

**COCONUT RESEARCH BOARD**

**COCONUT RESEARCH INSTITUTE  
OF SRI LANKA**

**REPORT FOR 1990**

**COCONUT RESEARCH INSTITUTE - REPORT FOR 1990**

# **COCONUT RESEARCH BOARD**

## **REPORT OF THE COCONUT RESEARCH INSTITUTE FOR 1990**

**Editor**

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

## THE COCONUT RESEARCH BOARD

Mr. R I Fernandopulle (*Chairman*) - up to 23 April  
Mr J Alwis (*Actg. Chairman*) - from 30 April to 14 June  
Mr Naomal S Dias (*Chairman*) - from 15 June  
Mr G P P N Perera - up to June  
Mr H P N Soysa - up to June  
Mr K A Karunaratne - up to June  
Dr L S K B Herath (resigned in October)  
Mr J L Amaratunga  
Vidya Jyothi Dr C R Panabokke  
Vidya Jyothi Mr P R Wijewardena - from July  
Mr A S Ranatunga - from July  
Lt Col A Amarasekera - from July  
Mr M L Wijesekera (*Ministry Representative*) - up to July  
Mr Sumith de Silva (*Ministry Representative*) - from August  
Mr S Jayaweera (*Ministry Representative*) - from October  
Mrs M B Ekanayake (*Treasury Representative*) from October

## COMMITTEES OF THE COCONUT RESEARCH BOARD

### 1. Research Committee

Mr R I Fernandopulle (*Chairman*) - up to April  
Mr Naomal S Dias (*Chairman*) - from June  
Dr U Pethiyagoda  
Dr L S K B Herath - up to October  
Vidya Jyothi Dr C R Panabokke  
Vidya Jyothi Mr P R Wijewardena  
Mr A S Ranatunga - from July  
Mr T R Jayawardena (JEDB)  
Mr K Karunanayake (CCB)  
Dr R Mahindapala (*Member & Convenor*)

### 2. Administrative Committee

Mr R I Fernandopulle (*Chairman*) - up to April  
Mr Naomal S Dias (*Chairman*) - from June  
Mr J L Amaratunga  
Mr R M C Bandaranayake  
Dr R Mahindapala  
Mr M L Wijesekera - up to July  
Mr S Jayaweera - from August  
Mr D N B Perera (*Deputy Director A&F*) - *Convenor*

### 3. Estates Committee

Mr G P P N Perera (*Chairman*) up to June and member thereafter  
Mr J L Amaratunga (*Chairman*) from July  
Mr Naomal S Dias - up to June  
Mr D V Jayasuriya  
Mr B R T de Tissera (JEDB)  
Dr R Mahindapala  
Mr P S Liyanagama [*Manager (Estates)*] (*Convenor*)

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# COCONUT RESEARCH INSTITUTE OF SRI LANKA

## THE STAFF\*

(as at 31 December, 1990)

### DIRECTORATE

**Director** - R Mahindapala, B Sc, M Sc (Exon), Ph D (Exon), F I Biol (S L)

**Acting Deputy Director (Research)** - R Mahindapala, B Sc, M Sc (Exon), Ph D (Exon), F I Biol (S L)

**Deputy Director (Administration and Finance)** - D N B Perera, B Sc

### RESEARCH DIVISIONS

#### Agronomy Division

##### *Head*

M de S Liyanage, B Sc Agric; M Sc (New England); Ph D

##### *Agronomist*

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

##### *Assistant Agronomists*

K B Dassanayake, B Sc Agric  
M T N Fernando, B Sc Agric  
T G L G Gunasekera, B Sc Agric \*\*  
H A J Gunathilake, B Sc Agric \*\*  
H P S Jayasundera, B Sc Agric \*\*  
R A J R Perera, B Sc Agric \*\*

##### *Senior Technical Assistant*

M Bastian

##### *Technical Assistants*

H A Abeysona  
M H F G Ivan Appuhamy  
M J I Costa  
R Marasinghe  
Mrs K C P Perera, B Sc  
S D J N Subasinghe, Dip Ag.  
A M U Wijeratne

##### *Lab & Field Assistants*

D Amarasinghe  
E M Gunaratne Banda  
W S M A Fernando  
M D V Saparamadu  
D B Benet Silvan  
W E J Tissera

##### *Clerk Typist*

A A D N Athauda

## Genetics and Plant Breeding Division

### *Officer-in-Charge*

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

### *Assistant Geneticists/ Plant Breeders*

Mrs W M U Fernando, B Sc \*\*  
J M D T Everard B Sc, M Sc

### *Technical Assistants*

J D J Abeysekera  
R B Attanayake  
Miss M A S Fernando  
Mrs W B S Fernando  
L M S R Jayathillake  
Miss H S G Kularatne

### *Lab and Field Assistants*

W T H C Fernando  
T M W Peiris  
M Victor

### *Clerk*

K P W Perera

### *Clerk/Typist*

Miss I N Jayawardena

### *Seed Production Unit*

#### *Seed Production Officer*

P Kariyawasam, Dip Agr.

#### *Lab and Field Assistant*

H Bandappuhamy

#### *Clerk/Typist*

Miss Kalyani Dondeenu

## Soils and Plant Nutrition Division

### *Officer-in-Charge*

K S Jayasekara, B Sc; C Chem; M I  
Chem C

### *Soil Scientist*

Miss M B M N Dias, B Sc Agric,  
M Phil

### *Assistant Soil Scientists*

Mrs M G F S Jayasundara, B Sc  
Agric \*\*\*  
L L W Somasiri, B Sc, C Chem, M I  
Chem C  
N A Tennakoon, B Sc Agric \*\*  
L P Vidhana Arachchi, B Sc Agric \*\*

### *Senior Technical Assistants*

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

### *Technical Assistants*

E M A T Banda  
Mrs S D H Bandara, B Sc  
Miss G D Jayasundara  
S Malavipathirane  
D P Panditharatne  
U S S Perera  
Miss J L J L Pinto  
Miss G S Ranasinghe  
R N Susantha  
Miss M A Wasanthimala  
Mrs D M D Wijebandara, B Sc

### *Senior Lab and Field Assistants*

K Murugiah  
B C E Perera

### *Typist Clerk*

Mrs H M W S Athauda

## Crop Protection Division

### *Head*

P A C R Perera, B Sc (Lond); M Sc  
(Lond); Ph D (Lond); D I.C; M I Biol  
(S L)

H M D T N Mudalige  
A H Norman  
D C L Pathirana  
K F G Perera  
P H A P Siriwardana

### *Senior Crop Protection Officer*

P Kanagaratnam, B Sc; Ph D  
(Lond); D I C \*\*\*

### *Clerk*

Mrs Anula de Zoysa

### *Assistant Crop Protection Officer*

Mrs L C P Fernando, B Sc Agric \*\*  
M M Keerthi, B Sc Agric

### *Senior Field Assistant*

D M Jayakody \*\*\*

### *Technical Assistants*

K A S Chandrasiri

### *Lab & Field Assistants*

W E A Fernando  
A S M Premalal

## Biometry Division

### *Head*

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

### *Senior Field Assistant*

E R Fernando

### *Biometrician*

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

### *Lab and Field Assistants*

A Dassanayake  
W M L G Fernando  
P J C Fernando  
W E R C Fernando  
W B P Fernando  
U T G Fernando  
D T Fernandopulle  
W K M K Herath  
J Wijedasa  
A Wilson

### *Experimental Officer*

G M R Karunasekera, B Sc

### *Technical Assistants*

H P de Zoysa, B Sc  
J D J S Kularatne

### *Clerk/Typist*

Mrs D M T Marasinghe

## **Tissue Culture Division**

### *Head*

Mrs S M Karunaratne, B Sc, M Sc *Technical Assistants*  
(Qld.)

Miss C K A Gamage  
E S Santha

### *Assistant Botanist*

Miss L K Periyapperuma, B Sc \*\*

## **Plant Physiology Division**

### *Head*

C Jayasekera, B Sc; Ph D (Qld)

### *Technical Assistants*

### *Assistant Phytologists*

Miss C S Ranasinghe, B Sc  
Miss S P Suriyapperuma, B Sc

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

## **Information Services Division**

### *Officer-in-Charge*

P A Henry Nimal Appuhamy  
B Sc Agric \*\*

### *Clerk/Typist*

R A L C Fernando

### *Assistant Information Officer*

J L J G Pinto

## **Coconut Information Centre & Library**

### *Librarian/Project Leader*

M J C Perera, A L A

### *Library Assistants*

Mrs P D U C Dharmapala  
Miss T I I Peiris

### *Assistant Librarian*

Mrs P A S F Perera, B Sc

### *Clerk/Typist*

Miss G N Gunathilake

### *Documentation Assistant*

D B Jayasinghe

### *Machine Operator*

W G Rodrigo

**ADMINISTRATION**

**Deputy Director (Administration & Finance)**

D N B Perera, B Sc

**Establishments Unit**

*Administrative Officer*

D G Manamudali B A; L I C A

*Personnel Officer*

P Daluwatta

*Administrative Assistant*

M Leelaratne, B A

*Secretary to the Chairman*

Mrs T M H Fernando

*Chief Clerk*

T Gunadasa

*Stenographers (English)*

Mrs M J Ariyadasa  
Mrs M P Premaratne  
Mrs S Z Suhair

*Supplies Assistant*

W F T Fernando

*Clerk/Typists*

Miss W E M Coonghe  
Mrs P C A Fernando  
C B B P Fernando  
Mrs M M M R Fernando  
Miss W S R Fernando  
B R Fernando  
Miss U I Gunasekera  
K D Jathiratne  
W A W Wijesuriya

*Clerks*

B M Dingiribanda  
A I F Fernando  
Miss H D Mangalika, B A

*Record Keeper*

I H Nelson

**Internal Audit Unit**

*Internal Auditor*

M M P Wijesekera, L I C A,  
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

<i>Chief Accountant</i>	<i>Assistant Shroff</i>
R M G D Rajapakse	H B Thalgahagoda
<i>Accountant</i>	<i>Clerk/Typists</i>
D R C M Handalage	Mrs A R S Hettiarachchi
<i>Accounting Assistant</i>	Mrs J K F Perera
A S Nanayakkara	Mrs C M B I Salwatura
<i>Book Keepers</i>	Y H Wijesena
B M Jayathilakabanda	<i>Clerks</i>
Mrs K M A Nonis	Mrs C Munasinghe
T M S Peiris	Mrs P H C M G Rodrigo
<i>Store Keeper</i>	<i>Accounts Clerks</i>
M B Upali	Miss A S M S Abeywickrema
	E A P Edirisinghe
	W P C Fernando

## Engineering Unit

<i>Resident Engineer</i>	<i>Foreman (Buildings)</i>
L U Jayawardene, Dip. (C Eng) T.	R M Dayaratne
<i>Works Superintendent</i>	<i>Draughtsman</i>
K N A S Perera, Dip (Mech Eng) T	Mrs R M S Ratnayake
<i>Foreman (Electrical)</i>	<i>Clerk/Typists</i>
M D Bernard Praxidus	Mrs K A P Chandani
<i>Foreman (Mechanical)</i>	C B B P Fernando
M J M D S Jayawardena	P P Fernando B A

## **Estates Management Division**

### *Manager (Estates)*

P S Liyanagama, B Sc Agric

### *Assistant Manager (Farms)*

K P de Silva

### *Clerk/Typists*

Mrs N R Ayagama  
W P R R Fernando  
Mrs K A D N S Marian

### *Field Assistant*

P P Jayasundara

### ***Bandirippuwa Estate***

#### *Superintendent*

M R L A Perera

#### *Field Officer*

G B A Wijesekara

#### *Field Assistants*

K P C Fernando  
J S Roberts  
W B L Silva

#### *Supervisors*

M J David  
H H D B K Dissanayake  
M P W Fernando

#### *Clerk/Typist*

H H J E Appuhamy

### ***Potbukulama Research Station***

#### *Superintendent*

D M Pathirage

#### *Supervisor*

M Chandrasoma  
T M Keerthiratne

#### *Estate Clerk*

J A Rexy Reginald

### ***Rathmalagara Estate***

#### *Superintendent*

G Vithanage

#### *Supervisor*

W M U Ratnayake

#### *Estate Clerk*

B L Senaghosha

### ***Walpita Estate***

#### *Officer-in-Charge*

N Gamage

### ***Makandura Seed Garden***

#### *Superintendent*

L J C Perera  
*Supervisor*

I A N Hemasiri

**Maduruoya Seed Garden**

*Superintendent*

A N Ekneligoda

*Supervisor*

W M P Weerasekera

**Passekudab Research & Demonstration Farm**

*Asst. Manager (Farms)*

A Thavaratnarajah

**Minneriya Research and Demonstration Farm**

*Officer-in-Charge*

M S Perera

**Isolated Seed Garden**

*Superintendent*

S M Wijeratne Banda

*Field Officer*

D L J Nettasinghe

*Lab and Field Assistants*

R B Attanayake  
U V M Fernando

*Clerk/Typist*

R P Victor

**Agricultural Research Project**

*Project Coordinator - M Jeganathan, M Phil*

- 
- \* 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 DIRECTOR FOR 1990

R Mahindapala, Ph D

### GENERAL

The year 1990 was a significant one in view of the unprecedented drought experienced in the coconut triangle, in particular in the northern areas of the Kurunegala and Puttalam districts. The loss of coconut trees has not been estimated but it is believed that about 30,000 palms have been severely affected, together with about a similar number of seedlings and palms in partial production. The consequences of this drought are already evident.

The climate in the northern areas of Kurunegala and Puttalam districts has been gradually deteriorating over the last two decades. There is not only a reduction in the total annual rainfall but also in the number of wet days. The boundary of the dry zone in the coconut triangle appears to be shifting southwardly converting more of the intermediate zone into the dry zone. The experiences of this year calls for a concerted effort in soil moisture conservation, particularly in the dry and intermediate zones for long-term rehabilitation of plantations.

Over the years, it has become obvious that parts of the dry zone in Puttalam and Hambantota districts have experienced very harsh climatic conditions, causing heavy mortality of coconut seedlings and young palms. Much of the efforts of replanting in these areas have been wasted, and a more cautious approach is required in expanding coconut lands in these areas. Perhaps planting of coconut should be discouraged and a more adapted plant for these conditions, such as cashew, should be encouraged.

A new four-year research programme was launched at the beginning of the year. This programme was formulated after a comprehensive review of the earlier five-year research programme, having considered the areas of research needing attention. Towards the end of the year, the Institute of Fundamental Studies (IFS) undertook a review of the research programme at the request of the Hon. Minister of Plantation Industries, as a part of the general review of research of the three plantation crop research institutes. The CRI provided the required information to the IFS, and at the end of the year, the review was in progress.

The CRI continued to provide technical assistance to the estates sector. Although the area under the estates is relatively small compared to the overall coconut area in the country, it was revealed that the production per unit area was much higher in the estates sector. The staff maintained a close liaison with the managerial staff in the estates sector and it was obvious that this sector was quite responsive to accept new

technology. Their better managerial capacity together with access to capital make them an attractive target group for 'selling' research findings. An encouraging aspect was that the number of enquiries made by the estates for technical assistance and their awareness of new developments.

The estates sector continued to draw CRI assistance for providing Differential Fertilizer Recommendations based on foliar analysis.

The CRI conducted a very successful COCONUT DAY on 25 November. The main objective of the event was to popularize fertilizer usage in coconut but an opportunity was provided for the participants to visit laboratories and discuss with staff their field problems. Also, an opportunity was given to the trade involved in fertilizer, farm implements, agrochemicals, irrigation equipment etc. to exhibit their products and to interact with coconut growers.

The newly-established seed gardens continued to perform satisfactorily. Seednut selection commenced at the Makandura Seed Garden and the first consignment was issued to the Coconut Cultivation Board towards the end of the year. The Institute continued to provide seednuts to the estates sector who have necessary infrastructure to establish nurseries and raise seedlings to meet their own requirements.

The number of coconut-based farm models in small-holdings was increased with the addition of several models in the intermediate zone.

An Inter-Institutional Research Programme on intercropping and animal husbandry was launched at the beginning of the year. The participating institutions of this project, funded by the Council for Agricultural Research Policy (CARP) are: the Coconut Research Institute, Veterinary Research Institute, Dept. of Export Agriculture and the Makandura Regional Research Centre of the Dept. of Agriculture. The project was subsequently expanded to include a further component of a coconut-based farm model with free-grazing cattle, jointly conducted by the CRI, Faculty of Agriculture of the University of Ruhuna and Dept. of Veterinary Medicine, University of Peradeniya.

Work on the improvements to infrastructural facilities at the CRI, funded by the Agricultural Research Project, commenced during the year.

The Passekudah Research & Demonstration Farm continued to be out of control. The Farm could not be visited and considerable damage to buildings and other assets was inflicted due to the disturbances in the area.

Almost all field experiments were conducted satisfactorily. Majority of these experiments are in estates belonging to the Janatha Estates Development Board.

The institute staff continued to work in close cooperation with the staff of the JEDB in the conduct of these experiments.

The requirements of seednuts for the national planting programme was increased by the Coconut Cultivation Board necessitating increase of the plus palm pool. Although a large number of plantations were examined as possible sources of plus palms, only about 7,000 additional palms which conformed to the standards for plus palms, could be selected.

On a directive of the Ministry of Coconut Industries & Crop Diversification, arrangements were made to transfer all activities relating to selection, collection and transport of seednuts to the Coconut Cultivation Board by the end of the year.

Due to escalating fuel prices, the fuel use had to be curtailed by 25% in keeping with the government policy. This affected field visits considerably, and data collection and other related activities were continued with difficulty.

The Plant Physiology Unit, Tissue Culture Unit and the Biometry Unit were upgraded to Divisions at the beginning of the year.

## **2. THE COCONUT RESEARCH BOARD**

The death of Mr R I Fernandopulle, Chairman of the Board on 23 April is recorded with deep regret. Mr Fernandopulle had been a pioneering planter and had been very closely involved with the processing sector. He was a past Chairman of the then Coconut Board and subsequently had been the Chairman, Coconut Development Authority and Chairman, Coconut Cultivation Board. His death was indeed a great loss to the coconut industry.

Mr J Alwis, Secretary, Ministry of Coconut Industries & Crop Diversification chaired the 216th and 217th meetings in the absence of Mr Fernandopulle, who was then indisposed, and was appointed Actg. Chairman on 30 April, consequent to the death of Mr Fernandopulle.

The Board was reconstituted on 15 June and Mr Naomal S Dias was appointed Chairman. Mr Dias was closely associated with the Coconut Research Board prior to his appointment, as a Member from September, 1981 to March, 1989. He was also the Chairman of the Estates Committee for a considerable period of time.

The membership and attendance at meetings of the Board up to 11 June (217th meeting) are given below:

Mr R I Fernandopulle (Chairman)	(attendance 1/1)
Mr J Alwis (Actg. Chairman)	(attendance 2/2)
Mr G P P N Perera	(attendance 2/3)
Dr L S K B Herath	(attendance 3/3)
Mr J L Amaratunga	(attendance 3/3)
Mr H P N Soysa	(attendance 3/3)
Mr K A Karunaratne	(attendance 3/3)
Vidya Jyothi Dr C R Panabokke	(attendance 2/3)
Mr M L Wijesekera (Ministry Representative)	(attendance 3/3)

The membership and attendance of the reconstituted Board at meetings from July are given below:

Mr Naomal S Dias (Chairman)	(attendance 6/6)
Mr J L Amaratunga	(attendance 6/6)
Dr L S K B Herath (resigned in October)	(attendance 0/3)
Vidya Jyothi Mr P R Wijewardena	(attendance 5/6)
Vidya Jyothi Dr C R Panabokke	(attendance 4/6)
Mr A S Ranatunga	(attendance 4/6)
Lt. Col. A Amarasekera	(attendance 4/6)
Mr M L Wijesekera *	
(Ministry Representative, up to July)	(attendance 0/1)
Mr Sumith de Silva *	
(Ministry Representative, from August)	(attendance 1/3)
Mr S Jayaweera *	
(Ministry Representative, from October)	(attendance 0/2)
Mrs M B Ekanayake *	
(Treasury Representative, from October)	(attendance 0/2)

\* Observer Member

Dr L S K B Herath resigned from the Board in October. Mrs M B Ekanayake was appointed as an Observer Member, representing the Treasury, with effect from 30 October.

The Board held nine meetings during the year. With the exception of 215th, 216th, 217th, 218th and 219th meetings, which were held in Colombo, the meetings were held at the Coconut Research Institute, Lunuwila.

Mr D N B Perera, Deputy Director (Admin. & Finance) continued to function as the Secretary to the Board. Dr R Mahindapala, Director, Coconut Research Institute participated in all Board Meetings, except the 222nd meeting.

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

#### **3.1 Research Committee**

The Research Committee held two meetings to review the progress of the implementation of the research programme. The Committee also visited the field experiments twice.

