. More than 29 of these were responded to satisfactorily providing reference lists and literature. Two were directed to correct sources of information. Out of 51 articles requested from other libraries on interlibrary loan 39 have been received. Total number of requests for interlibrary

loans received from other libraries was twenty (20) and seventeen (17) have been supplied. The photoduplicate service was provided satisfactorily. Current awareness service on coconut information was provided continuously through the Cocomunity (APCC) newsletter. 947 literature items on microfiche were despatched to the APCC for its literature collection.

### **3.2 External Services**

#### **3.2.1 APCC/IDRC Integrated Coconut Information Network**

The second Annual Bibliography covering coconut literature with five hundred and ninety four (594) references and abstracts for the period 1991-1992, was compiled and despatched to the Asian & Pacific Coconut Community. This was in accordance with the responsibilities entrusted to the Coconut Information Centre in the Integrated Coconut Information Network.

#### **3.2.2 Agricultural Information Network (AGRINET)**

The Library satisfactorily played its role as the co-ordinating centre of the above network. Five meetings were held during the year. Two AGRINET newsletters were published and circulated among member libraries. A bibliography on pineapple compiled from literature collections available in member libraries was published. This series aims at dissemination of information on topics of national interest to researchers and farmers in the country. Second of this series on banana is being processed.

The library has provided four hundred and eleven (411) contents pages from thirty three (33) journals to AGRINET member libraries under Selective Dissemination of Contents Page Service (SDCP) and has received 108 contents pages from 40 journals. The SDCP service has much influenced the interlibrary loan service among member libraries.

A training programme on Agricultural Information Technology was conducted by the International Irrigation Management Institute (IIMI) at its Headquarters on behalf of AGRINET. Nineteen (19) participants attended the course.

The annual user seminar of the AGRINET; the third of the series, was conducted at the Rubber Research Institute, Agalawatta. The objective of the seminar was to create awareness among agricultural scientists, extension personnel and educationists on the information resources and new information technologies available in the country.

The AGRINET also participated in the exhibition organized by the Natural Resources Energy & Science Authority (NARESA) of Sri Lanka at its premises. The exhibition was held from 01-05 December.

The AGRINET also demonstrated some of its computer based information resources and new Information Technologies at the Annual Sessions of the Sri Lanka Association for the Advancement of Science (SLAAS) held from 06-10 December at the Science Faculty, Peradeniya. This was a very fruitful exercise.

A database was created and maintained at the Library on Agricultural Research Scientists of Sri Lanka. A directory from the database will be published in due course.

### **3.3 Training**

Mrs. S N Gunatilake participated in the Training Programme conducted by the AGRINET on Agricultural Information Technologies from 08-12 March.

## **4. FURNITURE AND EQUIPMENT**

Following items were procured to the library during the year.

Computer tables (steel)	-	2
Typist table (steel)	-	1
Typist chairs (steel)	-	1
Computer chairs (steel)	-	2
Wall clock	-	1

## **5. PRINTING AND BINDING**

Twelve (12) colour transparencies were prepared for the SPND. Five hundred forty five (545) books were bound during the year for the Director, and the Chairman etc. 170 books mainly from the reference collection on coconut were bound.

## REPORT OF THE ESTATES MANAGEMENT DIVISION

Manager (Estates) - P S Liyanagama, B Sc

### 1. GENERAL

The following nine units were administered by the Division.

- 1 Bandirippuwa Estate, Lunuwila
- 2 Rathmalagara Estate, Madamape
- 3 Poththukulama Research Station, Pallama
- 4 Walpita Estate, Walpita
- 5 Isolated Seed Garden, Ambakelle
- 6 Makandura Seed Garden, Gonawila
- 7 Maduru Oya Seed Garden, Kasyapa Pura
- 8 Minneriya Research and Demonstration Farm, Minneriya
- 9 Passekudah Research and Demonstration Farm, Kalkudah

Continued terrorists violence in the region did not permit the re-opening of the Passekudah Research and Demonstration Farm which had to be deserted at the height of disturbances on June 17, 1990. Staff of the farm continued to work at the Head Office where they were re-deployed.

In deference to a decision by the CRB, the Research and Demonstration Farm in Minneriya was handed over to the Coconut Cultivation Board on May 13, 1993.

All the units excepting Passekudah Research and Demonstration Farm were maintained in good order. The recommended cultural practices were carried out. Emphasis had always been placed at soil and moisture conservation practices, especially in the vicinity of palm bases. The entire quantity of husks available on the properties were buried in pits supplemented with coir dust.

Rainfall during the year had been satisfactory with a good distribution at all stations. The results of this will be manifested in improved nut yield in the following year (Table 4). Heavy rains during the latter part of the year caused temporary water-logged conditions at the Isolated Seed Garden and Poththukulama Research Station.

## 2. PERFORMANCE OF INDIVIDUAL UNITS

### 2.1 Bandirippuwa Estate, Lunuwila (*Superintendent - Mr M R L A Perera*)

District	:	Puttalam
Electorate	:	Wennappuwa
Agro-climatic Zone	:	Semi-wet Intermediate.

Only 64 % of the planted area is in production whilst the balance is immature (Table 1).

**Rainfall:** The total rainfall (1778.8 mm) indicates a decrease of 13.4% over that of 1992 (Table 5). However, the number of wet days had been increased from 114 to 156 (37 %) confirming a better distribution during the year.

**Nut yield:** The total nut yield for the year (3,09802) is 10% less than that of 1992 attributable to the two consecutive droughts experienced during the first quarter of last two years( Table 3).

**Disposal of Crops:** Crop was disposed through brokers mainly as husked nuts for processing (Table 4).

#### Field operations

**Manuring:** Of the bearing palms, 5393 were manured in Yala season and the balance 1650 were manured in Maha season as per the field wise DFR. 3403 young palms ( below 3 yrs) were manured with YPM as recommended in two applications and at 1.0 kg dolomite per seedling.

Additional doses of kieserite, dolomite and MOP were applied to individual palms manifesting deficiency symptoms.

**Weed control:** Ground conditions were maintained in good order mainly with the repeated use of rotaslasher. Slashings were always transferred to the manure circles as a mulch. Cover cropped areas were cheddy weeded manually. Noxious weeds such as 'Mana. and 'Atora' appeared occasionally were kept under control with the use of herbicide glyphosate. Similarly, manure circles too were kept under control using glyphosate.

**Soil and moisture conservation:** Husks were buried in 1049 pits of 5' x '3 x 3' in fields Nos. 2 and 9. Contour drains and drainage canals were desilted and reconditioned where necessary.

Manure circles were regularly mulched with available material on the estate. Mulch in young plantations were supplemented with coir dust.

**Fences:** The perimeter fence, approximately 20 km in length, was maintained in good order at all times. In field No 1, 500 m and 125 m in field No 7 were re-erected using concrete fence posts. About 200 m of internal fencing was done in field No 3.

**Road and paths:** Field roads and paths were maintained free of weeds using herbicides. Sections eroded by storm water were reconditioned and resurfaced with gravel. Road-side drains with silt pits as desired were provided where necessary.

**Plantation improvements:** About 1300 seedlings were planted as infills or in vacant strips within the existing new clearings so that almost the entire plantable land is brought under coconut. All young palms and seedlings were well looked after.

**Tree planting:** Around 6000 *Acacia* seedlings raised in the estate nursery were planted successfully along the boundaries etc. Earlier planted ones were regularly pruned down for mulching purposes.