The membership and attendance of the meetings are as follows:

Mr R I Fernandopulle (Chairman, up to April)	(attendance 0/1)
Mr Naomal S Dias (Chairman, from June)	(attendance 1/1)
Dr U Pethiyagoda *	(attendance 2/2)
Dr L S K B Herath (up to October)	(attendance 0/2)
Vidya Jyothi Dr C R Panabokke	(attendance 2/2)
Vidya Jyothi Mr P R Wijewardena	(attendance 2/2)
Mr A S Ranatunga	(attendance 1/1)
Mr T R Jayawardena (JEDB)	(attendance 1/2)
Mr K Karunanayake (CCB)	(attendance 1/2)
Dr R Mahindapala	(attendance 2/2)

\* Chaired the 30th meeting in the absence of the Chairman, who was indisposed.

In the absence of the Deputy Director (Research), the Director functioned as the Convenor also.

#### **3.2 Administrative Committee**

The Administrative Committee met five times during the year to consider matters referred to it by the Board and to advise the Board on certain administrative issues.

The membership of the Committee and attendance at meetings are given below:

Mr R I Fernandopulle (Chairman, up to April)	(attendance 0/2)
Mr Naomal S Dias (Chairman, from June)	(attendance 2/3)
Mr J L Amaratunga *	(attendance 4/5)
Mr R M C Bandaranayake	(attendance 4/5)
Dr R Mahindapala	(attendance 4/5)
Mr M L Wijesekera * (up to July)	(attendance 2/2)
Mr S Jayaweera (from August)	(attendance 2/2)

\* M/S Amaratunga and Wijesekera chaired the 1st and 2nd meetings, respectively, in the absence of the Chairman.

Mr D N B Perera, Deputy Director (Admin. & Finance) continued to function as the Convenor, and was present at all meetings.

### **3.3 Estates Committee**

The Estates Committee met three times 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 by the measures introduced during the year.

The Committee continued to pay special attention to the agricultural conditions of Bandirippuwa Estate.

A group of members from the Committee made 15 visits to the Board's properties, including eight visits to Bandirippuwa Estate, to assess the agricultural standards and to recommend measures for further improvements. Some members of the Committee attended six of the monthly meetings of Superintendents.

The membership and attendance at the meetings are given below:

Mr G P P N Perera (Chairman up to June and Member thereafter)	(attendance 3/3)
Mr J L Amaratunga (Chairman from July)	(attendance 3/3)
Mr Naomal S Dias (up to June)	(attendance 2/2)
Mr D V Jayasuriya	(attendance 3/3)
Mr B R T de Tissera (JEDB)	(attendance 2/3)
Dr R Mahindapala	(attendance 2/3)

Mr P S Liyanagama, Manager (Estates) continued to function as the Convenor and participated in all meetings and in field visits.

### **3.4 Other Statutory Committees**

#### **.1 Provident Fund Committee**

The Provident Fund Committee met regularly to attend to matters relating to the administration of the staff Provident Fund and to disburse loans. M/S D T Mathes and P P Fernando continued as the members' representatives in the Committee while Mr R M G D Rajapakse continued as the Board's nominee. Mr G D Manamudali continued to function as the Secretary.

The membership and attendance at the meetings are given below:

Mr R I Fernandopulle (Chairman) (up to April)	(attendance 0/3)
Mr Naomal S Dias (Chairman, from July)	(attendance 4/4)
Dr R Mahindapala *	(attendance 8/9)
Mr D T Mathes	(attendance 8/9)
Mr P P Fernando	(attendance 8/9)
Mr R M G D Rajapakse	(attendance 8/9)
Mr G D Manamudali	(attendance 9/9)

\* Chaired the first five meetings in the year in the absence of the Chairman.

Mr D N B Perera, Deputy Director (Adm. & Fin.) participated in six meetings on invitation.

An interest rate of 12% was declared for members for the year 1989.

## **.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 to the members.

M/s K S Jayasekera and P P Fernando were the Board's nominees in the Board of Trustees.

The Board's contribution to this scheme was about Rs. 650,000. The provisional balance at the end of the year was about Rs. 760,000.

The membership and attendance at the meetings are given below:

Dr R Mahindapala (Chairman)	(attendance 12/12)
Mr D N B Perera	(attendance 11/12)
Mr K S Jayasekera	(attendance 06/12)
Mr P P Fernando	(attendance 10/12)
Mr P Daluwatta (Secretary)	(attendance 12/12)

The membership at the end of the year was 390.

The Medical Aid Scheme conducted an eye camp and a dental camp for the members and their families during the year.

#### 4. THE COCONUT RESEARCH INSTITUTE

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

##### 4.1 Agronomy Division

Research projects on moisture conservation, rehabilitation of low-yielding plantations, establishment and management of replantings/newplantings and coconut-based farming systems progressed satisfactorily. At the end of the year, there were 22 ongoing experiments managed by the division.

Of the several long-term experiments on soil moisture conservation in coconut lands in dry areas, ploughing treatments continued to show no significant effect on coconut yield despite some improvement in soil moisture status at 25 cm depth. In contrast, placement of husks and coir dust in 2.4 x 1.2 x 0.9 m pits between two palms or husk alone in single pits of 1.2 x 1.2 x 0.9 m on one side of each palm, or a layer of husk mulch, produced a substantial increase in coconut yield and improved the moisture content in lateritic gravel soil. On the other hand, palms in sandy soil benefited most from husk pits of 2.4 x 2.4 x 0.9 m located between two palms or from single pits of 1.2 x 1.2 x 0.9 m placed on one side of the palm.

In trials to test the effect of management practices on cover crops, *Pueraria phaseoloides* performed well in the wet zone and produced the highest top dry matter yield of 4500 kg/ha/year. In the dry zone, *Centrosema pubescens* and *Macroptilium atropurpureum* (Siratro) recovered well after the drought period and produced a satisfactory dry matter yield of 3200 and 3900 kg/ha/year, respectively. In biomass production trials of *Gliricidia sepium* intercropped with coconut, trees raised from seedlings produced a higher leaf biomass (1.27 kg/tree) than those from cuttings (0.76 kg/tree) at 12 months after planting.

In the rehabilitation of low-yielding palms, quarter circle trenches filled with either green manure or organic manure were found to be effective for improving the yield of such palms in lateritic gravel soil.

In the integrated farming systems involving pasture/tree fodder and cattle, yield of palms continued to benefit from nutrients recycled through animal excreta, leading to a substantial reduction in the cost of fertilizer. In the fuelwood trial, intercropping with *Leucaena leucocephala* did not affect nut and copra yield.

A new trial was established to study the management practices in new plantings. A ground cover and two bush covers were established in the trial area.

Long-term studies on intercropping cacao consistently revealed that 100 g nitrogen/tree/year and 120 K<sub>2</sub>O/tree/year would be the optimum requirement for obtaining the highest bean yield of cocoa.

The implementation of the on-farm trials was monitored closely. These trials demonstrated their income-generating capacity.

Several collaborative trials were established with the assistance from the Dept. of Agriculture (Makandura Research Centre), Dept. of Export Agriculture, Veterinary Research Institute and the University of Ruhuna. These trials form part of the Inter-Institutional Coconut Intercropping Research Programme, funded by the Council for Agricultural Research Policy.

A long-term experiment to study Biological Nitrogen Fixation (BNF) by *Gliricidia* and ipil ipil using <sup>15</sup>N technique was initiated with funds from the International Atomic Energy Agency in Vienna.

#### 4.2 Genetics and Plant Breeding Division

The staff position in the division improved with the recruitment of a Research Assistant and three Technical Assistants. The general administration and maintenance of the Isolated Seed Garden (ISG), Ambakelle was handed over to the Estates Management Division from 1 January. Arrangements were also finalised to hand over the activities of the Seed Production Unit to the Coconut Cultivation Board at the end of the year, following a decision of the Coconut Research Board.

Four multi-locational field trials for the evaluation of five improved cultivars at Bandirippuwa estate (Lunuwila), Thammenna estate (Puttalam), Dambakande estate (Kurunegala) and Suriyapura estate (Gampaha) were maintained satisfactorily. The fifth trial at Palugaswewa estate (Puttalam) suffered severely during the year due to adverse conditions and also due to lapses in management. It was therefore decided to terminate the experiment at Palugaswewa estate at the end of the year.

Both Bandirippuwa and Thammenna trials achieved 72% flowering. At Dambakande, flowering was slow and only increased from 6.5% to 21.5% during the year. The ability of *dwarf green x tall* to perform better than *dwarf yellow x tall* under increasing soil water deficit conditions was discernible at Dambakande. The analysis of growth in relation to weather could not be completed during the year due to delays in obtaining weather data from the Department of Meteorology.

The six progeny trials (1986/87) and the three observational trials (1989) were satisfactorily maintained. In most trials the *dwarf green x tall* hybrid maintained its superiority over the other progenies.

The early vegetative growth at the Ratmalagara observational trial was severely retarded by the prolonged dry weather, while the trial at Dalupotha was affected by water-logging.

As part of the germplasm conservation programme, several accessions collected (Clovis, Namalwatta, Margaret, St. Annes, Debarayaya and Kasagala) and evaluated in the nursery were established at the Poththukulama Research Station. No new collections or pre-prospection expeditions were undertaken during the year.

Four short-term nursery trials for improving nursery practices and evaluation of nursery seedlings on their water use were initiated during the year.

There was very poor rainfall and distribution at ISG during the year. Nut yields of both tall and dwarfs were very much reduced as a result of adverse weather in 1989. The individual palm yields in *tall* during the year (47 nuts/palm) was only 60% of that recorded in 1989.

The adverse weather during the year is likely to further reduce the seednut yield in 1991 by about 15%.

At ISG, nut component analysis was continued in both tall (fields 4 and 9) and dwarf (fields 5, 9, 10A and 10B). Controlled pollination was continued only in field No. 3 for the production of *tall x tall* material.

Seednut supply during the year amounted to 2.5 million. This consisted of 2,264,093 plus palm seednuts, 249,053 CRIC 60 and 50,855 CRIC 65 seednuts. Only about 12% of the total seednut requirement was supplied from the seed gardens. The pool of plus palms (seed palms) was increased from 47,181 to 54,213 during the year.

Pollen production was continued and 560 ampoules of pollen were produced. Of this, 170 ampoules were issued for hand-pollination programme. With the recommissioning of the freeze dryer, it is expected to increase the efficiency of pollen processing.

### **4.3 Soils and Plant Nutrition Division**

Four field experiments and two laboratory experiments on nutritional, soil physical and water use aspects of coconut progressed satisfactorily. Three long-term field trials were terminated as scheduled and six new experiments on fertilizer usage commenced.

Heavy leaching losses of potassium (K) and magnesium (Mg) in soil were found to be a major problem in coconut nutrition requiring adoption of more efficient methods of fertilizer use. Coloured organic compounds in coir dust and leached potassium were

found to contaminate ground water resources. This requires a cautious approach to large-scale use of coir dust.

Analysis of some common weeds in coconut plantations revealed a preferential uptake of micro-nutrients, namely iron, zinc and manganese by some species. Studies on K-Mg interaction demonstrated the importance of K and Mg balance in soil to avoid the adverse effects arising from K-Mg antagonism. The importance of the use of dolomite as a prophylactic measure for the supply of Mg was evident even after the use of kieserite to correct Mg deficiency, specially in high rainfall areas where soluble Mg could be leached.

Several important new trials on efficient use of fertilizer and on cheaper methods of fertilizer application began during the year. Also, preliminary work on a field trial to determine the nutrient requirements of seedlings and young palms was completed.

The division provided the Differential Fertilizer Recommendation (DFR) to 83 coconut estates covering an area of about 6,000 ha. The status of foliar nutrients in plantations indicated the order of priority as K, Mg, N and P which confirms the results obtained in 1989.

Analysis of data on yield, leaf nutrients and income and expenditure from the FAO Fertilizer Demonstration Plots indicated that the Value Cost Ratio (VCR) of most plots to be above 2.5, which is an acceptable return. However, few plots show VCR of less than 1 or negative returns for the application of NPK fertilizer, which is perhaps attributable to the reduced crop due to Mg deficiency, soil water deficit, etc. Analysis shows the necessity to use location-specific General Fertilizer Recommendations (GFR) for the small-holder sector to provide an acceptable VCR. It is also necessary to examine the constraints for the low fertilizer use by the growers, even under a high VCR of four or more, as evident from the data collected.

The division participated in the international Plant/Soil-Analytical Exchange Programme organised by the University of Netherlands, Wageningen and has shown a high level of accuracy in analytical measurements.

The division also actively participated in the organization and conduct of the "Coconut Day". A video-documentary on "Fertilizer Recommendations for Coconut" was prepared with the assistance of the Farm Broadcasting Service of the Ministry of Agricultural Research & Development and was telecast over the national television network, which attracted a considerable public response.

A motor-propelled "Coconut Climber" which enables a person to reach the coconut canopy safely, was developed. A demonstration irrigation system for a 2 ha coconut

plot was established at Ratmalagara Estate. Studies on hydrological and other aspects of this system are in progress.

#### **4.4 Crop Protection Division**

The division continued the laboratory and field investigations on integrated pest management.

Studies on the effect of potassium deficiency on the susceptibility of coconut to *Opisina arenosella* (coconut caterpillar) did not give statistically significant results. However, the data indicated that potassium deficiency in the plant encouraged the survival and development of the coconut caterpillar.

Out of the 18 plant extracts tested for insecticidal properties under the collaborative project with the University of Peradeniya, extracts from *Phyllanthus debilis* and *Melia dubia* only showed significant insecticidal properties.

Preliminary analysis of the survey data so far collected on the distribution and variation of earthworm population indicated that populations in the centre of the planting square were significantly higher than populations within the manure circle. Near significant differences were also recorded for earthworm population between different agroclimatic zones, with highest records in the wet lowlands having red yellow podzolic soil.

During the year, outbreaks of the coconut caterpillar in the western and north western provinces were low, compared to the previous year but a considerable number of outbreaks of the coconut scale pest was recorded from these provinces.

#### **4.5 Tissue Culture Division**

Preliminary investigations on vegetative propagation from immature embryo explants of coconut yielded satisfactory results. Some factors influencing the production of large numbers of somatic embryos were identified. A breakthrough in the germination of somatic embryos derived from immature embryo callus was made and three plants about 25 cm tall and a number of smaller plantlets have been produced. Some plantlets were lost through contamination caused by equipment failure. Consistency of plant development is yet to be tested. Experiments on culture of immature embryos derived from improved cultivars of coconut were also commenced during the year.

Investigations to improve the establishment in soil of *in vitro*-developed seedlings were also initiated.

The experiments on the development of an *in vitro* technique for selecting drought-tolerant material gave encouraging results. The technique, when tested on genotypes having different stress-tolerant potentials, responded differently. Stress-susceptible cultivars were eliminated early. 'Putative' drought-tolerant cultivars exhibited their tolerance to varying degrees. The lower level of NaCl to eliminate drought-susceptible material may be set between 200-250 mM. Experiments to refine the technique and to reduce the cost of screening were commenced towards the end of the year.

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

Physiological investigations of the coconut palm progressed well. However, work on some of the experiments suffered due to restrictions on travel, imposed towards the end of the year and shortage of staff in the division.

The glass house experiment on the effect of nitrogen, potassium and chlorine on drought tolerant characteristics of coconut seedlings was continued with good progress. Studies on photosynthesis and water use efficiency of these seedlings revealed that increase in nitrogen and potassium increased the rate of photosynthesis, while increase in chlorine reduced the rate of photosynthesis as well as the water use efficiency of seedlings. Potassium exerted a significant influence on assimilate partitioning within the seedlings. Both potassium and chlorine positively influenced the water economy of the seedlings.

Screening of drought tolerant palms in field nos. 1 and 2 at the Isolated Seed Garden, Anbakelle was continued. The selected palms proved to be drought tolerant, as was evident at the end of the severe drought prevailed during the latter part of the year.

Preliminary results from the glass house experiment conducted with self-pollinated seedlings obtained from drought-tolerant palms further revealed the heritability of drought-tolerant characters in the seedlings. In order to screen more drought-tolerant palms, a further 650 palms were selected from field nos. 4 and 6 at ISG.

A new experiment to determine the effect of canopy and root pruning (plant modifications) on the yield and water relations of coconut palms was initiated during the year at Bandirippuwa Estate.

The trials on physiological studies of Leaf Scorch Decline (LSD) progressed satisfactorily. Water relations studies of healthy and LSD-affected palms from the same site at Bandirippuwa Estate continued to show an internal water deficit in LSD-affected palms. A similar trend was observed at Walpita Estate, too.

Anatomical studies of the root vascular system of healthy and LSD-affected palms were carried out during the year. No significant anatomical differences in the vascular tissues or physical blockages in them were observed. Foliar analyses for three micro-nutrients, namely chlorine, sulphur and boron, did not show any deficiencies of these nutrients in leaves of LSD-affected palms. However, with increasing leaf age and severity of symptoms, chlorine level was decreased. Perhaps, due to the free mobility of these ions, they may have moved to other parts of the plant. Leaf boron level increased with increasing severity of LSD.

A new field experiment was commenced to compare the vegetative growth and flowering time of amputated poly-bagged seedlings and ordinary nursery-raised seedlings. The field experiment established to study the vegetative growth of embryo-cultured seedlings was continued. Few seedlings were lost due to the severe drought during the year.

Two new experiments under the multi-disciplinary research programme on immature nut fall were commenced.

Preliminary studies on light interception pattern of the coconut canopy revealed that 60% of the intercepted light are taken up by the upper canopy. Part of this light may be utilized for photosynthesis and the rest may be reflected. Middle and lower whorls of the canopy receive 30% of the sunlight. As part of this study a statistical method to measure the leaf area and the total photosynthetic area of the whole canopy by sampling a minimum number of leaflets was developed.

Water relations studies of young palms were carried out under different soil moisture conditions. The daily loss of water from a coconut palm canopy by transpiration under soil moisture saturated conditions, without taking into consideration the incidental environmental effects was estimated to be in the range of 75 - 100 l. However, transpiration is dependent on sunlight, wind velocity as well as other environmental and plant factors.

#### **4.7 Biometry Division**

The division continued to assist the research divisions in designing field experiments, analysis of data and their interpretation.

The computer facilities were expanded by increasing the hardware capability and by acquiring further software packages. A number of computer programmes was developed during the year.

The calibration trial recorded an increase of 11.5% for number of bunches and a reduction of 15.8% for nuts per palm. The number of nuts per hectare was 15,414

compared to 18,329 recorded in 1989. The copra yield was 3266.5 kg/ha and recorded a decrease of 12.7% over 1989.

The three agri-meteorological stations at Bandirippuwa Estate, Ratmalagara Estate and Isolated Seed Garden were maintained satisfactorily. The distribution of rainfall during the first half of the year was much lower than in the second half. A reduced crop is expected in 1991.

#### **4.8 Estates Management Division**

Administration of the Isolated Seed Garden was handed over to the Estates Management Division in January. With this, the division managed five estates, two research and demonstration farms and three seed gardens.

The general condition of the properties was very satisfactory. The agricultural standards at Bandirippuwa Estate continued to improve and the profitability of the properties was sustained. The use of cost-effective agricultural practices such as herbicides for manure circles and roadways became increasingly popular.

The Differential Fertilizer Recommendations based on foliar analysis were used in all estates and seed gardens in determining the fertilizer requirements. Soil moisture conservation measures continued to receive priority attention during the year.

Unprecedented drought conditions, particularly in the northern part of Puttalam district prevented any new plantings in that region. Altogether only 7 ha of new plantings could be undertaken during the year, of which 4 ha were at Maduru Oya Seed Garden and 3 ha at Bandirippuwa Estate. The total extent of the young plantation at the end of the year was 269 ha.

An overall reduction of coconut yield by 35% was recorded. At the ISG, the yield reduction was 63%. The drop in yield is attributable to the droughts of 1989 and 1990.

Both Makandura Seed Garden (MSG) and Maduru Oya Seed Garden (MOSG) were maintained in good order. Flowering at MSG and MOSG at the end of the year were 52% and 5% respectively. A total of 17,500 seednuts were produced at MSG.

Elephants and wild boar continued to damage the young plantations at the Minneriya Research & Demonstration Farm and at MOSG. Substantial yield losses due to monkey damage were reported from the ISG and Poththukulama Research Station.

The Passekudah Research & Demonstration Farm at Kalkudah continued to be out of control. The farm could not be visited and considerable damage to buildings and other assets was inflicted due to the disturbances in the area. The staff had no alternative but to abandon the farm.

The rainfall and its distribution during the year were poorer than the previous year's and this could affect the yield in 1991.

#### **4.9 Information Services Division, Library and the Coconut Information Centre**

The Information Services Division continued to provide the required technical assistance to the estates sector. A large number of estates and small-holdings were inspected on request and advice given.

The publications programme had to be curtailed owing to the shortage of funds. One issue each of *Pol Pawath* and *Coconut Bulletin* and *COCOS* (Volume 7) were published. An inordinate delay with the printer was encountered in the publication of the *Annual Report for 1988*. This was only ready at the end of the year. Two issues of the *Coconut Bulletin* and three issues of *Pol Pawath* had to be reprinted due to heavy demand.

Four new Advisory Circulars were issued during the year.

The CRI participated in the Ministry Mobile Secretariats held at Puttalam, Kegalle, Ratnapura and Hambantota and in the Presidential Mobile Secretariats at Puttalam and Kegalle. The CRI also participated in the 'Gam Udawa' exhibition held at Pallekelle. The division also coordinated in holding a 'Coconut Day' at the CRI.