**Dairy:** The herd strength by end of the year was as below.

(a)	Cows	33
(b)	Heifers	31
(c)	Bull calves	14
(d)	Bulls	01
	<b>Total</b>	<b>79</b>

The total production of milk during the year was 29 013 liters. After meeting the staff requirements the surplus was sold to the co-operative milk collecting center in Haldanduwana.

Disposal of milk is given below.

	Qty (litres)
(a) Sold to staff at subsidised rate	12009.25
(b) Sold to staff at normal rate	687.00
(c) Sold to milk collecting centre	18109.20
(d) Free issues to milkers	322.00
<b>Total</b>	<b>31127.45</b>

The income derived on sale of bull calves and culled animals during the year was Rs. 51, 560/-.

**Cost and returns on coconut:** Cost of production for the year was Rs 3787/= per 1000 nuts and Net Sales Average was Rs 5569/- per 1000 nuts.

**2.2 Rathmalagara Estate, Panirendawa**  
(*Superintendent - Mr L J C Perera*)

District : Puttalam  
Electorate : Chilaw  
Agro- Climatic Zone : Semi-dry Intermediate Zone.

Out of the total extent of 110.5ha 99.4ha are planted to coconut of which 50% is immature (Table 1).

**Rainfall:** The total rainfall of the year (1763.6mm) indicates a decrease of about 6% over that of 1992 (Table 5). However, the number of wet days was increased from 86 to 110. Rainfall this year was well distributed with virtually no dry months.

**Nut yields:** The total nut yield for the year (332 369) is more or less the same as that of last year (Table 3). However it is 25% less than the previous five years' average yield.

**Disposal of crops:** Crop was disposed through brokers mainly as husked nuts for processing (Table 4).

**Field operations**

**Manuring:** All adult palms were manured during Yala season as per the DFR of 1992. This contained about 6.5 kg of NPK and 3 kg of dolomite to each palm. Field No 1 and 4 (4254 palms) were applied with cattle manure at 30kg per palm in addition to the DFR.

All young palms below 3 years of age were manured with YPM at six-monthly intervals as recommended. Dolomite was applied at 1kg per seedling per year.

**Weed Control:** Ground conditions were kept well under control. Mainly the rotaslasher was utilised in keeping the weeds in check. Manual weeding was resorted to in cover cropped areas. Noxious weeds, mostly 'Illuk' were controlled using glyphosate. Herbicides were also used in keeping the manure circles free of weeds.

**Soil and moisture conservation:** 505 husk pits (5'x 3'x 3') in field No 5 and 100 semicircular husk trenches (3'x 2'x 2') in field No 4 were completed during the

year. Progress in this regard was restricted for want of husks as priority was given to research needs. The crop was low and husking was delayed by the buyers making the situation worse. Budgetary restrictions prevented bringing in material in large scale from outside as the expenditure had to be curtailed to compensate the drop in revenue due to poor cropping. However, the inter-row application of coir dust was continued in field No 1 and 7 and they were ploughed in during Maha rains. Nearly 325 000 husks were used in mulching palm bases of seedlings. Normal mulching of mature palms with fallen fronds and weed trash continued.

Cover crop *Pueraria* was successfully established in 4.5ha in field No 1.

**Fences:** The entire perimeter fence was maintained in good order. 1500 m of the Northern and Eastern perimeter fence were re-erected using concrete fence posts. Three rounds of herbicide spraying was done to keep the fence free of creeping weeds.

**Roads and paths:** All roads and paths were maintained in good order. The road in field No 1 was resurfaced using 15 cubes of gravel. Weeds on the roads were controlled chemically. New field paths were introduced along the boundary in field No 7 and 8.

**Plantation improvement:** Replanting the balance section in field No 6 was completed in Yala season using 200 CRIC 60 polybagged seedlings. Around 1 ha of waste land in field No 8 was planted with 210, CRIC 60 polybagged seedlings of Maduru Oya origin. Another 40 seedlings (CRIC 60 of Ambakelle origin / polybagged) were planted as an extra guard row in field No 5 on No 2 boundary. All young plantations were maintained in good order.

**Cost and returns on coconut:** The cost of production was Rs. 2275/- whilst the Net Sales Average was Rs. 5074/- per 1000 nuts.

### 2.3 Poththukulama Research Station, Pallama. (Officer in Charge - Mr K P de Silva)

District	:	Puttalam
Electorate	:	Anamaduwa
Agro-climatic Zone	:	Semi-dry Intermediate Zone.

The entire available land (81.5 ha) is now planted out and 18.5% of it is immature coconut (Table 1).

**Rainfall:** Although the total rainfall of the year (1458.7 mm) is slightly less

(2.7 %) than that of previous year it was better distributed over 82 days compared to 57 days in previous year. Compared to the average rainfall of last five years, 1993 has recorded a 13.3% increase.

**Nut yields:** Crop in 1993 is 7.8% less than that of last year but 11.5% more than the previous five years' average yield (Table 3).

**Disposal of Crops:** Entire harvest was sold through brokers as husked nuts for processing (Table 4).

### Field operations

**Manuring:** The entire plantation was manured as per the DFR (Urea 1.4 kg; Saphos 0.3 kg; ERP 0.8 kg; MOP 2.2 kg and dolomite 3.8 kg per palm). In addition to the DFR, kieserite was applied as recommended by the Estates Committee at 1 kg for 79 palms and at 500g for 169 palms depending on the severity of Mg deficiency symptoms and the rest of the plantation, 6472 palms at 250g.

Seedlings were manured with YPM and dolomite as recommended. No organic manuring was done during the year.

**Ground conditions:** Weeds were generally kept under control by the regular use of rotaslasher but there were occasions where ground conditions went out of hand. Noxious weeds, mainly 'Illuk' were controlled using herbicide glyphosate. It was also used in maintaining manure circles free of weeds.

There was an apparent decline in cover crop *Pueraria* during the year and very little work had been done in expanding covers.

**Soil and moisture conservation:** 979 husk pits of 5'x 3'x 3' in dimension were opened in various fields placed bordering the manure circle at one pit per each palm. Of these, 748 pits were closed by end of the year and the work was in progress.

Manure circles were regularly mulched with the available material on the estate.

**Fences:** The perimeter fence, about 10 km in length, was maintained in good order. Repairs were done where necessary. The boundary heavily over grown with scrub jungle in many sections was cleared and further growth was prevented. Vacancies in the live fence were infilled with gliricidia stakes in the northern perimeter.

Table 1.

*General Performance of the Estates, Seed Gardens etc.*

	BE	RE	PRS	WE	ISG	MK	MO	MIN	PAS	Total
<b>Coconut Extent (ha)</b>										
Mature	73.3	50.9	66.4	16.2	91.3	-	2.0	-	-	400.1
Immature	51.2	47.5	15.1	-	48.2	53.9	62.0	-	-	277.9
Total	124.5	98.4	81.5	16.2	139.5	53.9	64.0	-	-	578.6
Nursery	1.6	-	-	-	1.0	-	1.0	-	-	3.6
Other crops	-	4.1	1.8	-	-	-	-	-	-	5.9
Vacant land	-	2.8	-	-	1.0	-	-	-	-	3.8
Reservoir	-	-	-	-	2.0	2.4	-	-	-	4.4
Jungle	-	3.2	-	-	309.8	-	16.2	-	-	329.2
Roads & Buildings	22.0	2.0	2.5	1.6	3.0	2.0	4.0	-	-	37.1
Total	148.1	110.5	85.8	17.8	456.3	58.3	85.2	-	-	962.0
<b>Census of Palms</b>										
Bearing palms	8858	7040	6839	2166	15193	8757	2358	-	-	51211
Young Palms	4121	7420	3863	183	3673	565	897	-	-	20722
Seedlings	2915	-	783	-	4294	-	7286	-	-	15278
Dud palms	722	-	113	78	251	14	-	-	-	1178
Vacancies	2640	207	941	99	3330	707	931	-	-	8855
Total	19256	14667	12539	2526	26741	10043	1147	-	-	97244

Table 1.