During the year, several training programmes, including the CRI component of the Induction Course of the National Institute for Plantation Management for trainee Assistant Superintendents of the Janatha Estates Development Board and the Sri Lanka State Plantations Corporation were conducted. The CRI also conducted a two-week residential training programme in coconut cultivation techniques for the middle-level management staff of coconut estates.

The Library continued to provide its normal services satisfactorily. Routine work such as book acquisitioning, classification, cataloguing and indexing were carried out effectively. It also provided a current awareness service and an inter-library loan service to the CRI staff. A booklet entitled 'Easy Access to Coconut Information' was published and distributed amongst concerned agencies and individuals. A considerable number of new books was received through the Agricultural Research Project. The number of books at the end of the year was 4694.

Microfiching of documents was continued with the assistance of the Natural Resources, Energy and Science Authority (NARESA). However, towards the end of the year, it became necessary to seek assistance of the private sector as the facilities at NARESA were no longer available.

The financial assistance provided by the International Development & Research Centre (IDRC) to the Coconut Information Centre terminated in April with the completion of the project period.

#### **4. 10 Administration Division**

The total expenditure during the year was Rs. 44.2 million. The normal welfare activities were continued. The employer-employee relationship was cordially maintained.

The backlog of three years internal promotions was cleared. Also, the Annual Reports for the Parliament for 1986, 1987 and 1989 which had not been submitted in time, were prepared and submitted.

Once again this year, the availability of funds during the last two months of the year was restricted. Also, due to escalating fuel prices, fuel use from October had to be reduced by 25% in keeping with the government policy.

The Staff Provident Fund Scheme and the Medical Aid Scheme progressed satisfactorily. Beginning November, the contribution of 3% to the Employees' Trust Fund (ETF) was paid by the Board, thereby increasing the EPF and ETF contributions by the Board to 18% of the salary of employees.

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

##### **5.1 Agricultural Research Project (ARP)**

The Agricultural Research Project, funded by the World Bank continued its activities on the development of infrastructural facilities at CRI and substations. Several major items of civil construction began during the third quarter.

Whilst five officers continued their postgraduate studies under the sponsorship of the ARP, three other officers were awarded scholarships for postgraduate studies during the year.

##### **5.2 Other Projects**

Funding for the Coconut Information Centre (by the International Development & Research Centre) and the Tissue Culture Project (United State Agency for International Development) ceased during the year with the completion of the projects.

The other foreign-aided projects, namely agronomic projects (funded by the Canadian International Development Agency) and the Fertilizer Project for Small-holders (funded by the FAO) progressed satisfactorily.

## 6. FIELD DAYS, SEMINARS

A well-patronized COCONUT DAY was held at the CRI, where more than 1,500 coconut estate owners, plantation managers and growers participated. Traders dealing with fertilizer, agrochemicals and agricultural equipment were also given an opportunity to exhibit their products and give publicity to their services.

A Field Day was conducted at Ratmalagara Estate for the Managers of the National Livestock Development Board.

A series of discussions amongst research staff was organized to discuss the research highlights and new recommendations arising from the research programme.

The CRI personnel also participated in a number of seminars on coconut development and as resource persons at the Coconut Development Training Centre.

## 7. VISITORS

The important visitors to the CRI during the year included the following:

**Mr J Alwis** - Secretary, Ministry of Coconut Industries & Crop Diversification.

**Mr T Bakermans** - Mars, Holland

**Prof. J P N R Chandrasena**, University of Colombo

**Mr Robert Child** - Consultant, Cultural Triangle of Sri Lanka

**Mr Ray Fordham** - University of Peradeniya

**Mr R J Godwin** - England

**Prof V K Ganeshalingam** - University of Jaffna

**The Hon. Indradasa Hettiarachchi** - Minister of Coconut Industries & Crop Diversification

**Dr K S Kumarasinghe** - IAEA, Vienna, Austria

**Mr P Kalupathirana** - Chairman, Coconut Cultivation Board

**Dr C Lyal** - British Museum

**Mr B Mattiasson** - UNDP

**Dr Severino Magat** - Philippine Coconut Authority

**Dr A A MacGowan** - Dairy Research Institute, Australia

**Dr S Mack** - FAO, Rome

**Mr V Moustafaev** - UNESCO

**Mrs Premala de Mel** - USAID

**Dr D A Nethasinghe** - Chairman, Atomic Energy Agency

**Prof L P N Perera** - Vice Chancellor, University of Sri Jayewardenapura

**The Hon. Festus Perera** - Minister of Public Administration & Provincial Councils.

**Dr O S Perles** - Institute of Fundamental Studies

**Mr V Pjerozyski** - Mars, England

**Dr K Rawal** - USAID

**Mr I Serejski** - World Bank

**Dr G Steinecker** - World Bank

**H.E. Mr R Sajado** - Ambassador for Indonesia

**Mr Jo Anne Ward** - USAID

**Prof P L D Waidyasekera** - University of Sri Jayewardenapura

**The Hon. Ranjan Wijeratne** - Minister of Plantation Industries

## 8. ACKNOWLEDGEMENTS

The assistance of the staff of the Coconut Research Institute in the implementation of the programme of work is gratefully acknowledged. Some field staff had to undergo considerable hardship in data collection, field supervision etc. Their service is deeply appreciated.

The valuable assistance rendered by the members of various Committees of the Board is gratefully acknowledged.

The assistance of the following organizations is also acknowledged.

The Agricultural Research Project of the Ministry of Agricultural Research & Development

The Australian Development Assistance Bureau

The British Council & the Overseas Development Administration

The Coconut Development Authority

The Commonwealth Agricultural Bureau International

The Council for Agricultural Research Policy

Food & Agriculture Organization

The International Atomic Energy Agency

International Development & Research Centre, Canada

Janatha Estates Development Board

Ministry of Coconut Industries & Crop Diversification

Ministry of Plantation Industries

Natural Resources, Energy and Science Authority of Sri Lanka

The United States Agency for International Development

# REPORT OF THE AGRONOMY DIVISION

Head - M de S Liyanage, Ph D

## 1. GENERAL

Studies on moisture conservation and organic matter status in coconut lands continued to remain a high priority area in the research programme. During the year, much emphasis was given to the management aspects of replanting/underplanting and on the possibilities of mixed cropping with coconut in the dry zone. On-farm research programme conducted in different agro-ecological zones progressed satisfactorily. Several collaborative and multi-disciplinary studies were initiated during the year.

Mr A S Ranatunga continued to serve as a Consultant in agricultural economics for the farming systems research programme.

## 2. RESEARCH PROJECTS

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

#### Experiment 1.6.1 - Effect of three frequencies and two depths of ploughing on the performance of coconut in sandy soil. Jacintha Estate, Palavi - 1984.

As in the previous years, there was no significant difference in coconut yields due to ploughing treatments at both depths. The available data were analysed and it was concluded that ploughing had no effect on the improvement of coconut yield in sandy soil (Tables 1 a and 1 b). The experiment was terminated.

*T G L G Gunasekera, K B Dassanayake & A M U Wijeratne*

#### Experiment 1.6.2 - Effect of three frequencies and two depths of ploughing on the performance of coconut in lateritic soil. Heemaliyagara Estate, Dummalasuriya - 1984.

As in the past few years, no significant difference in the yield of coconut due to treatments was shown during the year. Based on these data it was concluded that ploughing had no effect on the improvement of coconut yield in lateritic soil (Tables 2 a and 2 b). The experiment was terminated.

*T G L G Gunasekera, K B Dassanayake & A M U Wijeratne*

#### Experiment 1.9.1 - Effect of different methods of placement of husk and coir dust on moisture conservation in lateritic soil, Kiniyama Estate, Bingiriya - 1984.

During the year, records on yield parameters of coconut were maintained. There was no significant effect on coconut yield due to treatments. However in previous

Contributions to multi disciplinary Projects are reported separately.

Table 1 (a) - Nut Yield under different ploughing treatments at Jacintha Estate from 1985 - 1990 - (Expt. 1.6.1)

Treatment	Nut yield (nuts/palm/year)					
	1985	1986	1987	1988	1989	1990
Control	88.05	69.75	68.05	79.00	84.00	83.02
F1 D1	77.88	65.44	64.72	66.22	79.58	60.38
F1 D2	84.91	74.25	76.11	79.50	83.13	62.19
F2 D1	77.00	66.47	67.69	73.27	75.55	60.58
F2 D2	70.44	70.41	61.73	63.06	80.37	58.89
F3 D1	80.41	66.55	62.00	60.58	73.21	56.72
F3 D2	74.44	67.16	71.88	68.57	79.54	64.15
Sig.	NS	NS	NS	NS	NS	NS
LSD (0.05)	15.47	14.95	14.65	22.42	15.72	23.98
CV (%)	13.18	14.67	14.61	21.55	13.33	25.34

Table 1 (b) - Copra Yield under different ploughing treatments at Jacintha Estate from 1985 - 1990 - (Expt. 1.6.1)

Treatment	Copra yield (kg/palm/year)					
	1985	1986	1987	1988	1989	1990
Control	20.93	17.40	17.76	20.34	21.04	19.41
F1 D1	18.86	16.91	15.64	17.14	19.81	13.53
F1 D2	19.59	18.56	18.50	19.49	19.60	13.51
F2 D1	17.50	16.25	16.27	17.70	17.78	12.77
F2 D2	16.83	17.74	14.92	16.35	18.61	12.56
F3 D1	19.49	17.64	15.46	15.91	18.27	13.26
F3 D2	17.80	17.30	17.28	17.02	18.80	14.04
Sig.	NS	NS	NS	NS	NS	NS
LSD (0.05)	3.189	3.53	3.8	5.36	3.45	5.58
CV (%)	11.46	13.66	15.4	20.36	12.15	26.55

F - Frequency of ploughing  
 F1 - 12 months interval  
 F2 - 24 " "  
 F3 - 36 " "

D - Depth of ploughing  
 D1 - 15 cm depth  
 D2 - 30 cm depth

Table 2 (a) - Nut Yield under different ploughing treatments at Heemmaliyagara Estate, Dummalasuriya, from 1985 - 1990 - (Expt. 1.6.2)

Treatment	Nut yield (nuts/palm/year)					
	1985	1986	1987	1988	1989	1990
Control	73.44	53.44	36.30	30.61	76.22	68.97
F1 D1	65.00	48.47	32.19	28.52	68.95	64.13
F1 D2	68.30	57.30	37.05	32.50	70.33	69.50
F2 D1	61.75	54.55	33.75	30.30	65.11	69.02
F2 D2	61.16	54.97	33.00	29.38	68.91	67.30
F3 D1	67.61	50.33	41.77	24.80	68.66	67.38
F3 D2	64.41	59.19	40.02	32.87	83.10	74.09
Sig.	NS	*	NS	NS	*	NS
LSD (0.05)	8.31	6.7	7.70	6.88	9.56	9.51
CV (%)	8.48	8.35	14.28	15.49	8.99	9.32

Table 2 (b) - Copra Yield under different ploughing treatments at Heemmaliyagara Estate, Dummalasuriya, from 1985 - 1990 - (Expt. 1.6.2)

Treatment	Copra weight (kg/palm/year)					
	1985	1986	1987	1988	1989	1990
Control	15.61	10.37	5.36	5.67	14.27	12.61
F1 D1	13.24	8.69	4.63	5.38	12.67	10.95
F1 D2	14.11	10.54	5.55	6.04	12.88	12.08
F2 D1	12.76	9.80	4.92	5.56	11.90	11.65
F2 D2	13.57	10.78	5.27	5.73	13.47	12.77
F3 D1	13.75	9.23	6.11	4.50	12.53	12.00
F3 D2	14.26	11.69	5.98	6.35	15.77	13.92
Sig.	NS	***	NS	NS	NS	
LSD (0.05)	1.83	1.15	1.35	1.52	2.38	1.54
CV (%)	8.85	7.62	16.8	18.15	11.99	8.44

F - Frequency of ploughing  
 F1 - 12 months interval  
 F2 - 24 " "  
 F3 - 36 " "

D - Depth of ploughing  
 D1 - 15 cm. depth  
 D2 - 30 cm. depth

years palms treated with either 2.4 x 1.2 x 0.9 m pits filled with a mixture of husk and coir dust, single husk pits of 1.2 x 1.2 x 0.9 m and single layer of husk mulch recorded a better yield than those in the control. Of the treatments, circular trenches (60 cm wide; 90 cm deep) proved to be detrimental to the performance of the palm. Based on the overall results, it could be concluded that single husk pits or single layer of husk mulch are suitable methods of moisture conservation in lateritic soils. The experiment was terminated.

*M de S Liyanage & H A Abeysoma*

**Experiment 1.9.2 - Effect of different methods of placement of husk coir dust on moisture conservation in sandy soil. Jacintha Estate, Palavi - 1984.**

Records on nut and copra yield were maintained throughout the year. Although there was no significant effect on yield due to treatments, overall results indicated that palms treated with single husk pits of 1.2 x 1.2 x 0.9 m recorded a higher yield than those in control plots. Further, circular trenches (60 cm wide; 90 cm deep) caused an adverse effect on the palms. The results show that single husk pits are suitable for moisture conservation in sandy soil. The experiment was concluded.

*M de S Liyanage & H A Abeysoma*

A detailed analysis of data from experiments 1.9.1 and 1.9.2 will be undertaken to elucidate the benefits of different methods of moisture conservation using husk and coir dust.

**Experiment 1.10 - Effect of five methods of management practices on the performance of three covers and their effects on coconut production - 1987.**

**Experiment 1.10.1 - Saddhatissa Estate, Divulapitiya (Wet Zone, lateritic soil) (1987)**

Sampling of the three cover crop species was done twice during the year to estimate biomass production. *Pueraria phaseoloides* produced the highest top dry matter yield of 4500 kg/ha/year and suppressed weeds. In contrast, both *Calopogonium mucunoides* and *Centrosema pubescens* performed poorly in terms of biomass production and in controlling weeds. Records in nut yield, copra weight, female flower production and setting percentage were maintained throughout the year.

The experiment is in progress.

*D N S Fernando, M de S Liyanage, H P S Jayasundara & K C P Perera*

**Experiment 1.10.2 - Poththukulama Research Station, Pallama (Dry Intermediate zone, sandy loam soil) (1988)**

Growth of all three cover crops was affected by dry weather prevailed during the second half of the year. Among the cover crops, growth of *Pueraria* was severely

affected causing a 30% reduction in top dry matter yield compared with the previous year. In contrast, *Cenrosema* and siratro cover were less affected by dry weather conditions and maintained biomass production at 3200 and 3900 kg/ha/year, respectively. Records were maintained throughout the year on nut yield, copra weight, female flowers and percentage setting.

The experiment is in progress.

*D N S Fernando, M de S Liyanage, H P S Jayasundara & R Marasinghe*

**Experiment 1.11 - Maximisation of biomass production of *Gliricidia septium* under coconut. Ratmalagara Estate, Madampe - 1989.**

During the year, initial cutting of gliricidia trees was made 12 months after planting at 1.0 m height to estimate leaf biomass production. The number of branches per tree as well as the height and girth of trees were recorded to assess their growth vigour. The initial growth of gliricidia seedlings appeared to be better than those from cuttings. Gliricidia seedlings produced 1.27 kg/tree of fresh biomass 12 months after planting compared with 0.76 kg/tree from those raised from cuttings.

Records on nut and copra yield of palm were maintained throughout the year.

The experiment is in progress.

*M de S Liyanage, H P S Jayasundara & R Marasinghe*

**PROJECT 2: REHABILITATION OF LOW YIELDING PLANTATIONS.**

**Experiment 2.2.1 - Effect of cultural operations designed to induce root formation on the rehabilitation of low yielding plantations in lateritic gravel soil. Heemaliyagara Estate, Dummalasuriya - 1984.**

Records on coconut yield, copra weight and the number of female flowers were maintained during the year. The treatments had no significant effect on the yield of palms compared with the control. However, the overall results indicated that opening quarter-circle trenches around the palm and filling up with gliricidia loppings or goat manure could improve the physical condition and the yield of palms (Tables 3 a and 3 b).

The experiment was terminated and the results are being analysed.

*D N S Fernando, T G L G Gunasekera, K B Dassanayake & A M U Wijeratne*

Table 3 (a) - Effect of Cultural Operations on the yield from 1985 to 1990 - (Expt. 2.2.1)

Treatment	Nut yield (nuts/palm/year)					
	1985	1986	1987	1988	1989	1990
T1	62.39	59.68	44.35	38.26	72.29	63.41
T2	54.19	55.01	35.87	29.61	71.15	64.39
T3	58.84	60.70	40.83	29.08	71.70	63.12
T4	57.74	55.33	34.96	27.92	59.85	64.29
T5	51.44	47.34	37.79	29.74	61.83	56.95
T6	59.39	55.73	34.51	29.14	67.81	66.62
T7	55.47	49.56	31.13	26.62	58.69	62.73
T8	49.89	46.90	29.37	25.93	52.06	60.08
T9	54.60	51.21	33.85	28.85	50.49	53.44
T10	58.70	45.47	25.72	24.81	56.61	59.56
T11	52.91	56.11	39.04	29.43	69.51	69.56
Sig.	NS	**	NS	NS	.	NS
LSD (P=0.05)	10.48	8.09	12.61	8.44	13.22	10.53
CV (%)	10.99	8.96	21.01	17.05	12.34	9.96

Treatments T-1 to T-11 see Table 4(b)

Table 3 (b) - Effect of Cultural Operations on Copra Production from 1985 to 1990 - (Expt. 2.2.1)

Treatment	Copra yield (kg/palm/year)					
	1985	1986	1987	1988	1989	1990
T1	13.72	12.24	6.89	7.16	13.58	11.04
T2	11.47	10.72	5.33	5.53	13.50	11.07
T3	11.72	11.54	5.68	5.13	12.72	10.74
T4	11.53	9.88	4.95	4.95	10.38	11.19
T5	10.58	9.42	5.65	5.65	11.59	9.45
T6	12.51	11.05	5.13	5.41	12.96	11.73
T7	11.26	9.13	4.49	4.68	10.50	11.02
T8	9.64	8.69	4.28	4.67	9.37	10.34
T9	10.95	9.53	4.70	5.05	9.18	9.52
T10	10.55	7.53	3.52	4.27	9.57	9.57
T11	11.30	11.05	5.47	5.20	12.35	11.97
Sig.	NS	***	NS	NS	**	NS
LSD (P=0.05)	2.21	1.64	1.95	1.57	2.25	2.09
CV (%)	11.42	9.56	22.40	17.55	11.59	11.48

**Experiment 2.2.2 - Effect of cultural operations designed to induce root formation on the rehabilitation of low yielding plantation in lateritic gavel soil. Puwakwatta Estate, Kotadeniyawa - 1984.**

During the year, records on nut yield and copra weight were kept. The treatments did not induce any significant effect on coconut yield compared with the control (Tables 4 a and 4 b).

The experiment was concluded.

*D N S Fernando, K B Dassanayake, T G L G Gunasekera & A M U Wijeratne*

**PROJECT 3: STUDIES ON THE ESTABLISHMENT AND MANAGEMENT OF NEW PLANTINGS/REPLANTINGS**

**Experiment 3.3 - Development of suitable cropping systems to increase the productivity of coconut lands in new plantings/replantings in the dry zone. Poththukulama Research Station, Pallama - 1990.**

Coconut seedlings (CRIC 60) were established in the avenue system at 10 m x 5 m. Double rows of *Gliricidia* and *Leucaena* were planted between coconut rows at 4 m x 1 m apart. Mixed pasture stand (*Brachiaria brizantha/Pueraria phaseoloides*) and an annual crop (Pigeon pea) were maintained as a ground cover. Initial growth of coconut seedlings was measured at six months after plantings.

The experiment is in progress.

*K B Dassanayake, M de S Liyanage & H A Abeysoma*

**Experiment 3.4 - Effect of management practices on the establishment and growth of coconut seedlings in the dry zone. Poththukulama Research Station, Pallama - 1990**

Treatments, as per schedule, were imposed during the year. Initial growth measurements on seedlings were taken at six and 12 months after planting.

The experiment is in progress.

*M de S Liyanage, K B Dassanayake & H A Abeysoma*

**PROJECT 4: STUDIES ON FIELD MANAGEMENT SYSTEMS**

**Experiment 4.1.2 - Utilization of animal husbandry for optimization of coconut production. Ratmalagara Estate, Madampe - 1985.**

This experiment was maintained as a model to demonstrate the feasibility of integrating legume-based pasture, tree fodder and cattle with coconut and for supplementing inorganic fertilizer with cattle manure for the palms. During the year *Brachiaria* mixed pasture stand was replaced with fodder grass, Guinea B and *Pueraria/Centrosema* mixture to ensure adequate feed for the cattle. *Gliricidia* cuttings were planted at 60 cm apart along the fence to produce more fodder during the dry season.

Table 4 (a) - *Effect of Cultural Operations on Nut yield from 1985 to 1990 -(Expt. 2.2.2)*

Treatment	Nut yield (nuts/palm/year)					
	1985	1986	1987	1988	1989	1990
T1	43.59	52.81	41.14	28.96	60.51	49.14
T2	37.77	54.52	38.29	26.84	52.56	45.94
T3	34.24	49.39	32.70	30.90	49.02	52.01
T4	30.11	45.66	33.00	25.29	47.29	39.51
T5	32.40	44.03	39.68	24.61	51.27	43.11
T6	39.70	49.88	36.77	28.22	48.29	45.29
T7	39.11	40.88	20.70	27.88	38.33	38.40
T8	35.46	46.87	32.50	30.25	47.26	41.47
T9	38.85	44.51	17.48	28.59	39.18	39.77
T10	36.84	50.99	28.17	29.03	45.10	45.02
T11	45.10	50.15	36.16	24.30	48.32	46.03
Sig	NS	NS	**	NS	NS	NS
LSD	11.11	13.06	10.85	9.93	14.56	19.84
CV (%)	17.36	15.92	19.64	21.04	17.87	13.09

The experiment is in progress.

*D N S Fernando, H P S Jayasundara & R Marasinghe*

**Experiment 4.2.3 - On-farm cropping models in the Wet and Wet-intermediate zone of coconut triangle (1987)**

Data on the use of external inputs and crop yields (coconut and intercrops) were maintained from 17 crop models. An increasing trend in coconut yield was observed in several crop models due to mixed cropping. These are being maintained.

*K B Dassanayake, 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)**

During the year, six more crop models and one crop/livestock farm model were established in coconut small-holdings in the wet, wet-intermediate, dry intermediate and dry zones. Records on input use, crop yields and socio-economic aspects were maintained during the year. The models are being maintained.

*M de S Liyanage, K B Dassanayake, M T N Fernando & S D J N Subasinghe*

Table 4 (b) - *Effect of Cultural Operations on Copra yield from 1985 to 1990 - (Expt. 2.2.2)*

Treatment	Copra yield (kg/palm/year)					
	1985	1986	1987	1988	1989	1990
T1	8.70	12.04	8.32	6.63	11.89	10.68
T2	7.59	12.19	7.43	5.99	10.10	9.44
T3	7.32	10.90	6.39	6.46	9.60	10.79
T4	5.74	9.27	5.97	5.18	8.81	8.20
T5	6.94	10.27	7.80	5.48	10.54	8.79
T6	8.44	10.92	7.16	6.36	9.51	9.88
T7	7.16	8.03	3.79	5.69	6.70	7.49
T8	6.53	9.44	5.73	5.92	8.55	8.05
T9	6.96	7.85	2.91	5.65	6.69	9.05
T10	6.94	9.86	4.91	5.66	8.18	9.05
T11	9.02	10.35	6.34	5.09	8.63	9.21
Sig.	NS	NS	***	NS	.	.
LSD (P=0.05)	2.36	3.14	2.04	2.32	2.78	2.2
CV (%)	18.76	18.23	19.80	23.38	18.11	14.38

- T1 - Opening up of 1/4 circle trench and filled with gliricidia leaves
- T2 - Opening up of 1/4 circle trench and filled with goat dung
- T3 - Opening up of 1/4 circle trench and filled with sandy soil
- T4 - Opening up of 1/2 circle trench and filled with gliricidia leaves
- T5 - Opening up of 1/2 circle trench and filled with goat dung
- T6 - Opening up of 1/2 circle trench and filled with sandy soil
- T7 - Opening up of 1/2 circle trench and filled with gliricidia leaves
- T8 - Opening up of full circle trench and filled with goat dung
- T9 - Opening up of full circle trench and filled with sandy soil
- T10 - Opening up of circle trench and filled with same soil
- T11 - Control

**Experiment 4.3 - Quantitative study on the production of fuelwood in *Leucaena leucocephala* grown in different planting systems under coconut and its effect on nut production. Ratmalagara Estate, Madampe - 1986**

Records on nut and copra yield of palms were maintained during the year. Although there was no significant difference in the yield of palms between treatments, nut yield in *Leucaena* plots showed an increase which ranged between 4.6 to 13.2% compared with those in control plots.

The experiment is in progress.

*T G L G Gunasekera, K B Dassanayake & A M U Wijeratne*

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

### **Experiment 7.12.1 - Demonstration on the use of cover crops and gliricidia in coconut lands. Ratmalagara and Walpita Estates - 1988.**

During the year, gliricidia trees showed satisfactory growth at both locations. Pueraria cover at Ratmalagara was almost completely wiped out due to extreme dry weather conditions while at Walpita, it recovered with the onset of rains. Palms at Walpita were manured as per treatment while at Ratmalagara, palms to be manured with Pueraria loppings had to be given gliricidia loppings due to lack of adequate Pueraria cover.

Records on nut and copra yield, female flowers and setting percentage were maintained during the year.

The experiment is in progress.

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

## **PROJECT 20: INTERCROPPING**

### **Experiment 20.5 - Effect of four levels of nitrogen (N) and five levels of potassium (K) on the growth and yield of cocoa mixed with coconut. Walpita Estate, Kotadeniyawa - 1981 (CIDA/85/16 fertilizer project).**

Response of cocoa to applied N and K was clearly demonstrated by the significant improvement in growth and yield compared with those in control plots. Treatment consisting of 100 g N/tree/year and 120 g K<sub>2</sub>O /tree/year consistently produced the optimum growth and yield in cocoa, indicating that these levels would be the optimum requirement for cocoa intercropped with coconut.

The experiment was terminated.

*M de S Lityanage, K B Dassanayake & M J Costa*

### **Experiment 20.6 - Effect of mixed cropping on the yield and productivity of coconut in the dry and dry intermedlate zone. Margeret Estate, Pallama - 1990.**

The objectives of the experiment were (1) to develop suitable mixed cropping system to increase the productivity of coconut lands in dry regions and (2) to study the effect of mixed cropping on coconut production.

The following treatments were arranged in a randomised block design with four replicates.

- T1 Coconut monoculture (control)
- T2 Coconut + lime + banana + annual crops
- T3 Coconut + papaya + banana + annual crops
- T4 Coconut + cashew + banana + annual crops
- T5 Coconut + mango + banana + annual crops

Field preparation and planting of perennial crops (mango, cashew and lime) were completed during the year.

The experiment is in progress.

*K B Dassanayake, M de S Liyanage & M J I Costa*

**Experiment 20.7 - Performance of mulberry under coconut in the intermediate zone, Ratmalagara Estate, Madampe - 1990.**

The objective of the experiment was to evaluate the performance of mulberry under coconut and its effect on coconut yield. Cuttings of mulberry cv. Kanva 2 were established in 45 cm wide and 45 cm deep trenches filled with coir dust and cattle manure. The trenches were spaced 1.2 m apart. After planting, a mulch of coconut fronds was maintained. Records on coconut yield were maintained during the year.

The experiment is in progress.

*M de S Liyanage, K B Dassanayake & M J I Costa*

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

In recent years, much attention has been focussed on the use of nitrogen-fixing multi-purpose trees as a source of green manure and their effect on soil improvement. However, no attempt has been made to grow these species as an intercrop under coconut. Hence, this trial was set up to evaluate the biomass production of several species of multi-purpose trees under coconut and to study their effect on coconut production.

Five nitrogen-fixing multi-purpose tree species *Gliricidia sepium*, *Leucaena leucocephala* cv. K 636, *Calliandra calothyrsus*, *Acacia auriculiformis* and *Acacia mangium* were selected for this experiment. These were planted at 2 m X 1 m apart in double rows. The design is randomized block design with four replicates.

Records on coconut yield were maintained during the year.

The experiment is in progress.

*M de S Liyanage, H P S Jayasundara & A M U Wijeratne*

**FOREIGN-AIDED PROJECT**

**Experiment 1.14 - Studies on Biological Nitrogen Fixation (BNF) in *Gliricidia* provenances and improvement of BNF in *Gliricidia* and *Leucaena* grown under coconut by tree management. Bandirippuwa Estate, Lunuwila - 1990.**

This study will be conducted with a grant awarded by the International Atomic Energy Agency in Vienna.

Experiment on BNF in *Gliricidia* provenances (OFI 14/84, 17/84, 12/86 and local cultivar) and non-fixing species (*Cassia seamea*): Seedlings were raised in polybags and planted at a spacing of 2m X 1 m. A basal fertilizer mixture consisting of P, K and micro nutrients was applied.

The experiment is in progress.

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

### **3. LECTURES AND SYMPOSIA**

Dr M de S Liyanage delivered several lectures on (a) Diversification of coconut land to Directors of Sri Lanka State Plantation Corporation (Galle Zone) on 20th April, and (b) Agronomic practices and pasture production to Trainee. Asst. Superintendants of JEDB or SLSPC in May 14-18.

Mr K B Dassanayake delivered several lectures to Gramasewa Niladharis in the NWP, to coconut growers in Gampaha District and to Trainee Asst. Superintendants to JEDB and SLSPC on (a) Home-gardening in coconut small-holdings (b) Mixed cropping for increased productivity of coconut lands, and (c) Mixed cropping in coconut lands.

### **4. EXTENSION ACTIVITIES**

Mr K B Dassanayake made four advisory visits during the year to advise the growers on intercropping and other management practices in coconut lands.

### **5. ACKNOWLEDGEMENTS**

The co-operation and assistance given by the staff of Agronomy Division in conducting the experiments and in the preparation of this report are gratefully acknowledged. Thanks are due to Head and staff of the Biometry Division for assistance in designing the experiments, providing nut yield records and for statistical analysis of data.

# REPORT OF THE GENETICS AND PLANT BREEDING DIVISION

Research Officer-in-Charge - R R A Peries, Ph D

## 1. GENERAL

The management of the Isolated Seed Garden (ISG) at Ambakele was handed over to the Estates Management Division from 01 January. Poor rainfall distribution during the year affected the yield of both tall and dwarf population in the seed garden. Several nursery trials were initiated during the year with a view to improving the quality of seedlings issued to the growers.

## 2. RESEARCH PROJECTS

### PROJECT 5 : PRODUCTION OF IMPROVED COCONUT VARIETIES

**Experiment 5.1.1 - Evaluation of five improved cultivars at Bandirippuwa Estate, Lunuwila (1984)**

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

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

These three field trials were in their sixth year from planting. Routine maintenance operations were carried out without any interruption in the Bandirippuwa and Thammenna trials. Dambakande estate was taken over by the Sri Lanka Army for the establishment of an Army training camp. Negotiations had to be made with the new management for the continuation of the trial. After some delay, the official clearance was granted for the continuation of the trial. Analysis of growth in response to changes in weather could not be completed as scheduled, due to the delay in obtaining weather data from the Department of Meteorology.

The number of palms of the different cultivars in flower at the end of the year is summarized in Table 1. The superior performance of DG x T over DY x T was more pronounced at Dambakande, where there was an increasing soil water deficit. There was little difference in the total number of palms in flower between Bandirippuwa and Thammenna trials. However, the overall time taken to flower was shorter at Bandirippuwa.

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

**Experiment 5.1.4 - Evaluation of five improved cultivars at Palugaswewa Estate, Rajakadahuwa (1985)**

Recording of growth measurements was done twice (6 February, 30 August) during the year. Fertilizer (YPM) was applied twice (14 June, 25 October) during the year at

the rate of 1400 g per seedling. By October, six palms of DG x T and seven palms of DY x T were in flower. However the prolonged dry periods during the latter part of the year affected the palms severely, and several palms succumbed to the stress injury. During the peak of the drought almost all the palms were further damaged by cattle and there was extensive loss of foliage. In view of the serious damage to the experiment, the usefulness of continuing the experiment was being reviewed as at the end of the year.

*R. R. A. Peries, J. M. D. T. Everard and M. A. S. Fernando*

Table 1 - Number of palms in flower in the Evaluation of Cultivars trials at Bandirippuwa, Thammenna and Dambakande ( December, 1990)

Site	Bandirippuwa (Chilaw)	Thammenna (Puttalam)	Dambakande (Kurunegala)
Cultivar			
DG X T	70	76	57
DY X T	75	64	25
T X T	52	45	02
MT	49	49	02
PPT	43	57	
Total	289	291	86

DG, dwarf green; DY, dwarf yellow; T, tall; MT, Moorock tall; PPT, plus palm tall

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

This trial was in its fifth year from planting and was satisfactorily maintained. Recording of growth measurements, flowering and fertilizer application was carried out twice during the year. There was a minor infestation of black beetle in October and the palms were treated with monocrotophos. At the end of the year, a total of 61 palms (DG x T : 34, DY x T : 26, PPT : 01) were in flower.

*R.R.A. Peries, J.M.D.T. Everard and H. S. G. Kularatne*

**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)**

The study on identification of parent palms was successfully completed in six fields ( 1,2,3, 5, 9 and 10A) at ISG, Ambakelle. These studies led to the identification of several palms which showed low yield variability in response to changes in weather. These palms have been used as pollen parents in subsequent progeny trials (Experiment 5.4.5.1). The open pollinated progeny from the selected palms from Fields 1 and 2 are used in the seed garden expansion programmes.

Selection of parent palms from Fields 4 and 8 would be undertaken in 1991.

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

**Experiment 5.3 - Pollen processing - To improve techniques of collection, processing and storage of coconut pollen (1983)**

The freeze dryer was put into operation with the assistance of Dr. Peter Key, Consultant from the International Centre for Analytical Technology in Luton, who conducted a course in instrumentation in Colombo in August. Staff are being trained on the technique of freeze drying and storage which is a skilled job. A high degree of accuracy in the job can only be obtained through practice.

*R.R.A. Peries, M. A. S. Fernando and W. B. S. Fernando*

**Experiment 5.4 - Pollination of selected palms at the isolated seed garden, Ambakelle, in different combinations and evaluation of the progeny (1984)**

**Experiment 5.4.1 - Combination 1. Tall (Ambakelle special) seed palms using tall, dwarf green or San Ramon pollen from palms believed to be drought tolerant.**

Progeny trials arising from these crosses are as follows:

**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 Ratmalagara 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 - Trial at JEDB Mangala Eliya Estate, Puttalam for the evaluation of progeny (1987)**

These trials were maintained satisfactorily despite the severe drought experienced during the latter half of the year. Although there were no casualties due to drought at Bandirippuwa, Ratmalagara and Andigama, 40 seedlings died at Mangala Eliya. Irrigation was virtually impossible at this site because almost all the neighboring water sources were dry during the height of the drought (September/October). Few rounds of irrigation were undertaken at Ratmalagara after the seedlings showed some signs of water stress.

Fertilizer application was carried out twice during the year with 1400 g of urea-based YPM per palm per application. Weed control and sanitation were satisfactory in all the trials except at Mangala Eliya where some debris of the old coconut stand were left uncleared. This was cleared only during the latter part of the year.

Growth parameters such as number of new leaves, girth at collar and the appearance of stem were recorded twice during the year in all the trials and the data were analyzed using the procedure of analysis of variance (ANOVA). The appearance of inflorescences were also recorded monthly.

The trials at Bandirippuwa and Ratmalagara are both of the same age and hence their data on girth at collar and leaf production at 36 and 48 months are tabulated together for ease of comparison (Tables 2 and 3).

Girth at collar was not measured after 36 months and the measurement at 36 months shows a clear varietal effect with T x DG being superior at both sites. T x SR progeny also shows a significantly large girth than the T x T progeny at Ratmalagara, although this difference was not significant at Bandirippuwa (Table 2).

Table 2 - Girth (cm) of the three types of progeny, T x DG, T x T and T x SR at two sites Bandirippuwa and Rathmalagara Estates at 36 months from planting (1986).

Site	Bandirippuwa		Ratmalagara	
	Mean	Range	Mean	Range
T x DG	110.07	56-145	108.57	40-140
T X T	93.33	40-136	79.14	31-138
T X SR	85.90	29-139	99.92	56-153
LSD 5%	8.92		8.14	
LSD 1%	12.30		11.22	

T, tall; DG, dwarf green; SR, San Ramon

LSD, Least significant difference

(LSD 5% = LSD (P<0.05), 1% = LSD 1% = LSD (P<0.01))

At both sites the number of leaves was significantly higher in the hybrid (T x DG) at 36 and 48 months from planting, compared to the progenies of both T x T and T x SR. The difference in leaf number between T x T and T x SR was not significant at Bandirippuwa at any time of recording. However, in the Rathmalagara trial T x SR produced significantly higher leaf numbers, compared to the other cultivars at both 36 and 48 months (Table 3).

The increase in leaf number during the third and fourth year after planting also showed a similar response to that observed with the leaf number. The rate of leaf production was highest in the hybrid at both locations. The rate of leaf production was similar in T x T and T x SR at Bandirippuwa. The rate was significantly higher in the T x SR progeny at Ratmalagara (Table 3).

Table 3 - Leaf number and the increase in leaf number of three types of progeny, T x DG, T x T and T x SR at two sites Bandirippuwa and Ratmalagara estates at 36 and 48 months from planting (1986).

Site	Bandirippuwa			Ratmalagara		
	Mean	LSD 5%	LSD 1%	Mean	LSD 5%	LSD 1%
<b>Progeny/Time after planting</b>						
<b>Leaf number</b>						
<i>(a) 36 months from planting</i>						
T x DG	28.01	0.93	1.28	25.34	0.94	1.29
T x T	23.29			19.82		
T x SR	23.29			22.18		
<i>(b) 48 months from planting</i>						
T x DG	43.01	1.80	2.49	34.99	1.47	2.03
T x T	36.08			26.62		
T x SR	35.31			30.31		
<b>Increase in leaf number</b>						
<i>(a) 24-36 months from planting</i>						
T x DG	11.18	0.52	0.71	9.13	0.47	0.65
T x T	9.4			6.45		
T x SR	9.7			7.55		
<i>(b) 36-48 months from planting</i>						
T x DG	15	1.31	1.89	9.64	0.63	0.87
T x T	12.8			6.90		
T x SR	12			8.13		

T, tall; DG, dwarf green; SR, San Ramon

LSD, Least significant difference

(LSD 5% = LSD (P<0.05), LSD 1% = LSD (P<0.01))

The total number of palms in flower and in stem at the end of the fourth year is summarized in Table 4. Again, T x DG was superior in both flowering and emergence of stem at the two sites although the total number of palms in flower at Ratmalagara was relatively low. Flowering in T x DG progeny was conspicuously high at Bandirippuwa where already 77% of the progeny were in flower at the end of the fourth year from planting. T x T and T x SR progeny were only just beginning to flower at both sites.

Progeny x site interaction was clearly evident from the above observations. The overall performance of the three progenies with respect to growth was better at Bandirippuwa. There was no difference in the performance between T x T and T x SR at Bandirippuwa. At Ratmalagara, T x SR appears to perform better than the others on the parameters recorded.

*J.M.D.T.Everard, R.R.A.Peries, W.B.S.Fernando and M.A.S.Fernando*

Table 4 - Number of palms in flower and number of palms in stem of the three types of progeny, T x DG, T x T and T x SR at two sites Bandirippuwa and Rathmalagara estates at 48 months from planting (1986).

	Bandirippuwa		Rathmalagara	
<i>Number of palms in flower</i>				
T x DG	69	(76.66)	32	(35.55)
T x T	02	(2.22)	01	(1.11)
T x SR	05	(5.56)	01	(1.11)
<i>Number of palms in stem</i>				
T x DG	75	(83.33)	69	(76.66)
T x T	55	(61.11)	06	(6.66)
T x SR	44	(48.89)	34	(37.77)

T, tall; DG, dwarf green; SR, San Ramon

Values in parenthesis indicate the % of total number of palms of each progeny.

**Experiment 5.4.1.2** - The trial at Andigama Farm, Giriulla (Mudalihamy Block) is now three and half years since planting. The growth parameters at the end of the third year and the leaf production rate during year 3 and from 3 to 3.5 years are tabulated in Table 5.

Table 5 - Girth (cm) and leaf production of the three types of progeny, T x DG, T x T and T x SR at the NLDB farm Andigama, (Mudalihamy block) at 36 months from planting (1986).

	Mean	Range	LSD 5%	LSD 1%
<i>Girth</i>				
T x DG.	93.33	39-132	9.7	13.36
T x T	72.22	32-127		
T x SR	84.44	41-144		
<i>Leaf number</i>				
T x DG	24.16		0.997	1.37
T x T	19.91			
T x SR	20.82			
<i>Increase in leaf number</i>				
<i>(a) 24-36 months</i>				
T x DG	7.9		0.476	0.655
T x T	5.9			
T x SR	6.4			
<i>(b) 36-42 months</i>				
T x DG	5.18		0.356	0.491
T x T	3.29			
T x SR	3.83			

T, tall; DG, dwarf green; SR, San Ramon

LSD, Least significant difference (LSD 5% = LSD (P<0.05), LSD 1% = LSD (P<0.01))

The ANOVA for girth at collar, leaf number and the rate of leaf production at 36 months from planting clearly reveals varietal differences. As expected, T x DG was superior to both T x T and T x SR in all the parameters studied. T x SR was also significantly superior to T x T in all the growth parameters. At the end of the year only four palms of T x DG were in flower.

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**Experiment 5.4.1.4** - The trial at JEDB Mangala Estate is now three years from planting and the growth parameters studied on the four types of progeny, T x DG, T x T, T x SR and T (OP) at this site are tabulated in Table 6.