(Contd.)

	BE	RE	PRS	WE	ISG	MK	MO	MIN	PAS	Total
<b>Crop disposal</b>										
Sold	211482	244105	351381	65122	937984	-	471	9250	-	1819795
Converted to copra	7672	15520	6132	4560	200217	37797	477	-	-	272375
Research	2082	9457	-	7628	4621	-	-	-	-	23788
Seednuts	2454	-	80	-	16591	114056	28468	1241	-	162890
Staff issues	39284	10866	5055	1922	15063	4500	2625	1287	-	80602
Rejections	9842	9302	20273	1486	25559	12430	741	546	-	80179
Awaiting Sale	36986	43119	182905	12427	66784	-	2067	-	-	344288
<b>Total</b>	<b>309802</b>	<b>332369</b>	<b>365826</b>	<b>93145</b>	<b>1266819</b>	<b>168783</b>	<b>34849</b>	<b>12324</b>	<b>-</b>	<b>2783917</b>
<b>COP</b>										
(Rs/1000 nuts)	3787/-	2275/-	2993/-	2859/-	3665/-	-	-	-	-	
<b>NSA</b>										
(Rs/1000 nuts)	5569/-	5074/-	5649/-	5323/-	8500/-	-	-	-	-	

Table 1.

(Contd.)

	BE	RE	PRS	WE	ISG	MK	MO	MIN	PAS	Total
<b>Crop Data</b>										
Pick 1	25726	30331	53377	5088	133337	-	22059	-	-	269838
Pick 2	38945	41788	43432	8031	175793	1149	5465	-	-	314603
Pick 3	52622	59289	101884	15381	316316	548	7228	-	-	558033
Pick 4	90161	80809	150097	23694	259653	16383	102	-	-	620899
Pick 5	57996	73761	133432	26955	226801	4172	-	-	-	523117
Pick 6	44352	46391	83666	14076	154919	155	-	-	-	343999
<b>Total - 1993</b>	<b>309802</b>	<b>332369</b>	<b>565828</b>	<b>93145</b>	<b>1266819</b>	<b>27677</b>	<b>34849</b>	-	-	<b>2630489</b>
<b>Total - 1992</b>	<b>412956</b>	<b>335662</b>	<b>613875</b>	<b>156247</b>	<b>1180460</b>	<b>168783</b>	<b>129270</b>	-	-	<b>2996653</b>
Difference + %	-25.0	-0.8	-7.8	-40.4	+7.3	-83.6	-73.0	-	-	-12.2
Estimate - 1993	300000	350000	5000000	150000	1200000	-	-	-	-	-
Average (1988-92)	417300	445284	507453	159331	753464	-	-	-	-	-
Nuts/palm 1992	49.7	38.2	35.4	85.9	27.8	-	-	-	-	-
Nuts/palm 1993	39.0	47.0	83.0	43.0	83.0	8.0	10.0	-	-	-
Yield/ha 1992	5735	6712	9245	9645	12930	-	-	-	-	-
Yield/ha 1993	6296	6441	8520	5750	12822	514	-	-	-	-

Table 2.

*Monthly rainfall (mm) with number of wet days in parenthesis*

Month	Bandirippuwa Estate		Rathmalagara Estate		Pothukulama Estate							
	1992	1993	1992	1993	1992	1993.						
Jan	5.3	(2)	3.8	(2)	36.2	(3)	17.5	(1)	5.0	(2)	-	-
Feb	-	-	20.6	(2)	-	-	22.9	(1)	-	-	12.5	(1)
Mar	-	-	-	-	-	-	85.1	(4)	-	-	106.6	(5)
Apr	54.5	(7)	191.4	(13)	236.9	(6)	278.9	(11)	156.8	(7)	162.8	(9)
May	413.5	(9)	255.2	(19)	275.2	(16)	216.4	(11)	226.9	(8)	105.6	(6)
Jun	260.2	(12)	49.2	(15)	191.2	(9)	23.5	(5)	174.9	(3)	5.3	(1)
Jul	78.0	(15)	73.6	(9)	71.5	(7)	25.8	(4)	116.6	(2)	33.6	(4)
Aug	57.3	(11)	56.7	(13)	11.5	(3)	22.7	(5)	62.2	(3)	5.0	(1)
Sep	362.6	(14)	200.9	(17)	192.8	(9)	198.3	(11)	80.8	(5)	81.6	(8)
Oct	443.7	(13)	324.7	(25)	326.9	(10)	281.4	(24)	277.1	(8)	335.5	(20)
Nov	319.7	(22)	301.6	(21)	505.5	(22)	393.5	(20)	366.5	(13)	345.3	(14)
Dec	60.7	(9)	237.6	(15)	56.4	(4)	197.6	(13)	32.1	(5)	264.9	(13)
<b>Total</b>	<b>2053.7</b>	<b>(114)</b>	<b>1778.8</b>	<b>(156)</b>	<b>1867.9</b>	<b>(86)</b>	<b>1743.6</b>	<b>(110)</b>	<b>1498.9</b>	<b>(57)</b>	<b>1458.7</b>	<b>(82)</b>

Table 2.

(Contd.)

Month	Walpita Estate		ISG Ambakelle		Makandura Seed Garden							
	1992	1993	1992	1993	1992	1993						
Jan	-	(-)	15.5	(1)	-	(-)	9.4	(2)	9.1	(2)	3.5	(1)
Feb	-	(-)	37.7	(2)	-	(-)	2.0	(1)	-	(-)	36.4	(1)
Mar	-	(-)	152.5	(6)	-	(-)	53.5	(6)	-	(-)	78.5	(4)
Apr	116.0	(8)	279.4	(8)	217.8	(9)	164.0	(9)	84.0	(9)	194.2	(9)
May	246.7	(14)	269.2	(13)	207.3	(11)	136.3	(13)	306.6	(16)	327.6	(16)
Jun	287.5	(12)	122.5	(11)	239.5	(8)	2.4	(2)	264.7	(11)	66.2	(12)
Jul	164.4	(10)	103.8	(7)	116.9	(7)	35.0	(5)	113.2	(13)	68.2	(6)
Aug	67.4	(6)	73.9	(7)	28.4	(5)	17.5	(5)	69.7	(8)	53.5	(3)
Sep	348.3	(11)	257.5	(10)	62.3	(7)	89.3	(11)	366.1	(16)	257.9	(13)
Oct	546.2	(15)	468.5	(26)	342.3	(10)	239.6	(22)	481.3	(14)	372.2	(29)
Nov	331.9	(14)	291.1	(16)	406.0	(22)	242.8	(17)	410.6	(15)	305.7	(21)
Dec	81.4	(8)	236.7	(12)	75.9	(8)	304.5	(14)	36.5	(4)	353.9	(15)
<b>Total</b>	<b>2189.8</b>	<b>(98)</b>	<b>2308.3</b>	<b>(119)</b>	<b>1696.4</b>	<b>(87)</b>	<b>1296.3</b>	<b>(107)</b>	<b>2143.8</b>	<b>(108)</b>	<b>2117.3</b>	<b>(130)</b>

Table 2.

(Contd.)

Month	Maduru Oya Seed Garden		Minneriya Farm	
	1992	1993	1992	1993
Jan	70.9 (5)	15.2 (2)	- (-)	- (-)
Feb	- (-)	32.5 (4)	- (-)	- (-)
Mar	- (-)	4.6 (1)	- (-)	- (-)
Apr	53.1 (3)	44.5 (4)	- (-)	- (-)
May	66.8 (4)	110.2 (5)	- (-)	- (-)
Jun	- -	13.7 (1)	- (-)	- (-)
Jul	38.1 (2)	84.3 (3)	- (-)	- (-)
Aug	1.8 (1)	67.1 (3)	- (-)	- (-)
Sep	85.6 (8)	177.0 (8)	- (-)	- (-)
Oct	76.2 (5)	146.8 (11)	- (-)	- (-)
Nov	546.6 (21)	714.8 (27)	- (-)	- (-)
Dec	580.1 (16)	741.9 (24)	- (-)	- (-)
<b>Total</b>	<b>1519.2 (65)</b>	<b>2152.6 (93)</b>	<b>- (-)</b>	<b>- (-)</b>

(- ; Not recorded)

**Roads and paths:** All field roads and paths were maintained in good order. About 1100 m of road reconditioned using gravel. New field roads of about 740m in field No 14 and about 460m in field No 15 were opened.

**Plantation improvements:** Germplasm collection in field No 14 by Genetics and Plant Breeding Division was extended by planting another 611 seedlings. In field No 13 new clearing 63 seedlings (CRIC 60) were planted. 39 vacancies in field No 9 and 60 vacancies in field No 15 were infilled with CRIC 60. 82 King coconut palms remained out of the old stand in field No 13 were uprooted.

**Intercropping:** Paddy field fallowed in Yala season was cultivated in Maha season. An income of Rs. 21,903/- has been realised in sale of bananas. However, the plantation is now approaching a declining phase.

**Cost and returns:** The cost production of coconuts was Rs 2992.94 while the Net Sales Average was Rs 5648.52 per 1000 nuts.

**Table 3.** *Area Intercropped (ha)*

Intercrop	Bearing	Non-bearing	Total
Cocoa	2.02	-	2.02
Coffee	0.80	-	0.80
Pepper	0.20	0.93	1.13
Cinnamon	0.18	-	0.18
Banana	1.64	-	1.64
Ginger	0.10	-	0.20
Mixed	0.20	-	0.20
<b>Total</b>	<b>5.14</b>	<b>0.93</b>	<b>6.07</b>

**Table 4.** *Breakdown of the Production 1992 and 1993 at Isolated Seed Garden, Ambakelle*

Pick	1992			1993		
	CRIC 60	CRIC 65	Total	CRIC 60	CRIC 65	Total
1	101377	22608	123985	103985	29352	133337
2	219274	35786	354460	142355	33438	175793
3	197185	37482	234640	276556	39760	316316
4	184865	59700	244565	234017	25636	259653
5	120027	42179	162206	199645	27156	226801
6	119758	40846	160604	132809	22110	154919
<b>Total</b>	<b>942459</b>	<b>238001</b>	<b>1180460</b>	<b>1089367</b>	<b>177452</b>	<b>1266819</b>
Bearing Palms	11527	292	414451	12241	3111	15352
Nuts/Palm	82	81	82	89	57	83

**Table 5** *Seednut Production*

Pick	1992			1993		
	CRIC 60	CRIC 65	Total	CRIC 60	CRIC 65	Total
1	77331	21000	98331	82364	25950	108314
2	189765	31322	221087	104065	27581	131646
3	173039	28604	201643	207785	33610	241395
4	160912	54655	215567	185691	21325	207016
5	100194	37885	138079	159611	22020	181631
6	91000	36489	127489	110159	18570	128729
<b>Total</b>	<b>792241</b>	<b>209955</b>	<b>1002196</b>	<b>849675</b>	<b>149056</b>	<b>998731</b>

# **REPORT OF THE AGRICULTURAL RESEARCH PROJECT**

**Project Co-ordinator - M Jeganthan, M Phil**

## **1. ACTIVITIES**

### **1.1 Manpower Development Programme**

#### **1.1.1 Long Term Training**

Dr T G L G Gunasekara, Assistant Agronomist, returned to the Island on 20 September after successfully completing the Ph.D programme at the University College of Wales, U.K.

Dr N A Tennakoon, Assistant Soil Scientist, returned to the Island on 19 November after successfully completing the Ph.D. programme at the University of Aberdeen, U.K.

Mr H P S Jayasundara, Assistant Agronomist, completed his field studies in Sri Lanka, under the split training programme, and for <sup>15</sup>N labelled nitrogen and write up the thesis.

Mr K B Dassanayake, Assistant Agronomist, and Ms C S Ranasinghe, Assistant Plant Physiologist continued with their studies at the Universities of Aberdeen and Sussex, U.K., respectively.

Mr M T N Fernando, Assistant Agronomist, left the Island on 30 September for postgraduate studies (M Phil) in Agricultural Economics at the University of Aberdeen, U.K.

#### **1.1.2 Long Term Training (Local)**

Ms D M D I Wijebandara continues with her post graduate studies (M Phil) at the Post Graduate Institute of Agriculture, Peradeniya. Presently she is conducting her field studies at the Institute.

Mr T S G Peiris, Senior Biometrician and Mr Lal Vidhanaarachchi, Assistant Soil Scientist continued with their post graduate studies at the Universities of Colombo and Sri Jayawardenepura, respectively.

### **1.1.3 Short Term Training (Local)**

Mr D P Panditharatne, Senior Technical Assistant, Soils and Plant Nutrition Division completed a short course on 'Plastic Mould and Press Tool Design and Manufacture' from 26 October to 10 November, conducted by the University of Moratuwa.

### **1.2 Council for Agricultural Research Policy (CARP) - Special Programme - Research Management**

The Institute has been selected for the Project on 'Research Prioritization and the Development of Research Management Capability' conducted by CARP/GTZ. Dr D T Wettasinghe (GTZ Team Leader) with Dr Hans-Joachim Holler and Dr Arther Ballantyne (shortterm Consultants, GTZ, Germany) visited the Institute on several occasions for discussions with the research staff.

A Discussion Document on 'Decision-making for Agricultural Research, Testing the Composite Approach' comprising Vol. I, Main Report and Vol. II, Statistical Annexes was prepared.

### **1.3 Strengthening of Research Station Facilities**

#### **1.3.1 Laboratory/Field Equipment and Spares**

Equipment Spares	-	Colorimeter for the Technicon Auto Analyzer
Officer Equipment	-	One microcomputer complete unit together with a printer
Furniture	-	Three wooden cupboards and a fume cupboard
Field Equipment	-	A coconut climber

#### **1.3.2 Procurements of Books and Periodicals**

05 books were received.

### **1.4 Civil Works**

All shortcomings and deficiencies of civil works undertaken at the Head Office have been completed satisfactorily and handed over. These include the

auditorium, screenhouse, six quarters and the water tank.

Tenders for the field laboratory, office and chemical stores to be constructed at the Isolated Seed Garden at Rajakadaluwa are under evaluation.

### **1.5 Fields Days, Workshops and Seminars**

Four field days, four training programmes, four land suitability workshops and two research-extension dialogues were held during the year.

A very successful 'Land Suitability Workshop' was held in Colombo on 27 August, covering the main coconut growing areas in the North Western Province. The invitees included planners, decision makers and management companies from the coconut sector.

### **1.6 Diagnostic Team (Research and Extension Linkage)**

The Diagnostic Team at the Coconut Research Institute consisted of Dr L L W Somasiri; Soil Scientist, Mr T S G Peiris, Senior Biometrician, Dr H A J Gunatilake, Agronomist, Mr J G L Pinto; Assistant Information Officer and Mr M T N Fernando; Assistant Agricultural Economist.