Table 6 - Girth (cm) and leaf production of the four types of progeny, T x DG, T x T, T x SR and T (OP) at Mangala Eliya estate at 36 months from planting (1987)

	Mean	Range	LSD 5%	LSD 1%
<b>Girth</b>				
T x DG	72.84	36-118	9.45	ns
T x T	58.84	10-118		
T x SR	60.96	20-129		
T (OP)	60.88	20-129		
<b>Leaf number</b>				
T x DG	23.73		1.38	1.88
T x T	19.91			
T x SR	20.02			
T (OP)	18.18			
<b>Increase in leaf number</b>				
<i>(a) 12-24 months</i>				
T x DG	7.11		0.537	0.7277
T x T	6.14			
T x SR	6.22			
T (OP)	5.93			
<i>(b) 24-36 months</i>				
T x DG	8.12		0.617	0.836
T x T	6.09			
T x SR	6.44			
T (OP)	6.13			

T, tall; DG, dwarf green; SR, San Ramon; T (OP), tall open pollinated  
 LSD, Least significant difference (LSD 5% = LSD (P<0.05), LSD 1% = LSD (P<0.01)  
 ns, not significant

Mean girth at 36 months was significantly higher in T x DG compared to the other three progenies, T x T, T x SR and T (OP). However, growth in these three progenies was similar. The number of leaves and the increase in leaf number in preceding years (12 - 24 and 24 - 36 months) also showed a similar response. The corresponding differences between T x T, T x SR and T(OP) were not significant. However, it should

be noted that the T (OP) material was slightly older than the other planting material and hence not truly comparable.

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

**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.**

The progeny trials arising from these crosses are as follows:

**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)**

These experiments were maintained satisfactorily during the year. Fertilizer application was carried out twice during the year as scheduled.

The progenies subjected for evaluation in the two trials are; T x DG, T x T, T x SR and DG x SR. The trial at Daisy Valley estate also has a DG x T progeny for evaluation.

Vegetative growth parameters were recorded twice during the year and the results were analyzed using the procedure of Analysis of Variance. Summary of results and analyses are presented in Tables 7 and 8.

The performance of the four types of progeny at the 'Puras' Block, Andigama at the end of 30 months after planting revealed that (a) mean girth was slightly higher in T x SR but there was no significant difference between any of the four progeny, and (b) the leaf number was highest in DG x SR followed by T x DG, again showing the superior early growth in hybrids. The difference between T x T and T x SR in this respect was not significant. The rate of leaf production also demonstrated a similar trend to that of leaf number (Table 7).

Results at Daisy Valley estate were similar to those observed at Andigama ('Puras' Block). At Daisy Valley Estate the rank order in mean girth was DG x T, T x DG, T x SR, DG x SR and T x T. The increased girth in T x SR over DG x SR was quite unusual compared to other trials. However, the difference in mean girth between the hybrids and T x T was statistically significant (Table 8).

The leaf number was high in hybrids with DG x T ranking first, followed by T x DG and DG x SR. Leaf number in T x T and T x SR was similar but significantly lower than the hybrids. The increase in leaf number also showed a trend similar to that of leaf number (Table 8).

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

Table 7 - *Girth (cm) and leaf production of the four types of progeny, T x DG, T x T, T x SR and DG x SR at NLDB Farm, (Puras block), Andigama at 30 months from planting.*

	Mean	Range	LSD 5%	LSD 1%
<b>Girth</b>				
T x DG	56.37	29-84	ns	ns
T x T	54.91	33-90		
T x SR	58.11	23-82		
DG x SR	56.59	28-81		
<b>Leaf number</b>				
T x DG	16.93		0.687	0.931
T x T	14.83			
T x SR	15.07			
DG x SR	7.12			
<b>Increase in leaf number</b>				
<i>(a) 12-24 months</i>				
T x DG	6.83		0.338	0.458
T x T	5.91			
T x SR	6.02			
DG x SR	17.24			
<i>(b) 24-30 months</i>				
T x DG	2.93		0.248	0.336
T x T	2.36			
T x SR	2.51			
DG x SR	3.17			

T, tall; DG, dwarf green; SR, San Ramon

LSD, Least significant difference (LSD 5% = LSD (P<0.05), LSD 1% = LSD (P<0.01)

ns, not significant

**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 SLSPC Monrovia State Plantation, Dodanduwa, for the evaluation of progeny (1989).**

**Experiment 5.4.3.2 - Observation trial at Open Prison Camp, Dalupotha, Negombo, 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 for evaluation in the first two trials were T x DG, T x DY, T x T and T x SR. The trial at Ratmalagara Estate was established only for evaluation of hybrid progeny DG x T, DY x T, DG x SR and DY x SR.

Table 8 - *Girth (cm) and leaf production of the five types of progeny, T x DG, T x T, T x SR, DG x SR and DG x T at Daisy Valley estate at 24 months from planting (1987).*

	Mean	Range	LSD 5%	LSD 1%
<b>Girth</b>				
T x DG	74.49	35-103	7.34	9.82
T x T	63.79	24-132		
T x SR	72.24	31-111		
DG x SR	65.37	29-122		
DG x T	75.20	30-126		
<b>Leaf number</b>				
T x DG	16.39		0.639	0.856
T x T	14.67			
T x SR	14.67			
DG x SR	16.17			
DG x T	17.06			
<b>Increase in leaf number</b>				
<i>(a) 12-24 months</i>				
T x DG	8.23		0.416	0.557
T x T	7.09			
T x SR	7.23			
DG x SR	8.17			
DG x T	8.54			

T, tall; DG, dwarf green; SR, San Ramon

LSD, Least significant difference (LSD 5% = LSD (P<0.05), LSD 1% = LSD (P<0.01)

ns, not significant

The experimental design was similar in the trials at Monrovia and Dalupotha where the seedlings were planted with four replicates per progeny. Each replicate comprises 18 seedlings. The design at Ratmalagara was a single palm plot plan (without replicates) with each progeny comprising 18 palms. The guard row was also planted with the same material used in the evaluation.

The trials at Monrovia and Dalupotha are now in their second year. The management at Monrovia is better than at Dalupotha where there were minor management problems. The trial site at Dalupotha has a further disadvantage, being subject to frequent water logging. This has resulted in death of 20 seedlings at the onset of the trial and another 30 seedlings died within the course of the first year after planting. Black beetle also caused considerable damage to the young plantation. At Monrovia too, there was a serious black beetle infestation during the latter part of the year. One round of monochrotophos spraying was undertaken at both sites as a control measure.

Growth measurements were taken at half-yearly intervals and the data were analyzed using the ANOVA procedure. The data in the Ratmalagara trial was processed but not statistically analyzed as there was only a single set of data. The summarized data of the three trials are presented in Tables 9, 10 and 11.

Table 9 - *Girth (cm), height (cm) and leaf production of the four types of progeny, T x DG, T x DY, T x T and T x SR at Sirikandura, Galle at 12 months from planting (1989).*

	Mean	Range	LSD 5%	LSD 1%
<b>Girth</b>				
T x DG	44.12	20-72	6.6	9.5
T x DY	46.05	26-61		
T x T	34.01	9-50		
T x SR	46.04	26-65		
<b>Height</b>				
T x DG	308.53		39.64	ns
T x DY	316.92			
T x T	249.69			
T x SR	318.25			
<b>Leaf number</b>				
T x DG	9.87		ns	ns
T x DY	9.52			
T x T	8.84			
T x SR	8.84			
<b>Increase in leaf number (06-12 months)</b>				
T x DG	4.61		ns	ns
T x DY	4.26			
T x T	4.14			
T x SR	3.99			

T, tall; DG, dwarf green; DY, dwarf yellow; SR, San Ramon

LSD, Least significant difference (LSD 5% = LSD (P<0.05), LSD 1% = LSD (P<0.01)

ns, not significant

In general, the performance of all four types of progeny was better at Monrovia than at Dalupotha. The hybrids (T x DG, T x DY) and T x SR at Monrovia had a significantly higher girth at 12 months compared to T x T. At Dalupotha the response was similar, except that T x DG did not differ from T x T significantly.

Height of palms at 12 months was significantly higher in T x SR and in the hybrids (T x DG, T x DY) compared to T x T. However, such a difference was not evident at Dalupotha (Tables 9 and 10).

There were trends in higher leaf number and in the rate of leaf production in the hybrids (T x DG, T x DY) compared to T x T and T x SR at Monrovia. However, at this stage (12 months) differences were not significant. Such a difference was not seen in the Dalupotha trial (Tables 9 and 10).

It is yet premature to make comments on the Ratmalagara trial (Table 11). Although the data appears encouraging, the early vegetative growth of seedlings suffered severely from drought during the latter part of the year.

All progeny trials are making satisfactory progress.

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Table 10 - *Girth (cm), height (cm) and leaf production of the four types of progeny, T x DG, T x DY, T x T and T x SR at Dalupotha, Negombo at 12 months from planting (1989).*

	Mean	Range	LSD 5%	LSD 1%
<b>Girth</b>				
T x DG	27.85	14-50	7.19	ns
T x DY	36.6	15-65		
T x T	24.7	7-45		
T x SR	28.6	14-55		
<b>Height</b>				
T x DG	168.75		ns	ns
T x DY	206.75			
T x T	164.50			
T x SR	176.5			
<b>Leaf number</b>				
T x DG	5.57		ns	ns
T x DY	6.6			
T x T	6.2			
T x SR	5.6			
<b>Increase in leaf number (06-12 months)</b>				
T x DG	3.25		ns	ns
T x DY	3.65			
T x T	3.32			
T x SR	3.27			

T, tall; DG, dwarf green; DY, dwarf yellow; SR, San Ramon  
 LSD, Least significant difference (LSD 5% = LSD (P<0.05), LSD 1% = LSD (P<0.01)  
 ns, not significant

Table 11 - *Girth (cm), height (cm) and leaf production of the four types of progeny, DG x T, DY x T, DG x SR and DY x SR at Ratmalagara Estate at 6 months from planting.*

	Mean	Range
<b>Girth</b>		
DG x T	27.33	18-35
DY x T	24.11	16-38
DG x SR	23.67	13-30
DY x SR	23.39	16-33
<b>Height</b>		
DG x T	206.72	147-255
DY x T	195.11	132-261
DG x SR	187.06	130-250
DY x SR	201.22	161-272
<b>Increase in leaf number (0-6 months)</b>		
DG x T	6.89	5-9
DY x T	4.94	2-8
DG x SR	4.06	2-7
DY x SR	4.39	2-7

T, tall; DG, dwarf green; DY, dwarf yellow; SR, San Ramon

#### **Experiment 5.4.5 - Production of planting material at ISG, for the proposed "super" seed garden (1986)**

The seedlings raised from the hand pollination programme launched for production of "Ambakelle super" seednuts were used as infills in the progeny trial at ISG (Experiment 5.4.5.1) and also in other fields (see CRI Annual Report 1989).

*R.R.A. Peries and M.H.L. Padmasiri*

#### **Experiment 5.4.5.1 - Progeny trial for testing of putative drought tolerant palms by the performance of their progeny (Ambakelle super seednuts) at ISG (1988)**

This trial comprises 441 seedlings obtained by crossing 22 selected palms from fields 1 and 2 (see Experiment 5.2) in 56 combinations (see CRI Annual Report 1988).

The trial was planted in November 1988 but suffered an early set-back due to water-logging after rain. Some vacancies had to be filled with T x T as the specific crosses were not available in adequate quantities. There were a further 24 casualties in the trial during the year.

The current position of the trial is that the seedlings are of different ages from planting and thus there is lack of uniformity in the plantation. Therefore, the growth measurements taken at 06 and 12 months after planting were highly variable and hence an analysis was not undertaken. However, it is expected that this plantation would fully establish in its second year and then an analysis of data would be attempted.

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

#### **Experiment 5.4.7 - Pollinations at ISG using spicata pollen (1987)**

A total of 22 seedlings resulted from pollination of Tall (05), DG (10) and DY (07) palms at Ambakelle using spicata pollen. They were planted in an area inside the Bandirippuwa research nursery. The seedlings have established well but four seedlings were lost due to porcupine damage. The seedlings are being closely observed for desirable traits.

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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)**

The block was maintained satisfactorily. Three seedlings of rathran thembili resulting from hand pollinations carried out in 1989 were planted in the block. Vacancies of pora-pol (04), gon thembili (03) and DG x T (01) were filled. Seven vacancies of navasi thembili remain to be filled.

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

Seedlings raised at the Bandirippuwa nursery were planted in experiment 5.5.1. No further pollinations were done during the year (see CRI Annual Report 1989)

**Experiment 5.5.3 - Conservation of San Ramon, (1986)**

The experiment was maintained satisfactorily during the year. Growth measurements were recorded twice during the year at six-monthly intervals. Fertilizer (urea-based YPM) was applied twice during the year at the rate of 1400 g per seedling, for 4 1/2 year old. The younger seedlings received 900 g per seedling.

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

The experiment was maintained satisfactorily during the year. Growth measurements were recorded twice (1 March, 27 September) during the year. Fertilizer was applied twice (6 July, 14 November) during the year at the rate of 900 g per seedling. Fifteen seedlings of dwarf red and four (04) of dwarf green were in flower at the end of the year.

**Experiment 5.5.5 - Germplasm from other countries (1985)**

**Experiment 5.5.5.1 - Import of exotic material**

No progress was made during the year. It is expected that the programme could be implemented in 1991.

**Experiment 5.5.5.2 - Purification and multiplication of exotic material already available**

**San Ramon (SR):** There were 16 seednuts resulting from pollinations carried out in 1989 which were laid at the Bandirippuwa nursery. A further 175 button nuts at the age of 6 months remain to be harvested from pollinations carried out on 34 inflorescences.

**Cameroon red dwarf (CRD):** Only 10 seednuts resulted from pollinations carried out in 1989. From pollinations done between January and March, a further 23 seednuts were harvested. They have been laid at the Bandirippuwa nursery.

**Brazilian green dwarf (BGD):** There was absolutely no success from the hand pollination programme. It is interesting to note that similar problems are encountered in the Philippines.

**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*)**

Vacancies arising from time to time were filled with seedlings available in the nursery. About 50 vacancies on the guard rows remain to be filled and this can be done only after seednuts are collected from Ambakelle Special palms in 1991. Fertilizer was applied thrice during the year at the rate of 900 g per seedling using urea-based YPM on 15 January (Maha 1989), 5 June (Yala 1990) and 23 October (Maha 1990).

**Assembly and evaluation of collected material**

• *Conservation Block- Poththukulama Research Station*

The following accessions were established.

Date of Accession	Number of seedlings per accession	Number of female parents	Number of progenies per parent
24 April Clovis	85	50	1 to 3
25 April Namalwatta	85	53	1 to 3
18 May Margaret	85	85	1
19 May St. Annes	85	85	1
24 July Debarayaya	39	26	1 to 2
24 July Kasagala	24	14	1 to 2

**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 and Collection of drought tolerant germplasm**

No progress was made during the year due to staff shortages and financial constraints

*R.R.A.Peries and M.A.S.Fernando*

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

### **MISCELLANEOUS RESEARCH**

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

Four experiments were initiated in order to upgrade the nursery techniques and produce quality seedlings with cost-efficient methods.

#### **Experiment 1 - Interaction of source of seednuts/nursery site**

A nursery trial was established at three locations; Bandirippuwa, Medamulana and Attavillu in June 1990. In each nursery, 300 seednuts from each source (ISG, Moorock and Dehigahalande) were laid in a RCB design. Germination records are taken at 14 day intervals beginning from 10 weeks after laying. The trial was designed to test the hypothesis that there was interaction between source and site in the success of seedling production. The study is making good progress.

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

#### **Experiment 2 - An alternative to top soil in raising of coconut seedlings in polybags**

This trial was established at the Bandirippuwa research nursery to study the possibility of using river sand as an alternative to top soil in raising seedlings in polybags. Five combinations of top soil, cow dung, coir dust and river sand are tested in a simple design using 25 seednuts per treatment. The seeds were laid in June 1990 and germination records are been taken fortnightly since 10 weeks of laying. The study is making good progress.

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

#### **Experiment 3 - Water use and water use efficiency at putative drought resistant tall palms at the Isolated Seed Garden at Ambakelle**

This trial was established at the Bandirippuwa research nursery to determine and compare the water use of open pollinated progenies of (a) Ambakelle special seedlings (selected for yield stability), (b) palms screened for physiological superiority and (c) the normal Ambakelle tall seed parents. This experiment is designed to test the hypothesis that drought tolerant cultivars would use less water and would also show high efficiency of water use. The relationships could possibly be correlated to adult palm characters.

The seeds were laid in June and were expected to be uprooted at the end of the 15th week and transplanted in polybags after amputation of the nut. The polybagged seedlings were then to be subjected to a glass house study where water use was to be measured through gravimetric methods.

A large variation was observed in days taken for sprouting of nuts and thus the anticipated transplanting at the 15th week was not done as scheduled as seedlings of uniform size in each category were not available in adequate numbers for a comparative study. The experiment would be repeated with a larger sample in 1991. This would be possible only after the parent palms at ISG recover from the effects of the recent drought.

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

#### **Experiment 4 - Germination of husked seed coconuts under low light intensity in a humid environment**

The trial was established to test the hypothesis that shade and high relative humidity will enhance germination, sprouting and subsequent growth of dehusked coconuts.

The trial was set up at the Bandirippuwa Estate nursery where seednuts were laid in nine seedbeds of 50 seednuts each. In the control seedbeds (beds 1, 2 and 3) seednuts were laid as in a conventional nursery. Beds 4, 5 and 6 were laid with husked seednuts. Beds 7, 8 and 9 were laid with husked seednuts and a cover was provided with 50% shade cloth from the top and with jutehessain on the sides of the beds. The jutehessain was wetted frequently to keep the beds humid. Humidity and temperature were measured inside and outside the beds twice daily. The experiment is progressing satisfactorily.

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

### **3. THE ISOLATED SEED GARDEN AT AMBAKELLE**

The general administration and maintenance of the seed garden was handed over to the Estates Management Division from 1 January. However the emasculation programmes and the progeny trials at ISG continue to be the responsibility of the Genetics and Plant Breeding Division.

**3.1 Rainfall:** The intensity and distribution of rainfall for 1990 is shown in Table 12 along with the values for the previous year and the 10 year average (1981-1990). The total rainfall for the year (1180 mm) was 330 mm higher than that of the previous year (850 mm) but most of this rain fell between October and December. The impact of this rainfall on yield may not show up at ISG until early 1992.

**3.2 Nut yields:** Total crop figures for 1989 and 1990 are shown in Table 13 with the 10 year average (1981-1990). As a result of poor rainfall distribution during the year the total nut yield was reduced to 37% of the yield in 1989. It was also 54% of the past 10-year average.

The nut yields of Talls and Dwarfs are shown separately in Table 14. The average number of nuts produced per palm in Talls fell from 116 in 1989 to 47 in 1990. The reduction was even greater in the Dwarfs (i.e. 89 to 19). In the talls, the nut number

was lower at each pick compared to the corresponding pick in 1989. Although there was an increase in the number of bearing palms, 527 of the adult palms were very badly affected by the severe drought. The effect of increasing soil water deficit was more severe on the dwarfs than on the tall. In the dwarfs there was no particular pattern in the yield over the six crops of the year. However, in the tall the first and third crops of the year were higher than the others. This appears to be the result of adequate soil water supply during October/November 1988 and April-June 1989. In 1989, the yields reached a peak during picks 4 and 5, which was not observed this year. Classification of the palms (census) as at 31 December, 1990 is shown in Table 14a.

Table 12 - *The intensity and distribution of rainfall for 1989 and 1990 and the 10 year average (1981-1990) for comparison at ISG*

Month	1989			1990			10 year average (1981-1990)		
	A	B	C	A	B	C	A	B	C
January	58.4	2	2	221.6	5	5	52.08	4.0	3.9
February	0	0	0	0	0	0	55.71	3.5	3.3
March	29.5	4	4	34.0	5	5	86.36	5.2	5.0
April	81.7	5	5	38.8	5	5	168.41	9.1	8.1
May	16.0	8	8	145.6	9	9	146.07	9.7	8.9
June	112.2	12	12	8.4	1	1	82.55	10.9	10.1
July	72.1	5	5	67.7	10	10	50.58	6.5	5.4
August	1.7	1	1	0	0	0	39.57	4.5	4.1
September	34.0	6	6	9.5	1	1	108.94	10.1	9.0
October	212.3	12	12	288.6	17	17	215.17	14.3	13.8
November	224.3	16	16	306.7	14	14	242.31	14.3	13.3
December	8.0	2	2	59.2	8	8	84.04	7.3	7.1
Total	850.2	73	73	1180.1	75	75	1331.79	99.4	92.0

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

### 3.3 Emasculation of dwarf palms for the production of CRIC 65 hybrid nuts:

Details of the emasculation programme are shown in Table 15. A total of 3142 dwarf palms comprising 2004 dwarf green and 1138 dwarf yellow forms were emasculated during the year.

**3.4 Controlled pollination:** Controlled pollinations were only carried out in field 3. A total of 9299 female flowers were pollinated in 449 inflorescences. This resulted in 1807 button nuts at the end of three months from pollination.

*M.H.L.Padmasiri, W.B.S.Fernando and J.D.J.Abeysekara*

Table 13 - Total nut yields at Isolated Seed Garden from the six picks of the year.