The team completed a survey of 325 farm holdings and interviewed the owners/farmers of the 450 holdings selected, covering six Districts and submitted their report in December, entitled "An Appraisal of Coconut Growers Reactions and Observations on CRI Recommended Cultural Practices and Other Related Issues".

### **1.7 Management Information System/Programme Budgeting System (MIS/PBS)**

The MIS/PBS system is now in place, and the information is being used to allocate funds for prioritized research programmes. Also this information has been used to re-allocate funds based on the priorities indicated.

## **2. CONTRACT RESEARCH PROGRAMME [CARP AWARDS]**

### **2.1 Inter Institutional Research Programme (IIRP) - Coconut Intercropping (Project Nos. 12/1/1 and 12/18/13)**

The fourteenth, fifteenth, sixteenth and seventeenth meetings of the Programme Coordinating Committee, IIRP were held on 13 January, 03 June, 23 July, and 14 October, to monitor the progress of the IIRP.

The Half-Yearly Progress Report of the programme ending December 1992 and June 1993 were submitted to the CARP on 04 April and 29 September respectively.

The Contract Research Programme on 'Integration of Cattle under Coconut' (12/13/18) was concluded at the end of the third year, in June, 1993.

**2.2 Studies on water balance of coconut under different soil landscapes, agroclimates and management practices (12/104/89)**

Work on this programme is progressing satisfactorily.

**2.3 Adaptive Research Trials in Coconut Based Cropping/Farming Systems (12/121/92)**

The award was granted for a one year period, commencing 06 February, 1992.

A progress report on the conclusion of the one year period was submitted to CARP on 02 August, 1993, along with a request, with justification, for continuation of the programme for a further one year period.

**2.4 Intercropping of Coconut with selected Medicinal Plants (12/167/136)**

The award was made on 1 December, 1992 to be undertaken in collaboration with the Ceylon Institute of Scientific and Industrial Research (CISIR). Work is progressing satisfactorily.

**2.5 Characterization of physical properties of soils and studies on the development of coconut roots (12/175/149)**

The award was made on 27 April, 1993. Field work commenced in June.

## REPORT OF THE ADMINISTRATION DIVISION

Deputy Director (Adm. & Fin.) - D G Manamudali, B A

### 1. GENERAL

The Division continued to assist the Research Divisions in routine administrative and financial matters and related affairs including maintenance work.

### 2 CADRE

The staff position of the Coconut Research Institute at the end of December, 1993 is given in Table 1.

Table 1. *Staff position as at 31.12.1993*

Grade	Ungraded	Special class	----- Class -----				Total
			I	II	III	IV	
Executive	02	-	05	14	18	13	52
Technical	-	24	08	25	-	-	57
Intermediate	-	03	01	03	-	-	07
Clerical & Allied	-	21	06	10	-	-	37
Operative	-	25	08	22	-	-	55
Minor	-	65	09	36	-	-	110
Driver	-	12	03	13	-	-	28
Watcher	11	-	-	-	-	-	11
Grand Total	13	150	40	123	18	13	357

### 3. WELFARE

#### 3.1 Financial Aid

**Provident Fund:** The loans granted from the provident fund to employees amounted to Rs.3,420,500/-.

**Distress Loans:** Distress loans paid to employees amounted to Rs. 2,311,135/-.

**Transport Loans:** Transport loans paid to employees amounted to Rs. 942,000/-.

**Loans to Relieve Indebtedness:** Loans to relieve indebtedness to employees amounted Rs. 67,500/-.

**Refrigerator Loans:** Refrigerator loans to employees amounted to Rs. 3,348,000/-.

**Educational Loans:** Educational loans to employees amounted to Rs. 50,000/-.

**Medical Aid:** A sum of Rs. 730,312/- was reimbursed by the Medical Aid Scheme to its members during the year 1993.

### **3.2 Other Facilities to Employees**

Financial assistance was also granted to the Multi Purpose Co-operative Society, the Recreation Club, and the Art Circle to promote their activities during the year.

The members contribution of the Medical Scheme was increased to 2% of those who contributed less than this amount with effect from 01.01.1994.

Two clinics, (a) Eye Clinic at Bandirippuwa Estate on 20 June and (b) Dental Clinic at ISG were organized by the Medical Aid Scheme for the benefit of Staff and their Families.

The amount of Rs. 167,475/- has been spent by the Medical Aid Scheme for the upliftment of the common health condition of its members.

## STAFF MATTERS

### 1 APPOINTMENTS

Eighteen appointments were made during the year and the details are shown in Table 1.

**Table 1.** *Appointments made during the year 1993*

Name	Designation	Division	Date
Mr. N M Chandrasoma	Lab/Field Assistant	Soils & Pla. Nutrition	07.01.93
Mr. R Vithanage	Mechanic	Engineering	15.01.93
Mr. A S M T Abeywickrama	Technical Assistant	Isolated Seed Garden	10.02.93
Mr. G K Ekanayake	Technical Assistant	Gen. & Pla. Breeding	10.02.93
Mr. M S M P Fernando	Technical Assistant	Soils & Pla. Nutrition	10.02.93
Mr. J M I Diupathi	Technical Assistant	Agronomy	10.02.93
Ms. C P A Kurundukumbura	Technical Assistant	Soils & Pla. Nutrition	10.02.93
Mr. S. Prabath Manohara	Technical Assistant	Crop Protection	26.04.93
Mr. W K K R Aryaratne	Technical Assistant	Biometry	03.05.93
Ms. M J M D Jayasundara	Clerk/Typist	Administration	01.10.93
Mr J Amarasinghe (contract)	Driver	Administration	02.10.93
Mr. W A H Upali	Supervisor	Estate Management	01.11.93
Mr. M R L A Perera	Superintendent	Estate Management	01.11.93
Mr. M Wijeratnabanda	Superintendent	Estate Management	01.11.93
Mr. L J C Perera	Superintendent	Estate Management	01.11.93
Mr. A N Eknaligoda	Superintendent	Estate Management	04.11.93
Mrs. Anoma de Alwis	Accountant	Accounts	07.12.93
Dr. M de. S Liyanage	DD (Research)	Coconut Research Inst.	24.12.93

#### 1.1 Extensions

The services of one Senior Research Officer, Dr. P A C R Perera, Head, Crop Protection Division who was due to retire on 24.07.93 has been extended for one year from 24.07.94 to 23.07.94.

#### 1.2 Retirements, Voluntarily Retirements, Resignations, Vacation of Post, Deaths, and Terminations

The details are given in Table 2.