Pick	1989	1990	Ten year average (1981- 1990)
01	186665	92177	111732.6
02	223595	81224	153099.7
03	216763	98105	172007.2
04	219573	49882	151448.7
05	232430	63324	147028.4
06	146674	73421	112962.6
Total	1225700	458133	848279.2
Number of bearing palms	11,227	11,517	
Average number of nuts per palm	109	40	

Table 14 - Nut yields from the tall and dwarf palms at ISG during the year.

	1989	1990	Five year average (1986- 1990)
<i>Tall pick</i>			
01	144714	72768	90761.0
02	159975	66632	102231.4
03	162983	86346	117965.0
04	179154	46069	102924.2
05	177112	60090	105893.4
06	120167	70620	95595.2
Total	944105	402525	615370.2
Number of palms in bearing	8070	8616*	
Number of nuts/palm	116	47	
<i>Dwarf pick</i>			
01	41951	19409	25743.2
02	63620	14592	31409.8
03	53780	11759	25811.6
04	40419	3813	18158.0
05	55318	3234	25699.8
06	26507	2801	18028.4
Total	281595	55608	144850.8
Number of palms in bearing	3157	2901	
Number of nuts/palm	89	19	

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



Table 15 - *Emasculation of dwarf palms for the production of CRIC 65 seednuts.*

Field number	Number of palms emasculated		Number of inflorescences emasculated		Number of button nuts at emasculation	
	DG	DY	DG	DY	DG	DY
05	207	-	1432	-	22933	-
09	420	-	2949	-	56931	-
10A	93	848	1082	6614	18285	142416
10B	305	290	3920	2780	103565	48186
14	979	-	11185	-	132436	-
Total	2004	1138	20568	9394	334150	190602

#### 4. SEED PRODUCTION

##### 4.1 Seednut supply

Table 16 summarizes the seednut supplies during the year. A total of 2.5 million seednuts were issued during the year for the national replanting programmes of Maha 90, Yala 91 and Maha 91. This consisted of 2,264,093 plus palm seednuts, 249,053 CRIC 60 seednuts and 50,855 CRIC 65 seednuts. A total of 2964 seednuts were also exported.

The Coconut Cultivation Board was supplied with 2,008,777 seednuts for its nurseries. It consisted of 1,797,807 plus palm seednuts and 172,488 and 38,482 seednuts of CRIC 60 and CRIC 65, respectively. The Ambakelle and Makandura seed gardens contributed to the overall seed production through improved varieties CRIC 60 (8.5% of total) and CRIC 65 (2% of total).

North East and North Western Provincial Councils were supplied with 496,050 and 156,386 seednuts respectively at their request. State-owned plantations and estates over 20 ha were provided with 56,340 seednuts of improved cultivars during the year.

##### 4.2 Plus Palm Selection

The pool of plus palms was increased from 47,181 to 54,213 by selecting from the following additional sources during the year.

1.	Randeniya Estate	CCB	457	palms
2.	Nagansole Estate	CCB	937	palms
3.	Luxman Estate	Private	983	palms
4.	Udalawela Estate	Private	790	palms
5.	Dewagiriya Estate	Private	1093	palms
6.	Graceland Estate	Private	589	palms
7.	St Ives Estate	Private	1430	palms
8.	Kalukelle Estate	NLDB	331	palms
9.	Sedawatta Estate	NLDB	367	palms
	TOTAL		7032	palms

Table 16 - Seednuts supplied during 1990.

Year & Quarter	Planting season	CCB nurseries				Total	CRB nurseries				Total	Others			Total	Grand Total
		PP	TxT	D x T			PP	TxT	DxT			PP	TxT	DxT		
1989/4	90 Maha	119,210	34,935	5,000	159,145	-	-	-	-	12,000	22,500	3,000*	47,500	20,645		
												10,000				
90/1	90 Maha	379,864	50,090	16,685	446,639	-	830	235	1,065	278,100	45,500	11,950	335,550	783,254		
90/2	90 Maha	381,634	5,000	15,792	402,426	-	-	-	-	186,386	-	685*	187,071	589,497		
Total		761,498	55,090	32,477	849,065	-	830	235	1,065	464,486	45,500	12,635	522,621	1,372,751		
90/2	91 Yala	154,845	1,720	-	156,565	1,800	6,280	-	8,080	-	4,150	-	4,150	168,795		
90/3	91 Yala	741,584	83,558	6,005	831,147	-	11,525	-	11,525	-	-	1,279	1,279	843,951		
Total		896,429	82,278	6,005	987,712	1,800	17,805	-	19,605	-	4,150	1,279	5,429	1,012,746		
90/4	91 Maha	139,880	32,120	-	172,000	-	-	288	288	-	8,280	900*	9,180	181,468		
Total		1,797,807	172,488	38,482	2,008,877	1,800	18,635	523	20,958	464,486	57,930	14,814	537,230	2,566,965		

\* Exports

### 4.3 Seednut selection

Seednut selection was carried out during the year in the plus palm estates and seed gardens. Makandura seed garden was used as a source of improved seednuts from the third pick onwards.

Crop-wise production of typica and hybrid seednuts at ISG and Typica seednuts at Makandura seed gardens are given in Tables 17, 18 and 19.

Table 17 - *Cropwise production of typica (CRIC 60) seednuts during 1990 (excluding nuts from controlled pollinations)*

Pick	Heaped	Selected	Percent of heap selected
1	64,500	41,645	64.5
2	58,485	32,210	55.0
3	76,572	46,363	60.5
4	39,584	24,750	62.5
5	57,725	40,220	69.6
6	63,782	41,400	64.9
Total	360,648	226,588	62.8

Table 18 - *Cropwise production of hybrid seednuts (CRIC 65) during 1990.*

Pick	Heaped	Selected	Percent selected	Heaped	Selected	Percent selected
1	7,689	6,555	85.2	6,518	5,300	81.3
2	4,865	3,672	75.4	5,434	2,855	52.5
3	5,670	3,795	66.9	2,604	490	18.8
4	1,522	1,233	81.0	312	213	68.2
5	1,439	1,205	83.7	449	354	78.8
6	1,309	1,103	84.2	90	85	94.4
Total	22,494	17,563	78.0	15,407	9,297	60.3

Table 19 - *Cropwise production of typica seednuts at Makandura Seed Garden*

Pick	Heaped	Selected	Percent of heap selected
1	-	-	-
2	-	-	-
3	2,540	2,020	79.5
4	3,723	2,790	74.9
5	4,069	3,140	77.1
6	3,250	2,490	76.6
Total	13,582	10,440	76.8

#### 4.4 Miscellaneous activities

##### *Cover crop seed production*

Fifty six kilograms of *Pueraria phaseoloides* seed were collected from the CRI estates and issued to small-holders and estates over 20 ha at the rate of Rs 65.00 per kg.

Negotiations were finalised during the year to hand over the seed production activities to the Coconut Cultivation Board following a decision of the Coconut Research Board and the Ministry of Coconut Industries and Crop Diversification.

*P. Kariyawasam*

#### 5. POLLEN AND POLLINATION

##### 5.1 Pollen collection and issue

Details of pollen collection and issue are shown in Table 20. Pollen from typical variety was collected from 22 inflorescences of 15 selected palms in fields 1 and 2 of the ISG. A total of 357 unadulterated pollen ampoules were sealed. Pollen from palms in fields 1 and 2 was also mixed together, adulterated with *lycopodium* and resealed. A total of 203 such ampoules were produced during the year.

Table 20 - *Pollen collection and Issues*

	ISG palms	San Ramon (B/E)	DG (ISG)	DY (ISG)	BGD (B/E)
<b>Carried over from 1989</b>					
Pollen from individual palms	145	27	207	111	14
Mixed pollen adulterated with <i>lycopodium</i>	40	-	-	-	-
<b>Sealed in 1990</b>					
Pollen from individual palms	357	34	-	-	-
Mixed pollen adulterated with <i>lycopodium</i>	203	-	-	-	-
<b>Issued for pollination programmes</b>					
Pollen from individual palms					
1. At ISG	237	-	-	-	-
2. At B/E	-	14	-	-	14
<b>Issued to estates (at Rs.10/ampoule)</b>					
Mixed pollen adulterated with <i>lycopodium</i>	170	-	-	-	-
<b>Other uses</b>					
(Viability tests, demonstrations, breakages etc.)	10	10	30	20	08
<b>No viability /Low viability</b>					
Pollen from individual palms	20	-	177	91	-
<b>Balance as at 31 December 1990</b>					
Pollen from individual palms	175	37	-	-	-
Mixed pollen adulterated with <i>lycopodium</i>	33	-	-	-	-

DG, Green dwarf; BGD, Brazilian green dwarf; DY, Yellow dwarf

San Ramon pollen was collected from three inflorescences of six selected palms on field no. 16 at Bandirippuwa and 34 ampoules of pollen were produced.

Pollen of the Brazilian green dwarf was collected from four inflorescences of six palms and 30 ampoules were sealed.

One hundred and seventy ampoules of typical pollen were issued to Palugaswewa estate, Daisy Valley estate and Pitiyakanda estate of the JEDB at Rs. 10.00 per ampoule.

## 6. RESEARCH NURSERY

### 6.1 Bandirippuwa Research Nursery

Tables 21, 22 and 23 summarize the data on seednuts 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 at Bandirippuwa Estate and Pothukulama Research Station germplasm fields. Some of the material from the selections made for drought tolerance were issued to B/E for its replanting programmes.

*R.R.A.Peries and H.S.G.Kularatne*

Table 21 - *Seednuts laid in the Bandirippuwa nursery during the year.*

Variety	Source	Number of seednuts	
		In beds	In Polybags
Tall x Tall	Mahayaya	300	-
Ambakelle Special	ISG	550	-
SR x SR	field 16 B/E	-	25
CRD	B/E	-	33
Rathran thembili	private	-	03
D x T	ISG	-	03
<i>Germplasm Collections</i>			
Tall (Mahahena)	Akuressa	103	-
<i>Experimental</i>			
T x T	ISG	300	-
Moorock tall	Moorock	300	-
Dehigahalanda	Dehigahalanda	300	-
T x T	ISG	150	-
T x T	ISG	150	(dehusked)
T x T	ISG	-	125
	Total	2524	189
	Grand total	2713	

Table 22 - *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	
T x T	10	-	21	-	45	-	1455	-	1531
D x T	-	-	-	-	-	-	111	-	111
T (OP)	02	-	-	-	-	-	194	-	196
T x T (HP)	-	-	200	-	-	-	-	-	200
Ambakelle tall	13	-	-	-	-	-	-	-	13
SR x SR	-	-	-	-	-	02	-	75	77
DG selfed	37	-	08	-	-	-	-	-	45
BGD	-	02	-	-	-	-	-	-	02
<i>Navasi</i>	-	08	-	-	-	-	-	-	08
<i>Bodiri</i>	-	01	-	-	-	-	-	-	01
<i>Kamandala</i>	-	01	-	-	-	-	-	-	01
<i>Pora-pol</i>	04	-	-	-	-	-	-	-	04
<i>Rathran thembili</i>	03	-	-	-	-	-	-	-	03
<i>Gon thembili</i>	01	-	-	-	-	-	-	-	01
<i>Dikiri pol</i>	03	-	-	-	-	-	-	-	03
Clovis	16	133	-	-	-	-	-	-	149
Namatwatta	80	43	-	-	-	-	-	-	123
Moorock	14	02	-	-	-	-	-	-	16
Ptityakande	10	02	-	-	-	-	-	-	12
St. Annes	235	-	-	-	-	-	-	-	235
Margaret	185	17	-	-	-	-	-	-	202
Palugaswewa	34	-	-	-	-	-	-	-	34
Sausiri	-	29	-	-	-	-	-	-	29
Kasagala	24	-	-	-	-	-	-	-	24
Debarayaya	39	-	-	-	-	-	-	-	39
Total	710	238	229	-	45	02	1760	75	3059

HP, Hand pollinated; A and B are seedlings from conventional seeds beds and polybags respectively.

## 7. SYMPOSIA, LECTURES, STUDY TOURS ETC.

Dr R R A Peries functioned as a resource person at the Coconut Development Training Centre (CDTC) of the Coconut Cultivation Board. Dr R R A Peries and Mr J M D T Everard delivered several lectures in the training programme for Assistant Superintendents, on 4 April. Mr. Everard also accompanied the trainees on a field visit to the Isolated Seed Garden on 5 April.

The same series of lectures (with some modifications and in the Sinhalese medium) was delivered in a training programme for middle-level management staff on 28 May. Mr Everard accompanied the trainees on a field visit to ISG on 2 June.

Mr P Kariyawasam, Seed Production Officer delivered lectures at a training programme for Nursery Assistants of the CCB on 26 February, for two groups of Grama Niladari on 23 April and to a group of Regional Managers of the CCB on 05 March. Mr Kariyawasam functioned as a member in the three-member committee appointed by the Chairman, CCB to investigate and report on the guidelines for the selection of the best coconut nursery. From December, he also functioned as the Chairman of this Committee.

Table 23 - Availability of planting material at Bandirippuwa Research Nursery as at 31 December, 1990.

Variety	Seedlings over 5 months in age		Total
	In seedbeds	In polybags	
T x T	104	-	104
D x T	34	-	34
T x T (HP)	599	-	599
TT (OP)	45	-	45
Variety nuts	277	-	277
SR x SR	81	14	95
CRD	-	06	06
BGD	-	02	02
<i>Pora-pol</i>	-	16	16
St. Annes	54	-	54
Margaret	70	-	70
Pityakande	25	23	48
Moorock	16	20	36
Goluwapokuna	06	-	06
Kasagala	24	04	28
Namalwatta	39	02	41
Debarayaya	22	-	22
Clovis	24	-	24
Palugaswowa	11	-	11
Sausiri	-	03	03
Wellawa	-	02	02
T x DY	-	25*	25
DY x DG	-	07	07
DG	26*	-	26
DG**	26	-	26
DY**	41	-	41
DR**	08	-	08
Total	1532	124	1656

\*\* (from Kundasale), \* reserved for Tissue Culture Division

## 8. ACKNOWLEDGEMENTS

The assistance and cooperation of the staff of the Genetics and Plant Breeding division in compiling this report are gratefully acknowledged.

# REPORT OF THE SOILS AND PLANT NUTRITION DIVISION

Officer-in-Charge - K S Jayasekara, B Sc

## 1. GENERAL

Several field and laboratory experiments on nutritional, soil physical and water use aspects of coconut were conducted satisfactorily. Emphasis was given to identify possible nutritional deficiencies in coconut plantations. Magnesium and potassium were found to be the main nutritional deficiencies in adult coconut, and low levels of sulphur were encountered in several plantations.

The importance of regular application of dolomite has been recognized by the planting community, as evidenced by the increased use of dolomite.

A low-cost irrigation system was introduced to the coconut growers during the year.

### 1.1 Innovations

Mr K S Jayasekara, Officer-in-Charge and Mr D P Panditharatne, Technical Assistant developed a working model of a "Coconut Climber" with the assistance of Technic Industries, Dehiwala. The Agricultural Research Project of the Ministry of Agricultural Research and Development awarded a grant of Rs. 70 000 on 12 November to manufacture a prototype of the "Coconut Climber", which is a gasoline and electrically powered climber with an extended platform for a worker to reach the canopy of coconut palms to make on the spot observations and measurements.

### 1.2 Other activities

Mr K S Jayasekara, Officer-in-Charge supervised the final year research projects of two undergraduates from the University of Ruhuna, Matara as shown below:

1. Miss P W Amaradiwakara: "Studies on growth and nutrient levels of some common weeds in coconut plantations".
2. Mr R M T B Ratnayake: "Effects of coir dust use in coconut plantations".

## LABORATORY AND GLASSHOUSE STUDIES

### 2.1 Studies on leaching of nutrients after the application of fertilizer in coconut

Laboratory simulation studies were extended to the field conditions to monitor leaching of nutrients after application of the recommended rates of fertilizer in the manure circle and at the center of squares of coconut palms. Soil samples were taken from 20 cm depth intervals upto a depth of 2.0 m to monitor the changes in soil nutrient levels with time. Leaf nutrient levels were also monitored.

Preliminary results show leaching of K and Mg in both gravelly and sandy soils in the manure circle area, but there are indications that part of the leached nutrients were taken up by the roots of the coconut palm. However, leaching of K and Mg from surface layers and accumulation at depths were detected at the center of square of palms, perhaps due to lesser interference by the root system of coconut.

Simulation studies of nutrient leaching by different organic manures when exposed to rainfall and under different soil/organic levels are also in progress.

T W Fernando, D P Panditharatne, & K S Jayasekara

## 2.2 Studies on the nutrient balance and water use by weeds in coconut plantations (Expt. 4.5)

The study was conducted by Miss P W Amaradiwakara, undergraduate student of the University of Ruhuna.

A detailed study of the weeds has been incorporated in her report, "Studies on growth and nutrient levels of some common weeds in coconut plantations".

The common weeds in coconut plantations around Lunuwila are:

*Acalypha indica* (kuppamenia), *Achyranthes aspera* (karalhaba), *Cassia* spp. (tora), *Chromolaena odorata* (podisinghomarang), *Chrysopogon aciculatus* (heen tuththiri), *Cleome viscosa* (wal aba), *Cyperus esculentus* (yellow nutsedge), *Commelina benghalensis* (diya meneri), *Euphorbia heterophylla* (wal rubber), *Euphorbia hirta* (kapumkieriya), *Hedyotis auricularia* (getakola), *Imperata cylindrica* (illuk), *Kyllinga erecta* (uru kalanduru), *Mikania scandens* (wathupalu), *Mimosa pudica* (nidikumba), *Ocimum sanctum* (madurutala), *Panicum repens* (atora), *Phyllanthus niruri* (pitavakka), *Scoparia dulcis* (wal koththamalli), *Sida* spp. (babila), *Stachytarpheta indica* (balunakuta), *Tephrosia purpurea* (pinna), *Tridax procumbens* (kurunegala desiya), *Vernonia cinerea* (monarakudumbiya) and *Urena lobata* (wal epala).

The predominant broad leaf weeds were *Achyranthes aspera*, *Cleome viscosa*, *Euphorbia heterophylla*, *Scoparia dulcis*, *Tridax procumbens* and *Vernonia cinerea*.

*Cyperus esculentus*, *Eleusine indica*, *Imperata cylindrica* and *Kyllinga erecta* were the predominant grasses found in coconut plantations.

The weed flora of coconut plantations generally contains more broad leaf weeds than grasses, perhaps due to the shade conditions prevailing under coconut.

Among the weeds *Euphorbia hirta* and *Commelina benghalensis* generally have a shallow root system (ie: < 5 cm), whereas *Achyranthes aspera*, and *Scoparia dulcis* extend their roots into deep sub-soil (ie: > 0.5 m). Weeds such as *Chromolaena odorata* and *Sida acuta* generally grow more than 2 m in height and thus adversely affect the agricultural operations. Depending on the structure and efficiency of the root system, these weeds can compete for nutrients and water at different depths and distances.

The accumulation of both macro and micro-nutrients in different plant components in different weeds varied widely (Tables 1-3). Generally, nitrogen (N) content of leaves and stems were high, while roots had high levels of potassium (K). These weeds remove micro-elements such as iron, zinc and manganese from soils in much greater quantity than copper.

It was also observed that the nutrient contents in different plant parts in different species of weeds vary considerably. Nutrients such as nitrogen, potassium, phosphorus, calcium and magnesium were high in leaves and flowers than in roots and stems of weeds. Stems contain higher percentage of nitrogen, potassium and phosphorus than in roots.

The highest level of nutrients recorded in stems and roots of these weeds was for potassium while leaves and flowers contained the highest level of nitrogen.

Further studies on nutrient and water relation of weeds in coconut are in progress and the results are expected to contribute towards understanding the nutrient balance in coconut plantations.

*P W Amaradiwakara & K S Jayasekara*

### **2.3 Studies on the effects of coir dust on the quality of ground water in coconut plantations**

This study was undertaken by Mr R M T B Ratnayake, undergraduate student of University of Ruhuna, as a part of his studies and the findings are incorporated in the report, "Effects of coir dust use in coconut plantations".

Coir dust is being used in pits similar to that of husk pits to conserve soil moisture in coconut lands. Experiments are also in progress on the use of coir dust as a soil ameliorant.

The main objective of this study was to study the effects of coir dust on the ground water in coconut plantations. Preliminary results showed that coir dust leachate contained high levels of potassium. Nutrient levels of fresh coir dust were relatively higher than those in the old and decomposed coir dust.

Fresh coir dust leachate is light yellow in colour, while leachate from the decomposed coir dust is dark in colour. The level and intensity of rainfall has an effect on the volume, colour and the nutrient content of the leachate.

This study indicated that heavy use of coir dust in coconut plantations may lead to pollution of ground water reserves by coloured organic compounds and other nutrients.