**Table 2.** *Details of Retirements, Voluntarily retirements, Resignations, Vacation of post, Deaths, and Terminations during the year 1993.*

Name	Designation	Division	Date
<b>Retirements</b>			
Mr. P. Marcus Fernando	Electrician	Engineering	10.02.93
Mr. M Ramasamy	Lab/Field Attendant	Plant Physiology	27.02.93
Mr. W Gunaratne	Cattle Keeper	Agronomy	15.05.93
Mr. W A W Wijesuriya	Clerk/Typist	Administration	07.11.93
<b>Voluntarily retirements</b>			
Mr. R K Seelaratne	Lab/Field Attendant	Crop Protection	01.09.93
Mr. V Sithambarampillai	Labourer	Crop Protection	01.09.93
Ms. M P Isabel	Labourer	Estate Management	01.09.93
Mr. G D Benjamin	Labourer	Agronomy	01.09.93
Mr. M Nadarajah	Lab/Field Attendant	Crop Protection	01.09.93
Mr. P P J Peiris	Office Attendant	Administration	01.09.93
Mr. I H Amaradasa	Office Attendant	Information Service	01.09.93
<b>Resignations</b>			
K A D N S Mariyan	Clerk/Typist	Estate Management	01.02.93
Mr. B L Senagosa	Estate Clerk	Estate Management	17.02.93
Mr. R M G D Rajapakse	Chief Accountant	Accounts	31.03.93
Mr. G Vithanage	Superintendent	Estate Management	30.03.93
Mr. W L S S Fernando	Tractor Driver	Administration	30.06.93
Ms. J K F Perera	Clerk	Accounts	01.09.93
Ms. I K Rahathungoda(contract)	Asst. Accountant	Accounts	01.09.93
Mr. U C Hettiarachchi	Supervisor	Estate Management	01.10.93
Dr. R Mahindapala	Director	Coconut Research Inst.	01.11.93
Mr. E A P Edirisinghe	Accounts Clerk	Accounts	22.10.93
Ms. J A N Thushara	Clerk/Typist	Engineering	03.11.93
Mr. M S M P Fernando	Technical Assistant	Soils & Pla. Nutrition	01.11.93
Mr. M Chandrasoma	Supervisor	Estate Management	31.12.93
<b>Vacation of Post</b>			
S Malavipathirana	Technical Assistant	Soils & Pla. Nutrition	07.01.1993
Mr. J A R Sarath Sisira	Driver	Administration	25.08.1993
<b>Deaths</b>			
P A Nonis	Clerk/Typist	Accounts	23.09.1993
<b>Terminations</b>			
G D Gunasekara	Linesman	Engineering	30.09.1993

### 3. PROMOTIONS

#### 3.1 Promotions in Executive Grades

Eight promotions were made during the year and the details are shown in Table 3.

**Table 3.** *Promotions in Executive Grade during the year 1993*

Name	Designation	Division	Date
<b>Executive Grade Class II to I</b>			
Dr (Mrs) C Jayasekera	Head	Plant Physiology	14.04.93
<b>Executive Grade Class III to II</b>			
Mr. P A H N Appuhamy	Head	Information Service	26.05.93
Dr. W M U Fernando	Research Officer	Gen. & Pla. Breeding	02.05.93
Mrs. C N K Rajapakse	Head	Crop Protection	15.04.93
Dr. T G L G Gunasekara	Research Officer	Agronomy	20.09.93
Dr. K S Jayasekera	Research Officer	Soils & Pla. Nutrition	23.09.93
Dr. N A Tennakoon	Research Officer	Soils & Pla. Nutrition	22.11.93
Dr. L C P Fernando	Research Officer	Crop Protection	23.11.93

#### 3.2 Promotions in Non Executive Grades

Following internal promotions in Non-Executive Grades were implemented during the year 1993 as shown in Table 4. The effective date of these promotions was 01 January, 1993.

**Table 4.** *Promotions in Non Executive Grades during the year 1993.*

Name	Designation	Division
<b>Technical Grade from Class I to Special Class</b>		
Mr. H A Abeysoma	Technical Assistant	Agronomy
Mr. D M Pathirage	Technical Assistant	Estate Management
Mr. K A Chandrasiri	Technical Assistant	Crop Protection
Mr. R Marasinghe	Technical Assistant	Agronomy
Mr. R D N Premasiri	Technical Assistant	Plant Physiology
Mr. D P Panditharatne	Technical Assistant	Soils & Pla. Nutrition
Mr. B M Jayathilake	Book Keeper	Accounts
Mr. M J I costa	Technical Assistant	Agronomy
<b>Intermediate Grade from Class I to Special Class</b>		
Mrs. M P Premarathe	Steno (English)	Administration
<b>Clerical &amp; Allied Grade from Class I to Special Class</b>		
Ms N R Ayagama	Clerk/Typist	Estate Management
Ms M M J R Fernando	Internal Audit Clerk	Establishment
Ms R D I Somasiri	Internal Audit Clerk	Establishment
Mr M R U Attanayake	Internal Audit Clerk	Establishment
Ms H M W S Athauda	Typist (English)	Soils & Pla. Nutrition
<b>Operative Grade from Class I to Special Class</b>		
Mr W E J Tissera	Lab/Field Assistant	Agronomy
Mr B C E Perera	Lab/Field Assistant	Soils & Pla. Nutrition
Mr W T H C Fernando	Lab/Field Assistant	Gen. & Pla. Breeding
Mr W S M J Fernando	Lab/Field Assistant	Agronomy
Mr W E R C Fernando	Lab/Field Assistant	Biometry
<b>Drivers Grade from Class I to Special Class</b>		
Mr W A D S R Appuhamy	Driver	Transport
Mr S A D K Antony	Driver	Transport
Mr A A Dayaratne	Driver	Transport

**Table 4.** (Contd.)

Name	Designation	Division
<b>Minor Grade from Class I to Special Class</b>		
Mr G D Benjamin	Cattle Keeper	Agronomy
Mr A P Nandasena	Office Attendant	Gen. & Pla. Breeding
Mr W P Pieris	Lab/Field Assistant	Agronomy
Mr N P E Indrawansa	Office Attendant	Agronomy
Mr G S S Siripala	Labourer	Transport
Mr H A G Perera	Office Attendant	Accounts
Mr Y M Chandrasiri	Lab/Field Assistant	Agronomy
Mr R P Somasiri	Mechanical helper	Engineering
Mr K L W Fernando	Office Attendant	Library
Mr M Somasiri	Office Attendant	Agronomy
<b>Technical Grade from Class II to Class I</b>		
Mr S D J N Subasinghe	Technical Assistant	Agronomy
Mr D L J Nethasinghe	Field Officer	Estate Management
Mr G B A Wijesekera	Field Officer	Estate Management
<b>Intermediate Grade from Class II to Class I</b>		
Mr M B Upali	Store Keeper	Accounts
<b>Clerical &amp; Allied Grade from Class II to Class I</b>		
Mrs K A P Chandani	Clerk/Typist	Administration
Mrs. S N Gunatilaka	Clerk/Typist	Library
Mr J A R Reginold	Estate Clerk	Estate Management
<b>Operative Grade from Class II to Class I</b>		
Mr I A N Hemasiri	Lab/Field Assistant	Agronomy
Mr M J David	Supervisor	Estate Management
Mr W M Danapala	Mason	Engineering
Mr A A K Amarasinghe	Carpenter	Engineering
<b>Minor Grade from Class II to Class I</b>		
Mr P Nihal	Conservancy Labourer	Estate Management

#### 4. TRANSFERS

Mr H A D Raxy, Labourer, from the Establishment Unit to the Plant Physiology Division on 04 March.

Mr A S M T Abeywickrama, Technical Assistant from Genetics & Plant Breeding Division to the Isolated Seed Garden on 07 June.

Mr K P Wilson Perera, Clerk from Genetics & Plant Breeding Division to the Establishment Unit on 01 July.

#### 5. OVERSEAS LEAVE ON NO-PAY

Mr M A M Perera, (Middle East).

#### 6. FULL PAY LEAVE FOR STUDY IN SRI LANKA

Mr M T N Fernando, Assistant Agric. Economist for M Phil Degree.

Mr L M S R Jayathilaka for B Sc examination, for two weeks from 15 April.

Mrs W P K Fernando for B Sc examination, for two weeks from 14 June.

Mrs P S A de Seram, Technical Assistant for B Sc examination for two weeks from 14 June.

Mr J A D Abeysekara, Technical Assistant for B Sc examination for two weeks from 19 July.

Miss H D Mangalika, Clerk for LLB examination for two weeks from 18 October.

#### 7. TRAINING IN SRI LANKA

Mr L P Vidhana Arachchi, Assistant Soil Scientist continued his Ph D programme at the University of Sri Jayawardenepura.

Mr J D J S Kularatna, Technical Assistant continued his B Sc degree programme at the Colombo Campus.

Mr T S G Peiris, Senior Biometrician continued his Ph D programme at the University of Colombo

Mrs D M D I Wijebandara, Technical Assistant, continued her M Sc Programme at the Postgraduate Institute of Agriculture, Peradeniya.

Mr P de Zoysa, Analyst Programmer continued his M Sc degree programme at the Colombo Campus.

Mr K R E M Fernando, Field Assistant, training course on Basic Electronics organized by the Atomic Energy Authority for three weeks from 17 January.

Mr H P de Zoysa, Analyst Programmer, training course on computers at the University of Colombo, for four weeks from 06 June.

Mr. D R C M Handalage, Accountant, seminar on Auditing Standards at the Institute of Chartered Accountants on 24 June.

Mr M M P Wijesekara, Internal Auditor, seminar on Auditing Standards at the Institute of Chartered Accountants on 24 June.

Mr K N A S Perera, Engineer, seminar at the SLSI for 3 days from 07 September.

Mr P D Panditharatne, Technical Assistant, training course on Design and manufacture of mould and press tools, at the University of Moratuwa, Katubadda, for 8 days from 26 October.

Mr P A H Nimal Appuhamy, Head, Information Services, training course on Training of Trainers in Advanced Agricultural Communication Technology, at the Department of Agriculture, Gannoruwa. Peradeniya for two weeks from 1 November.

Mr J L J G Pinto, Assistant Information Officer, training course on Training of Trainers in Advanced Agricultural Communication Technology, at the Department of Agriculture, Gannoruwa. Peradeniya for two weeks from 1 November.

Mr W P C Fernando, Account Clerk, training course on Accounts/Auditing at the NIBM for 5 days from 15 November.

Miss R H M Dilhani, Account Clerk training course on Accounts/Auditing at the NIBM for 5 days from 15 November.

Mrs S Abeywickrama, Account Clerk training on Accounts/Auditing, NIBM for 5 days from 15 November.

Miss A A N Pushpakanthi, Clerk/Typist training on Accounts/Auditing, NIBM for 5 days from 15 November.

Mr D G Manamudali, Deputy Director (Adm. & Fin.), course for the Diploma in Personnel Management, NIBM.

Mr A S Nanayakara, Accounting Assistant, training course in Advance Accounting, NIBM.

Mr B M Jayatilaka, Book Keeper training course in Advance Accounting, NIBM.

## 8. TRAINING IN OVERSEAS

Mrs M G F S Jayasundara, Assistant Soil Scientist continued her studies at the University of Western Australia, Perth, Australia under a Colombo Plan Award.

Mr T G L Gunasekara, Research Assistant left for the United Kingdom to complete his postgraduate studies at the University of Bangor on Crop Management, on 01 January.

Mr H P S Jayasundara, Research Assistant left for the United Kingdom to complete his postgraduate studies at the University of Reading on Agronomy on 15 May.

Mr M T N Fernando, Research Assistant left for the United Kingdom, to complete his post graduate studies at the University of Aberdeen on Agricultural Economics on 30 October.

## 9. OVERSEAS VISITS

Dr M de S Liyanage, Head, Agronomy Division participated in the Conference on Nitrogen Fixation held in Brisbane, Australia, for one week from 05 September.

Mrs W N I S C Fernando, Research Assistant, participated in the Workshop on Plant Biotechnology in Philippine for one week from 06 October.

10. **PARTICIPATION OF CRI STAFF IN OTHER STATUTORY BODIES, COMMITTEES ETC.**

*Mr P A H Nimal Appuhamy*

Member, Extension Committee, CCB

*Dr D N S Fernando*

Assisant Editor, Council of the Institute of Biology, Sri Lanka

*Dr (Mrs) W M U Fernando*

Member, Committee for Plus Palms and Seed Selection.  
Member, Board of Trustees, Medical Aid Scheme, CRI.

*Dr (Mrs) M N Fernandopulle*

Member, Fertilizer Co-ordinating Committee, National Fertilizer Secretariat (NFS)  
Member, Fertilizer Advisory Committee  
Member, Drafting Committee on Fertilizer, Sri Lanka Standards Institution

*Dr T G L G Gunasekera*

Member, Institute of Biology, Sri Lanka

*Dr H A J Gunathilake*

Member, Operational Committee, Technology Transfer Centre, Integrated Rural Development Project, Gampaha

*Dr (Mrs) C Jayasekera*

Member, Nuclear Agriculture Co-ordinating Committee, Atomic Energy Authority, Colombo

***Dr M de S Liyanage***

Member, National Multipurpose Tree Research Committee, Peradeniya  
Member, Council of the Institute of Biology, Sri Lanka  
Member, Nuclear Agricultural Co-ordinating Committee, Atomic  
Energy Authority, Sri Lanka

***Mr T S G Peiris***

Fellow of the Royal Statics Society, UK  
External Examiner in Biometry & Crop Experimentation, University of  
Eastern

***Dr P A C R Perera***

Member, Sri Lanka Pesticides Formulary Committee  
Hon. President, Institute of Biology, Sri Lanka

***Dr R R A Peries***

General Secretary, International Association of Coconut Breeders  
(IACB).  
Member, Committee for Plus Palms and Seed Selection

***Mrs (Mrs) C N K Rajapakse***

Member, Institute of Biology, Sri Lanka

***Dr N A Tennakoon***

Member, Institute of Biology, Sri Lanka

**11. ACADEMIC AND PROFESSIONAL ACHIEVEMENTS**

**Dr (Mrs) L C P Fernando**, Assistant Entomologist, was awarded the Ph D degree by the University of Queensland, Australia.

**Dr T G L G Gunasekera**, Assistant Agronomist, was awarded the Ph D degree by the University of Wales, UK.

**Dr K S Jayasekara**, Assistant Soil Scientist, was awarded the Ph D degree by the University of Queensland, Australia.

**Dr N A Tennakoon, Assistant Soil Scientist, was awarded the Ph D degree by the University of Aberdeen, UK.**

## STAFF PUBLICATIONS AND COMMUNICATIONS AT SCIENTIFIC MEETINGS

(CRI members are shown in bold type)

### THESES

✓ **Fernando, L C P** (1993). Ovarian status, activity patterns and ecology of *Aphytis Lingnanensis* Compere in Queensland Citrus. (Ph D - University of Queensland, Australia).

**Gunasekera, T G L G** (1993). Physiological studies on growth and development of weed species, with particular reference to *Galium aparine* L (Cleavers) and *Chromolaena odorata* (L). (Ph D - University of Wales, UK).

**Jayasekara, K S** (1993). The effect of shoot/root ratio on the water relations of sorghum (*Sorghum bicolor* L Monach). (Ph D - University of Queensland, Australia).

**Tennakoon, N A** (1993). Effect of heavy metal contaminated sewage sludge on biological and chemical properties of conifer forest soils. (Ph D - University of Aberdeen, UK).

### OTHERS

**Amarasinghe, L** (1993). Physiography of the coconut growing lands in the coconut triangle. Paper presented at the Workshop on Land Suitability Studies for Coconut Lands held in Colombo, 27 August, 1993.

**Fernandopulle, M N & I R Wickramananda** (1993). Effectiveness of perennial legumes as a source of nitrogen for coconut. *Proceeding of the Sri Lanka Association for the Advancement of Science (Part I)*, 49th Annual Session. December, 1993. 121p.