*R M T B Ratnayaka & K S Jayasekara*

Table 1 - Macro-nutrient levels of some prominent weeds (leaves and flowers)

Weed species	Nutrient %									
	N	P	K	Na	Ca	Mg	Fe (ppm)	Mn (ppm)	Cu (ppm)	Zn (ppm)
<i>Cleome viscosa</i>	4.6	0.36	2.15	0.23	1.84	0.34	654	156	10	92
<i>Euphorbia heterophylla</i>	2.4	0.35	1.75	0.01	1.53	0.37	155	57	10	51
<i>Euphorbia hirta</i>	2.1	0.43	1.81	0.02	1.02	0.33	302	102	7	37
<i>Commelina benghalensis</i>	3.1	0.32	3.56	0.42	1.04	0.43	153	57	6	45
<i>Vernonia cinerea</i>	2.4	0.32	2.93	0.52	0.85	0.40	219	88	7	76
<i>Scoparia dulcis</i>	2.5	0.34	1.88	0.06	0.79	0.37	366	180	13	50
<i>Achyranthes aspera</i>	2.6	0.33	4.01	0.48	1.68	0.95	432	217	9	92
<i>Acalypha indica</i>	3.0	0.46	3.31	0.07	2.94	2.23	312	70	5	48
<i>Tridax procumbens</i>	3.1	0.35	3.46	0.24	1.55	0.58	400	93	6	32
<i>Kyllinga erecta</i>	1.2	0.15	1.57	0.17	0.36	0.25	302	283	11	47
Least Significant Difference	0.5	0.08	0.99	0.22	0.60	0.61	147	35	3	27

Table 2 - Macro-nutrient levels of some prominent weeds (stem)

Weed species	Nutrient%									
	N	P	K	Na	Ca	Mg	Fe (ppm)	Mn (ppm)	Cu (ppm)	Zn (ppm)
<i>Cleome vrscosa</i>	1.9	0.36	4.19	0.10	0.78	0.20	223	45	8	303
<i>Euphorbia heterophylla</i>	0.5	0.31	2.49	0.01	0.71	0.23	81	28	10	47
<i>Euphorbia hirta</i>	0.8	0.26	2.62	0.02	0.61	0.17	181	60	6	29
<i>Commelina benghalensis</i>	1.5	0.30	4.54	0.37	0.89	0.84	155	79	5	46
<i>Vernonia cinerea</i>	0.8	0.18	3.21	0.10	0.41	0.14	128	26	5	63
<i>Scoparia dulcis</i>	0.7	0.14	1.34	0.05	0.45	0.14	145	110	4	56
<i>Achyranthes aspera</i>	0.9	0.24	2.69	0.05	0.63	0.19	357	49	8	46
<i>Acalypha indica</i>	1.2	0.24	3.54	0.18	0.97	0.27	167	101	3	46
<i>Tridax procumbens</i>	1.1	0.34	4.12	0.03	0.64	0.20	136	48	4	40
<i>Kyllinga eresia</i>	0.6	0.11	1.87	0.22	0.12	0.12	108	211	5	21
Least Significant Difference	0.26	0.09	1.00	0.11	0.21	0.10	70	28	2	25

Table 3 - Macro-nutrient levels of some prominent weeds (roots)

Weed species	Nutrient %									
	N	P	K	Na	Ca	Mg	Fe (ppm)	Mn (ppm)	Cu (ppm)	Zn (ppm)
<i>Cleome vrscosa</i>	1.3	0.30	2.26	0.25	0.37	0.11	875	45	10	163
<i>Euphorbia heterophylla</i>	0.5	0.10	0.93	0.12	0.26	0.12	553	18	21	77
<i>Euphorbia hirta</i>	0.8	0.16	0.95	0.06	0.20	0.09	389	18	10	39
<i>Commelina benghalensis</i>	1.2	0.25	1.89	0.21	0.56	0.38	504	29	7	42
<i>Vernonia cinerea</i>	0.5	0.07	1.60	0.03	0.17	0.08	391	34	4	66
<i>Scoparia dulcis</i>	0.7	0.10	0.85	0.40	0.22	0.13	876	81	5	74
<i>Achyranthes aspera</i>	0.7	0.15	1.37	0.04	0.47	0.16	517	49	6	55
<i>Acalypha indica</i>	0.8	0.20	1.17	0.09	0.33	0.18	643	34	5	36
<i>Tridax procumbens</i>	0.9	0.18	1.28	0.05	0.21	0.07	476	65	6	24
<i>Kyllinga erecta</i>	0.5	0.17	0.69	0.09	0.10	0.08	413	78	12	31
Least Significant Difference	0.29	0.07	0.45	0.08	0.10	0.10	300	13	5	46

### **3. RESEARCH PROJECTS**

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

##### **Experiment 1.5.1 : Effect of coir dust on the physical condition of the soil. Heemmeliyagara Estate, Hiruwalpola (1984).**

A preliminary analysis of the data from 1985 to 1989 showed a general increase in female flower production in plots treated with high levels of coir dust. However, such differences were not discernible in nut and copra yields.

A detailed analysis of data is in progress.

*K S Jayasekara & L P Vidhana Arachchi*

##### **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 leaf samples were collected during July-August. Manuring was postponed in order to apply the fertilizer depending on the leaf nutrient levels. This is necessary to avoid any adverse effects by nutrient deficiencies on the main effect of soil moisture, the levels of which were monitored using the neutron probe.

*K S Jayasekara & L P Vidhana Arachchi*

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

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

The objectives of the experiment are 1) to evaluate the water, nutrient, soil and light balance in coconut plantations by considering all inputs (ie: rainfall, fertilizer, light etc.) and outputs of the closed "Black box" system, and 2) to identify and evaluate the efficiencies and constraints of the various processes within the system in an attempt to improve the overall productivity.

Initial studies of this experiment were reported in the Annual Reports of 1988 and 1989 under the title "Rainfall interception in coconut plantations".

During the year, monitoring of rainfall interception was continued. The total amount of intercepted rain water and its nutrient content were determined. Canopy drippings were found to have high levels of N and K, with nitrogen being predominant in the form of NO<sub>3</sub> and organic-N.

A 1 m x 1 m x 1 m cement tank was constructed at the lowest point of a sloping land planted with coconut seedlings at Bandirippuwa Estate to collect the run-off water to monitor soil erosion and nutrient losses with run-off.

The experiments are in progress.

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

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

### **Experiment 7.1 : Effect of NPK fertilizer and organic manure on coconut (CRIC 65). Bandirippuwa Estate, Lunuwila (1984).**

Seventh basal dose of 4.5 kg of CU1 fertilizer mixture/palm and sixth application of 20 kg of goat dung (in addition to CU1) to half of the treatment palms (ie. 3 palms/plot) in each plot were carried out in June. Two kg of dolomite were applied to all palms in September.

Statistical analysis of the results are in progress. However, there is an indication of an increasing trend in the number of nuts and the copra yield with time in plots treated with organic manure supplemented with inorganic fertilizer over treatment of inorganic fertilizer only (control).

*M B M N Dias*

### **Experiment 7.6 : Levels of organic manure (goat dung) supplemented with inorganic.**

7.6.1:	Heemmeliyagara Estate	-	Hiruwalpola	(1984)
7.6.2:	Kiniyama Estate	-	Weerapokuna	(1984)
7.6.3:	Saraswathie Estate	-	Divulapitiya	(1984)

Experiments 7.6.1 and 7.6.2 were terminated in March and July, respectively, and leaf and soil samples were collected. Statistical analysis showed no significant differences among treatments.

In experiment 7.6.3, the fifth differential application of organic manure supplemented with inorganic fertilizers was completed in July.

Statistical analysis of nuts and copra yield is in progress. The final leaf and soil samples will be collected in February 1991, before the termination of the experiment.

*M B M N Dias*

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

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

The Differential Fertilizer Recommendation Computer Model (DFR) that was developed based on the leaf/soil nutrient level and present/"potential/target" productivity of the coconut plantation was further modified to include the use of Eppawala Rock Phosphate.

The DFR service was provided to 83 coconut estates (>50 ac) covering an area of about 14463 acres. The status of N, P, K, Mg, Cl, S and B in these estates are given in Figs. 1-7. A total of 704 leaf (14th) samples were collected from the 83 coconut estates and analyzed for relevant nutrients.

The data show that nearly 48% of the palms in estates had adequate or excess levels of leaf nitrogen (N), while about 94% of the palms had adequate or excess levels of leaf phosphorus (P). However, nearly 70% of the palms were deficient in both potassium (K) and magnesium (Mg). Data on the chlorine (Cl) and sulphur (S) show that about 20% of the palms have low levels, requiring corrective measures. Boron (B) was not found to be deficient in any of the estates. Inferences were based on the "sufficiency" ranges of N 1.9-2.1%, P 0.11-0.13%, K 1.2-1.4%, Mg 0.25-0.35%, Cl 0.3-0.6%, S 0.15-0.20% and B 8-10 ppm (Jayasekara, 1988). The results show the importance of leaf analysis-based DFR Programme, where any possible nutrient deficiency can be detected early to provide remedial measures.

Further refinements of the DFR Computer Model are in progress with new data and cost/price factors. Studies are also in progress to extend this facility small-holder sector of coconut.

Data from the DFR Programme are being used to monitor annually the nutritional status of coconut plantations and to prepare a nutrient map (Expt. 7.13). This service has also assisted the Institute in establishing a close rapport with the planting community and to obtain a feed-back on the nutritional problems encountered in coconut lands.

*K S Jayasekara*

### *b) FAO Fertilizer Project*

Two tri-partite (FAO-CCB-CRI) meetings were held to review and monitor the progress of the project. It was decided to use the "Adult Coconut (0-6-32-5)" mixture and organic manure/urea for these plots. This move is expected to popularize the use of organic manures and/or green manures for the nitrogen requirement, instead of Urea. For example, ten plants could annually provide about 30 kg fresh leaves, adequate for one coconut palm. Accordingly, planting of glyricidia along the perimeter of the plots in double row with triangular spacing of 0.6 m was recommended.

Leaf analysis data collected over the years showed that leaf K and Mg levels in certain plots were low. This was later confirmed by field inspections. The DFR Model was used to determine the fertilizer requirements, and these rates will be applied in a few selected plots for verification studies.

The available data are being further analyzed with a view to formulate Location-Specific General Fertilizer Recommendations (LS-GFR) for the small-holder sector.

*K S Jayasekara*

**Experiment 7.9.1: Studies on K-Mg interaction in coconut. Heemmeliyagara Estate, Hiruwalpola (1984). (Funded by CIDA)**

*Leaf analysis* : Analysis of leaf (14th) samples collected in December 1989 showed a significant ( $P=0.05$ ) increase in leaf K and highly significant ( $P=0.001$ ) decrease in Mg for increased application of K.

Application of increased levels of Mg caused significant ( $P=0.05$ ) linear increase in Mg (Table 4).

Statistical analysis of the yield data, for the years 1986, 1987, 1988, and 1989 in terms of nuts and copra showed neither a significant response to the main treatments K and Mg nor any interaction between them.

A combination of factors contributed to the lack of yield response; "no fertilizer" plots performing much better than the others at the commencement of the studies (Table 5); delayed application of fertilizers due to prolonged drought periods, compounded by drought itself on yield response.

The experiment was terminated as no response were observed at the end of 1989.

*M Jeganathan*

**Experiment 7.9.2: Studies on K-Mg interaction in coconut. Sirikandura Estate, Dodanduwa (1984). (Funded by CIDA)**

*Soil analysis* : Analysis of the soil samples collected in April 1988 showed, as expected, a significant linear and quadratic build up in the concentration of both K and Mg for the increased application of K and Mg, in the form of muriate of potash and kieserite. It was also observed that in both cases the concentration in the top soil (0-25 cm) was much higher than that in the sub-soil (25-50 cm). The results are presented in Tables 6 and 7.

Table 4 - Nutrient concentration in leaf due to differential application of K & Mg at Heemeliyagara Estate Expt.(7.9.1) December 1989 - (14 leaf - % DM)

Treatment	N	P	K	Ca	Mg
K1	1.80	0.127	0.82	0.521	0.384
K2	1.80	0.123	0.96	0.529	0.332
K3	1.78	0.125	1.05	0.546	0.317
K4	1.84	0.127	1.10	0.509	0.292
Mg1	1.80	0.130	0.93	0.502	0.305
Mg2	1.79	0.122	0.98	0.549	0.318
Mg3	1.81	0.124	1.10	0.498	0.338
Mg4	1.82	0.124	0.91	0.555	0.365
K1Mg1	1.80	0.137	0.58	0.463	0.370
K1Mg2	1.85	0.122	0.75	0.530	0.343
K1Mg3	1.86	0.126	1.24	0.550	0.410
K1Mg4	1.68	0.124	0.72	0.540	0.413
K2Mg1	1.74	0.127	0.90	0.500	0.303
K2Mg2	1.76	0.113	0.98	0.543	0.290
K2Mg3	1.89	0.123	0.89	0.567	0.363
K2Mg4	1.28	0.131	1.06	0.507	0.373
K3Mg1	1.82	0.131	1.17	0.507	0.283
K3Mg2	1.71	0.122	1.01	0.543	0.310
K3Mg3	1.77	0.128	1.17	0.470	0.303
K3Mg4	1.83	0.121	0.87	0.663	0.373
K4Mg1	1.85	0.126	1.08	0.540	0.263
K4Mg2	1.85	0.132	1.20	0.580	0.330
K4Mg3	1.72	0.121	1.10	0.407	0.277
K4Mg4	1.94	0.130	1.01	0.510	0.300
Sig. Level					
	-	-	-	-	***
K					
q					
	-	-	-	-	
Mg					
q	-	-	-	-	
K&Mg.	-	-	-	-	
CV%	6.82	9.44	28.22	15.61	18.13

\* P = 0.5; \*\* P = 0.01; \*\*\* P = 0.001

l = linear response; q = quadratic response

Table 5 - Rainfall at Heemmeliyagara Estate (7.9.1) and Sirikandura Estate (7.9.2) and yield of the control (no fertilizer) treatment at both estates.

Year	Rainfall (mm)	Wet Days	Nuts/ha	Copra/ha (kg)
<i>Heemmeliyagara Estate</i>				
1984	1815	87	-	-
1985	1262	55	11179	2074
1986	885	44	9263	1501
1987	1134	59	5649	751
1988	807	42	5267	898
<i>Sirikandura Estate</i>				
1984	2240	133	-	-
1985	2724	164	9381	1936
1986	1990	174	8907	1783
1987	2676	149	8117	1541
1988	2505	137	6590	1249

*Leaf analysis* : Results from the analysis of the 6th and 14th leaves, for samples collected in October 1989, are given in Tables 8 and 9. Both leaves showed highly significant ( $P=0.001$ ) responses to increased application of K.

Application of K showed significant linear and quadratic responses for K, Ca, and Mg with respect to both 6th and 14th leaves, K showed increasing concentration and Ca & Mg, the opposite effect. Significant linear responses were also observed for both leaves with respect to Na and Cl, a decrease for Na and an increase for Cl. Phosphorus showed a significant response ( $P=0.05$ ) for the first time, increasing linearly in leaf 6 and decreasing in leaf 14. N remained unaffected.

Increasing the rates of Mg application showed a highly significant increase in Mg in both leaves. The similar trend was observed for 1988, the fourth year of the experiment.

*Nut water analysis* : Analysis of nut water collected in June

1990 showed highly significant responses to the increased application of K, Na, Ca and Cl exhibiting both linear and quadratic responses (Table 10).

Mg application showed a significant linear increase in Mg and decrease in both Ca and Cl. The latter was not observed in leaf analysis.

Table 6 - Nutrient concentration in the soil due to differential application of K & Mg  
Sirikanudra Estate (7.9.2) - April 1988 (meq% ; depth 0.9")

Treatment	Na	K	Ca	Mg	Cl
K1	0.052	0.111	1.37	0.495	25.97
K2	0.052	0.148	1.36	0.446	31.87
K3	0.070	0.377	1.46	0.492	30.51
Mg1	0.060	0.205	1.32	0.139	30.32
Mg2	0.075	0.215	1.46	0.554	27.20
Mg3	0.039	0.214	1.41	0.741	30.83
K1Mg1	0.043	0.100	1.46	0.170	22.04
K1Mg2	0.063	0.120	1.41	0.473	29.31
K1Mg3	0.050	0.113	1.25	0.843	26.57
K2Mg1	0.050	0.140	1.07	0.050	31.80
K2Mg2	0.066	0.167	1.52	0.633	27.47
K2Mg3	0.040	0.137	1.49	0.657	36.35
K3Mg1	0.087	0.377	1.43	0.197	37.13
K3Mg2	0.097	0.360	1.46	0.557	24.82
K3Mg3	0.027	0.393	1.50	0.723	29.58
Sig. Level					
I	-	***	-	-	-
K					
q	-	***	-	-	-
I	-	-	-	***	-
Mg					
q	-	-	-	-	-
K&Mg					
CV%	59.18	21.35	15.00	25.65	20.94

\*p = 0.05; \*\*p = 0.01; \*\*\*p = 0.001

I = linear response; q = quadratic response

*Yield* : Analysis of each of the four years data from 1986 to 1989 showed highly significant responses (P=0.001) in terms of copra production to increased application of K (Table 11).

Table 7 - Nutrient concentration in the soil due to differential application of K & Mg  
Sirikandura Estate (7.9.2) April 1988 (meq %, depth 9-18")

Treatment	Na	K	Ca	Mg	Cl (ppm)
K1	0.042	0.052	0.704	0.191	31.47
K2	0.050	0.131	0.883	0.252	30.68
K3	0.044	0.307	0.647	0.217	30.90
Mg1	0.044	0.156	0.778	0.142	29.26
Mg2	0.048	0.171	0.705	0.197	31.28
Mg3	0.044	0.163	0.751	0.321	32.51
K1Mg1	0.053	0.057	0.623	0.033	31.11
K1Mg2	0.037	0.053	0.726	0.167	33.68
K1Mg3	0.037	0.047	0.763	0.373	29.61
K2Mg1	0.043	0.170	0.990	0.240	28.16
K2Mg2	0.050	0.120	0.870	0.227	31.47
K2Mg3	0.057	0.103	0.790	0.290	32.43
K3Mg1	0.035	0.240	0.720	0.153	28.51
K3Mg2	0.057	0.340	0.520	0.196	28.70
K3Mg3	0.040	0.340	0.700	0.300	35.48
Sig. Level					
1	-	***	-	-	-
K					
q	-	**	-	-	-
1	-	-	-	-	-
Mg					
q	-	-	-	-	-
K&Mg.	-	**	-	-	-
CV%	32.82	21.63	39.33	62.42	14.71

\*P = 0.05; \*\*P = 0.01; \*\*\*P = 0.001

1 = linear response; q = quadratic response

Table 8 - Nutrient concentration in leaf K and Mg at Sirikandura Estate (7.9.2)  
October 1989 (6th leaf - % DM)

Treatment	N	P	Na	K	Ca	Mg	Cl
K1	2.25	0.145	0.343	0.59	0.354	0.225	0.389
K2	2.29	0.149	0.300	1.30	0.270	0.143	0.624
K3	2.26	0.153	0.173	1.68	0.269	0.128	0.887
Mg1	2.28	0.149	0.277	1.23	0.305	0.119	0.531
Mg2	2.32	0.150	0.284	1.19	0.301	0.177	0.643
Mg3	2.21	0.147	0.255	1.14	0.287	0.201	0.726
K1Mg1	2.30	0.144	0.410	0.63	0.340	0.153	0.490
K1Mg2	2.31	0.150	0.320	0.64	0.360	0.250	0.303
K1Mg3	2.15	0.140	0.300	0.50	0.363	0.273	0.373
K2Mg1	2.30	0.149	0.250	1.41	0.277	0.093	0.567
K2Mg2	2.30	0.146	0.340	1.24	0.260	0.147	0.643
K2Mg3	2.28	0.152	0.310	1.26	0.273	0.190	0.663
K3Mg1	2.24	0.153	0.170	1.66	0.300	0.110	0.537
K3Mg2	2.34	0.155	0.193	1.70	0.283	0.133	0.983
K3Mg3	2.20	0.150	0.157	1.67	0.223	0.140	1.140
Sig. Level							
		*	***	***	***	***	**
K							
q				*	**	*	
						***	
Mg							
q							
K&Mg							
CV%	4.33	5.16	22.21	14.03	11.28	18.40	46.63

P = 0.5; \*\* P = 0.01; \*\*\* P = 0.001

l = linear; q = quadratic response.