**Fernando, D N S** (1993). Compost for coconut plantations. *Coconut Bull.*, 8 (1 & 2), 24-28.

✓ **Fernando, L C P** (1993). Timing of oviposition in *Aphytis lingnanensis* compere females: a parasitoid of California scale *Aoniella aurantii*. *Proceeding of the Sri Lanka Association for the Advancement of Science (Part I)*, 49th Annual Session. December, 1993. 100p.

- Fernando, S C (1993).** Status of coconut tissue culture and biotechnology research in Sri Lanka. Presented at the International GTZ Workshop held in the Philippines. 6 - 11 October, 1993.
- Gunathilake, H A J (1993).** Development of low-yielding coconut lands by intercropping. *Coconut Bull.*, 8 (1 & 2) 1-3.
- Gunathilake, H A J (1993).** Interpretation of land suitability maps for intercropping in coconut lands. Presented at the Workshop on Land Suitability studies for Coconut lands, held in Colombo on 27 August, 1993.
- Jayasekara, C (1993).** Water-use efficiency and discrimination of  $^{13}\text{C}$  among the coconut cultivars. *Proceeding of the Sri Lanka Association for the Advancement of Science (Part I)*, 49th Annual Session. December, 1993. 119p.
- Jayasekara, C and D T Mathes (1993).** A method to determine leaf area of a found and the whole canopy of an adult coconut palm. *Indian Coconut Journal* Vol. XXXIII(3), 7-13.
- Jayasekara, C, K S Jayasekera and G D Bowen (1993).** Use of  $^{14}\text{CO}_2$  and  $^{13}\text{C}/^{12}\text{C}$  isotope discrimination ratio for assimilate partitioning and transpiration efficiency studies in coconut. Proceedings of FAO/IAEA Regional Seminar for Asia and the Pacific on nuclear related methods on Soil/Plant aspects of sustainable agriculture, Colombo, 5 - 9 April, 1993.
- Jayasekara, C, N A D P Nainanayake and K S Jayasekara (1993).** Physiological adaptation of the coconut palm to soil water deficit. *Proceeding of the Sri Lanka Association for the Advancement of Science (Part I)*, 49th Annual Session. December, 1993. 53p.
- Jayasekara, C, C S Ranasinghe & D T Mathes (1993).** Screening for high yield and drought tolerance in coconut. *Advances in coconut research and development (Proceedings of the Symposium on Coconut Research and Development)*, 209-218. (Eds. M K Nair *et al.*). Oxford & IBH Publishing Co Pvt Ltd., New Delhi.
- Jayasekara, K S (1993).** Differential fertilizer recommendations for coconut based on nutrient and productivity level. *Advances in coconut research and development (Proceedings of the Symposium on Coconut Research and Development)*, 413-420. (Eds. M K Nair *et al.*). Oxford & IBH Publishing Co Pvt Ltd., New Delhi.
- Jayasekera, K S & C Jayasekera (1993).** Efficiency of water-use in coconut under different soil/plant management systems. *Advances in coconut research and development (Proceedings of the Symposium on Coconut Research and*

*Development*), 209-218. (Eds. M K Nair *et al.*). Oxford & IBH Publishing Co Pvt Ltd., New Delhi.

Jayasekara, K S, D P Panditharatne & M A Thilakaratne Banda (1993). A new "Mulch Rake" for increased efficiency. *Coconut Bull.*, 8 (1/2): 20-21.

Jayasekara, K S, W M P B Wahala, C Jayasekera & K R R A Peries (1993). Water-use of coconut (*Cocos nucifera* L.). *Proceeding of the Sri Lanka Association for the Advancement of Science (Part I)*, 49th Annual Session. December, 1993. 120p.

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Liyanage, M de S (1993). Utilization of *Gliricidia sepium* for coconut small-holdings in Sri Lanka. Presented at the International Symposium on the use of multipurpose trees for rural livelihood. Manila, Philippines. 3-6, May 1993.

Liyanage, M de S (1993). The role of MPTS in coconut-based farming systems in Sri Lanka, *Agroforestry Today* (Editor T R Roach) 5 (3) 7-9.

Liyanage, M de S (1993). Sustainable land use options for Sri Lanka. Paper presented at the Seminar on National Priorities of Biology, Colombo, March, 1993

Liyanage, M de S & K B Dassanayake (1993). Experiences in coconut-based farming systems in Sri Lanka. *Advances in coconut research and development (Proceedings of the Symposium on Coconut Research and Development)*, 357-368. (Eds. M K Nair *et al.*). Oxford & IBH Publishing Co Pvt Ltd., New Delhi.

Liyanage, M de S, M Bastian & A M U Wijeratna (1993) Performance of four multipurpose tree species under coconut. *Proc. Fourth Regional Workshop on MPTS, Kandy Sri Lanka*. (Editor. H P M Gunasena) 80-89.

Liyanage, M de S, H P S Jayasundra & T G L G Gunasekara (1993) *Leucaena* a multipurpose tree for coconut plantations in Sri Lanka. *Journal of Tropical Forest Sciences (Forest Research Institute of Malaysia)* 6(2) 91-97.

Mahindapala, R & T S G Peiris (1993). The use of Information and Agricultural Research Managers (INFORM) in an Institute Context. Paper presented at the INFORM Workshop held at the Hotel Dolphin, Waikkala, 13 - 14 February, 1993.

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Panabokke, C R (1993). Land suitability assessment of coconut growing lands in the coconut triangle. Paper presented at the Workshop on Land Suitability Studies for Coconut Lands, held in Colombo 27 August, 1993.

Peiris, T S G (1993). Statistical analysis of field experiments in coconut using fewer number of picks. *J. Experimental Agric.* (29), 207-213p.

Peiris, T S G (1993). The degree of influence of rainfall on coconut. *Advances in Coconut Research and Development. Advances in coconut research and development (Proceedings of the Symposium on Coconut Research and Development)*, 413-420. (Eds. M K Nair et al.). Oxford & IBH Publishing Co Pvt Ltd., New Delhi.

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✓ Perera, P A C R (1993). Integrated control of *Opisina avenosella*. *Advances in coconut research and development (Proceedings of the Symposium on Coconut Research and Development)*, 443-454. (Eds. M K Nair et al.). Oxford & IBH Publishing Co Pvt Ltd., New Delhi.

✓ Perera, P A C R, (1993). The analysis of insect population censuses with overlapping generations. *Proceeding of the Sri Lanka Association for the Advancement of Science (Part I)*, 49th Annual Session. December, 1993. 110p.

✓ Perera, P A C R (1993). The impact of toxic chemicals on the environment. Paper presented at the Seminar on National Priorities of Biology, Colombo, March, 1993.

✓ Perera, P A C R & M M Keerthi (1993). A survey on the distribution and seasonal variation of earthworm populations in coconut soils within the coconut triangle. *Proceeding of the Sri Lanka Association for the Advancement of Science (Part I)*, 49th Annual Session. December, 1993. 109p.

✓ Perera, P A C R, V Kumar, L Perera, K S Hemachandra & J Ranaweera (1993). Pesticides from Sri Lanka Plants for the Control of Coconut Pests. *Proceeding of the Sri Lanka Association for the Advancement of Science (Part I)*, 49th Annual Session. December, 1993. 107p.

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Vidhana Arachchi, L P (1993). A method of measuring the root surface area of coconut root, (*Cocos nucifera* L.). *Proceeding of the Sri Lanka Association for the Advancement of Science (Part I)*, 49th Annual Session. December, 1993. 133p.

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