Table 9 - Nutrient concentration in leaf due to differential application of K and Mg at Sirikandura Estate (7.9.2) October 1989 (14th leaf - %DM)

Treatment	N	P	Na	K	Ca	Mg	Cl
K1	2.10	0.140	0.219	0.57	0.445	0.248	0.389
K2	2.09	0.133	0.215	1.12	0.309	0.105	0.500
K3	2.08	0.132	0.154	1.44	0.300	0.082	0.668
Mg1	2.05	0.129	0.202	1.09	0.339	0.082	0.569
Mg2	2.13	0.138	0.193	1.04	0.361	0.155	0.513
Mg3	2.09	0.139	0.193	0.98	0.354	0.198	0.474
K1Mg1	2.17	0.139	0.270	0.63	0.430	0.133	0.520
K1Mg2	2.09	0.145	0.190	0.60	0.467	0.290	0.323
K1Mg3	2.05	0.136	0.197	0.48	0.440	0.320	0.323
K2Mg1	1.88	0.120	0.187	1.21	0.270	0.043	0.520
K2Mg2	2.23	0.141	0.233	1.15	0.310	0.107	0.510
K2Mg3	2.17	0.140	0.227	0.99	0.347	0.167	0.470
K3Mg1	2.10	0.130	0.150	1.45	0.317	0.070	0.667
K3Mg2	2.08	0.127	0.157	1.39	0.307	0.070	0.707
K3Mg3	2.05	0.141	0.157	1.47	0.277	0.107	0.630
Sig. Level							
	-	*	**	***	***	***	**
K							
q	-	-	-	-	**	**	-
	-	-	-	-	-	***	-
Mg							
q	-	-	-	-	-	-	-
K&Mg	**	*	-	-	-	-	-
CV%	4.71	5.95	22.55	14.05	12.98	31.34	32.05

\* P = 0.05; \*\* P = 0.01; \*\*\* p = 0.001

| = linear; q = quadratic response

Table 10 - Nutrient concentration in nut water due to differential application of K & Mg at Sirikandura Estate (7.9.2) - June 1990

Treatment	Na	K	Ca	Mg	Cl
K1	353	1183	199	117	1714
K2	196	1983	167	121	1920
K3	117	2281	189	116	1877
Mg1	223	1838	200	113	1892
Mg2	225	1820	185	117	1845
Mg3	217	1790	171	124	1774
K1Mg1	376	1165	193	112	1800
K1Mg2	335	1239	192	115	1723
K1Mg3	347	1144	211	123	1619
K2Mg1	180	2003	194	116	1958
K2Mg2	210	1959	159	116	1910
K2Mg3	197	1989	148	133	1893
K3Mg1	113	2346	212	112	1918
K3Mg2	130	2262	203	122	1902
K3Mg3	106	2236	152	116	1811
Sig. Level					
	***	***	**	-	**
K					
q	.	***	-	-	**
	.	-	**	.	.
Mg					
q	-	-	-	-	-
K&Mg	-	-	-	-	-
CV%	15.22	6.12	11.31	8.04	4.99

\* P = 0.05; \*\* P = 0.01; \*\*\* P = 0.001

l = linear; q = quadratic response

Table 11 - Weight of copra due to differential application of K and Mg at Sirikandura Estate  
(kg copra/ha - 158 palms/ha)

Treatment/palm/year		Copra/ha	%	Difference (Copra/ha)
<b>Yield 1986</b>				
K1	0.0	1668	100	-
K2	1.2	1882	113	214
K3	2.4	1985	119	317
<b>Yield 1987</b>				
...				
K1	0.0	1442	100	-
K2	1.2	1798	125	356
K3	2.4	1843	129	401
<b>Yield 1988</b>				
...				
K1	0.0	1127	100	-
K2	1.2	1559	138	356
K3	2.4	1696	150	569
<b>Yield 1989</b>				
...				
K1	0.0	1124	100	-
K2	1.2	1643	146	519
K3	2.4	1667	148	543

\* P = 0.05; \*\* P = 0.01; \*\*\* P = 0.001

However, for each successive year, copra production continued to decline with increased rates of K, perhaps due to induced Mg deficiency, as indicated by low Mg levels (0.25 to 0.30%) in leaf 14 at the rates of treatments imposed or due to some other ionic imbalance. In order to overcome this, modifications were introduced to the treatments as follows:

original treatment	Muriate of Potash (60% K <sub>2</sub> O) kg/palm/y	original	Kieserite (24% MgO) kg/palm/y	modified*
K1	0.0	Mg1	0.0	0.0*
K2	1.2	Mg2	0.6	1.2
K3	2.4	Mg3	1.2	2.4

\*An additional 0.8 kg dolomite was incorporated to the modified treatments.

The basal application of urea and saphosphosphate, each at the rate of 0.7 kg/palm/y remained the same for all palms in all treatments.

The modified treatment was introduced in the fifth fertilizer application done in May, with half the palms in each plot (4 palms) receiving the original treatment, and the rest (4 palms) double the dose of kieserite and an additional 0.8 kg of dolomite, with muriate of potash remaining the same.

However, the drop in yield of copra in the "no fertilizer" plots has been drastic, 32.6% between 1986 and 1987 (Table 17). During the same period, at the K1 and K2 levels, the decreases have been 12.7% and 16.0%, respectively. Fertilizer application has, to some extent, arrested the decline in copra production.

*M Jeganathan*

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

The objectives of this study are to 1) prepare a nutrient status map of the coconut growing soils in Sri Lanka to be used as a guide in fertilizer recommendations, 2) evaluate the nutrient supply capacity of different coconut soils, and 3) annually monitor the nutrient status of coconut palms/soils.

This study uses the data collected from experiment 7.7. All previous leaf and soil analytical results were collated and processed for analysis.

In general, data show that the present nutritional order of priority for adult coconut palms as  $K > Mg > N > P > S > Cl > B$ . This is a marked deviation from the conventional NPK approach. Magnesium (Mg) and potassium (K) appear to be the yield limiting nutrients in about 70% of the coconut plantations, while nitrogen (N) and phosphorus (P) were adequate in about 90% of the lands.

Leaf sulphur (S) and chlorine (Cl) levels were also found to be at marginal levels (ie: Figs. 5 and 6) in about 20% of the lands. Such situations will require application of appropriate nutrients to supply S and Cl. Earlier work has shown that S is supplied via rain water and Cl via sea spray. The distance of plantations from industrial areas (sulphur fumes) and from the sea could affect supplies. These studies once again demonstrate the benefits of leaf analysis for monitoring nutrient status of palms.

Studies on other nutrients (Ca, Na, Fe, Mn, Cu, Zn, Mo, etc.) are also in progress.

*K S Jayasekara*

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

**Experiment 24.1 : The effect of frequency and rate of drip irrigation on the soil-plant water relations and the productivity of coconut. Marandawila NLDH Farm, Marandawila (1987).**

Yield records were maintained but the irrigation treatments could not be imposed on schedule due to the lack of water. Bowser irrigation also could not be done satisfactorily due to several problems. However, few neutron probe measurements were taken during the dry period.

*LP Vidhana Arachchi & K S Jayasekara*

**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 carried out and plants were fertilized with YPM (13-12-17) fertilizer mixture at the rate of 800 g/seedling in May and in September, and 1 kg/seedling of dolomite in September. Several growth parameters (leaf number, leaf area) and leaf nutrient levels were measured. Currently, plants show different growth responses to differential irrigation treatments. The trial is in progress.

*K S Jayasekara*

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

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

The objectives of the experiments are to 1) evaluate the resistance to water flow in different plant parts 2) investigate the water relations of abnormal palms, different cultivars and intercrops and 3) map hydrological architecture of coconut and intercrops.

Pressure regulated water suction system was prepared to measure the conductivity of water under different sections. Preliminary studies show a high resistance to water entry in coconut roots.

Vascular system in the growing section of the stem of an adult palm and a seedling was studied by dissection. Vascular system between leaves were found to be interconnected and hence a trial was initiated to apply nutrients to axils of leaves. Initial results show that axil feeding of fertilizers increases the leaf/palm K, Mg, and N nutrient levels within a week. Trials were commenced to test the practical applicability of this technique under field conditions.

*K S Jayasekara*

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

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

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)

The objective of the study is to verify and modify the DFR Model in order to achieve a sustainable high productivity with increased profits.

All seven estates of the CRI were given the relevant fertilizer recommendations based on the DFR Model and the progress is being monitored regularly.

*K S Jayasekara*

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

##### **4.1 Studies on dolomite and NPK fertilizer in coconut**

Loss of nitrogen through ammonia under several application methods were conducted with urea and ammonium sulphate-based mixtures under a wide range of soil water and atmospheric conditions. The study is in progress.

*T W Fernando & K S Jayasekara*

##### **4.2 Sea water in irrigation of coconut**

Differential sea water irrigation treatments were continued. Coconut seedlings were fertilized with 500 g of YPM (13-12-17) mixture seedling in May and October during the monsoonal rains and 1 kg dolomite/seedling in October. Plant growth parameters (leaf number and area) and leaf nutrient levels were monitored, as scheduled.

Seedlings show discernible growth differences in response to different treatments. The trial is in progress.

##### **4.3 Nutrient culture (hydroponics) technique in coconut**

Growth of seedlings was less vigorous than anticipated and some root decay was noted. The cause for the root decay could not be identified, but plants recovered after cleaning the root system with fresh water. Few plants were treated with high rates of fertilizer in order to ascertain the toxic level of nutrient concentration. Studies on the effect of aeration on nutrient uptake and related nutritional and physiological aspects are in progress.

*D P Panditharatne and K S Jayasekara*

#### **4.4 Ground water nutrient study**

Monitoring of the nutrient levels in 19 locations (ie: 17 wells, 1 pond and 1 stream) at Bandirippuwa Estate, Lunuwila was continued. Analysis show high levels of N, K and Mg in the ground water in certain locations. The levels of K and Mg increased after heavy rain fall, indicating high leaching losses of K and Mg. The studies are in progress.

*U S S Perera & K S Jayasekara*

#### **4.5 Coir dust in manure circle of coconut**

Soil and leaf samples were collected for nutrient analysis. Infiltration and soil moisture storage capacities increased with the addition of coir dust. Nitrogen dynamics and root growth studies are in progress.

*E M A T Banda & K S Jayasekara*

#### **4.6 Evaluation of the Ion Exchange Resin Method for Soil Extraction - Ph D studies, Mr L L W Somasiri, University of Aberdeen.**

This study involves the evaluation of Anion and Cation Exchange Resin method for soil analysis and its comparison with other accepted methods. Soil sampling was carried out at monthly intervals at Sirikandura Estate in the expt. No. 7.9. A total of 576 soil samples were analyzed using the Anion and Cation Exchange Resin method, ammonium acetate extraction method, acetic acid extraction method, extraction with water and Bray & Kurtz method.

Four sets of leaf samples were also collected during this period. The results will be presented in a thesis for Ph.D at the University of Aberdeen in 1991.

*L L W Somasiri*

#### **4.7 Studies on irrigation systems for coconut plantations**

A prototype of the irrigation system described by Jayasekara and Mahindapala (1988) was installed in an area of 1 ha mature coconut plantation at Ratmalagara estate, Madampe with financial assistance from the Coconut Development Authority to demonstrate the equipment and benefits of irrigation and to study the different hydrological aspects.

Water is fed into the sub-terranean reticulation system (at 0.5 m depth) via a 8000 l overhead tank.

Detail studies are in progress and the system is available for demonstrations.

*D P Panditharatne, E M A T Banda & K S Jayasekara*

## **5. CHEMICAL, PHYSICAL AND MICROBIOLOGICAL ANALYSIS**

**5.1 Analytical standards** The division continued to participate in the Leaf Sample Exchange Programme (LSEP) under the International Plant Analytical Exchange (IPE) organized by the University of Wageningen, the Netherlands. Twenty four leaf samples were analyzed for N, P, K, Ca, Mg, S, Cl, Na, Fe, Mn, Cu, Zn and B at two monthly intervals during the year.

Annual review of the LSEP-ISE showed that 300 entries of analysis were comparable with that of other international laboratories throughout the world, out of a total of 312 analyses conducted by the division.

The division also participated in the Soil Sample Exchange Programme (SSEP) under the International Soil-Analytical Exchange (ISE) organized by the University of Wageningen, The Netherlands. Four soil samples were analyzed for Total (K, Mg, Mn, N, Na, P, Zn, Cu, Fe), pH-H<sub>2</sub>O (1:5), pH-CaCl<sub>2</sub> (1:10), Extractable with CaCl<sub>2</sub> 0.01 M 1:10 w/v (Cu, Fe, K, Mg, Mn, Na, Zn), Extractable with 1 M NH<sub>4</sub>OAC (Ca, K, Mg, Na).

Annual review of the SSEP-ISE showed that 85 entries of analysis were comparable with other international laboratories, out of a total of 92 analysis.

**5.2 Leaf, Soil, Fertilizer and Water Analysis** A total of 2321 leaf samples were analyzed N, P, K, Ca and Mg. About 75% of these samples were analyzed for Cl, S, B, Fe, Mn, Cu, Zn and Mo.

One thousand four hundred and eight soil samples were analyzed for pH and conductivity. About half of these samples were analyzed for Total N, Exch. K, Exch. Mg avail. P (Bray/Olsen) and Total Exchangeable Bases (TEB). Forty five fertilizer (chemical and organic) and coir dust samples were analyzed for N, P, K, Mg and Organic-C.

Twenty two samples of toddy and 318 water (ground and rain water) samples were also analyzed for N, P, K, Mg, Cl, S, B, Fe, Mn, Cu, Zn and Mo.

A total of 862 soil samples were analyzed for several soil physical parameters such as bulk density (142 samples), particle size (40), particle density (38), available water (656 samples at 1/10, 1/3, 15 bar using pressure plate) and gravimetric moisture (250).

## **6. SERVICES AND EXTENSION ACTIVITIES**

**6.1 Electronic Workshop** Several minor repairs and maintenance work were carried out in the Soils and Plant Nutrition, Plant Physiology, Agronomy, Tissue Culture and Advisory and Information Divisions.

**6.2 Seminars/Field Days and Training Programmes** Mr K S Jayasekara briefed the JEDB Superintendents at the JEDB Office, Chilaw on the Differential Fertilizer

Recommendation and new "Adult Coconut 0-6-32-5" and organic/urea fertilizer package. Mr Jayasekara and other divisional staff conducted a programme for superintendents and other estate staff of CRI estates on the Differential Fertilizer Recommendation and on the "Adult Coconut" fertilizer package.

Mr K S Jayasekara and Miss M B M N Dias functioned as resource persons in two training programmes conducted at the Coconut Development Training Centre, Lunuwila.

Six student trainees from the National Apprenticeship Board were given a general training on fertilizer and cultural practices in coconut.

6.3 Advisory/Extension Work Eighty three coconut estates covering about 14463 acres were inspected for Differential Fertilizer Recommendations (DFR). As the data from the analysis were to be used in experiments 7.7 and 7.13, the changes for chemical analysis were waived off. Transport was provided by estates.

Field demonstrations on (magnesium deficiency and Fertilizer/Irrigation/Cultural practices) were well maintained and used in the field training programmes.

A 25-minute documentary on "Fertilizer Recommendations for Coconut" was prepared with the assistance of the Farm Broadcasting Unit of the Ministry of Agricultural Research and Development with financial assistance from the FAO Fertilizer Project. The documentary was telecast on 22 August under the fortnightly programme "Govithanai Divimagai". Public response for the telecast was very encouraging.

The divisional staff actively participated in the organizational and the conduct of the "Coconut Day" held on 25 November. Mr K S Jayasekara functioned as the Chairman of the Organizing Committee for this event.

## 7. REFERENCES

Jayasekara, K.S. and R Mahindapala, (1988). An irrigation system for a five-acre coconut plantation. *Coconut Bulletin* 5(1): 14-17.

Jayasekara, K.S. (1988). Status on Nutritional Deficiencies of Coconut in Sri Lanka. Proceedings of the "Working Group Meeting on Coconut Nutritional Deficiencies". Davao City, Philippines. pp 42.

## 7. ACKNOWLEDGEMENTS

The encouragement and co-operation rendered by Mr Naomal S Dias, Chairman, Coconut Research Board and Dr R Mahindapala, Director, Coconut Research Institute are gratefully acknowledged. Thanks are due to Mr D T Mathes/Head and Mr T S G Peiris, Biometrician of the Biometry Division for the assistance given in Biometry, to Dr (Mrs) C Jayasekara, Head, Plant Physiology Division for the assistance rendered in eco-

physiological studies, Mr M Jeganathan, ARP-Project Coordinator for the assistance on "Coconut Climber" and Dr M Rezanía for the analysis of data and valuable suggestions on the FAO Fertilizer Project. Assistance given by the Heads and staff of other research and services divisions of the Coconut Research Institute is sincerely appreciated. Cooperation from Janatha Estates Development Board (JEDB), National Livestock Development Board (NLDB) and Sri Lanka State Plantations Corporation (SPC), in the conduct of the field experiments in their plantations and the encouraging response from the coconut growers 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.

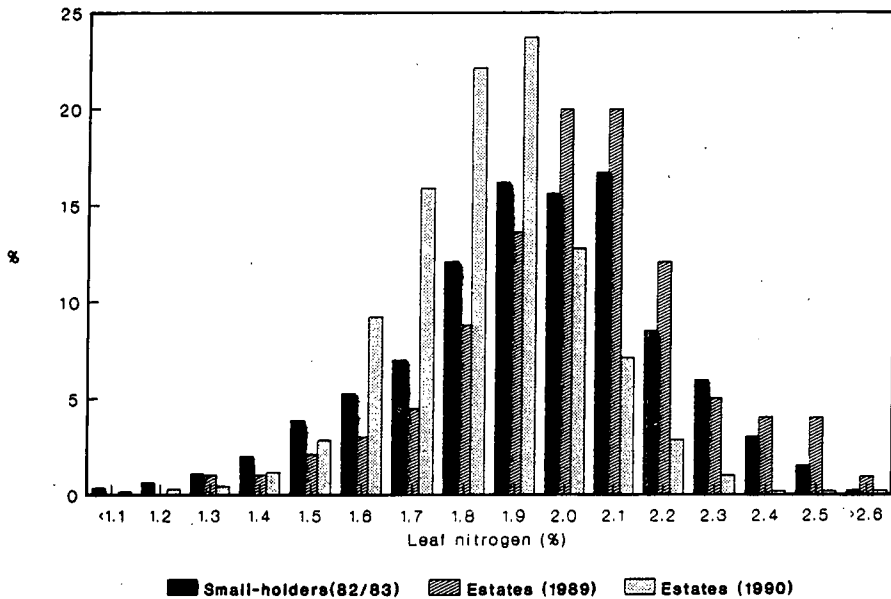
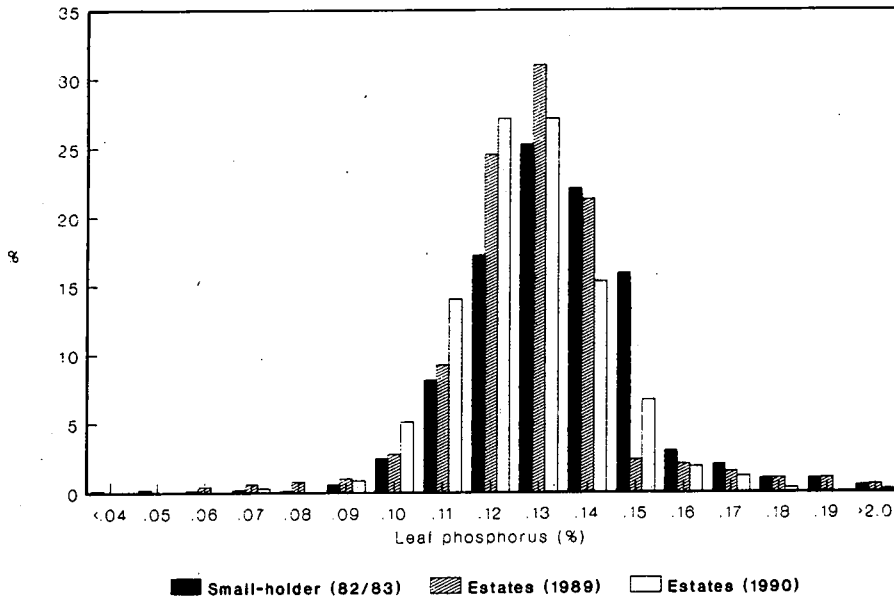
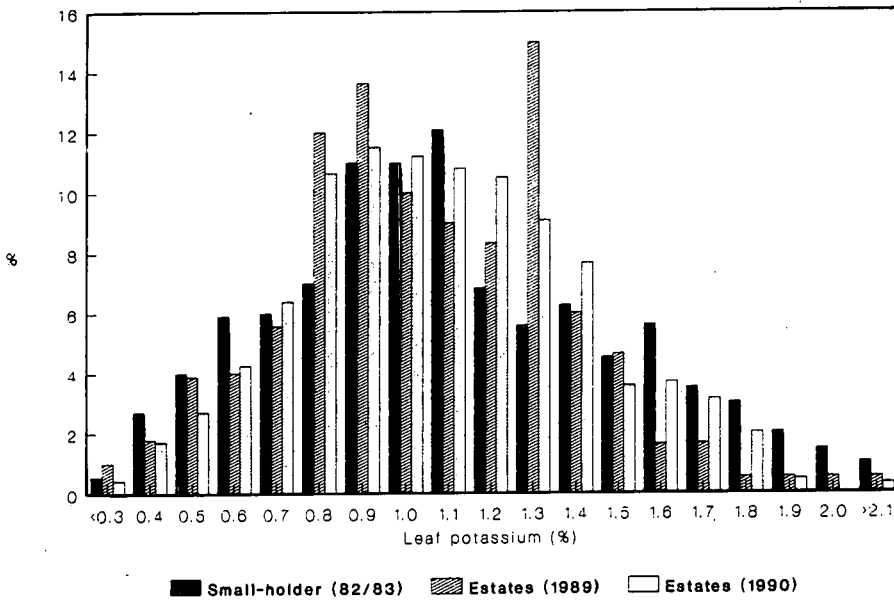


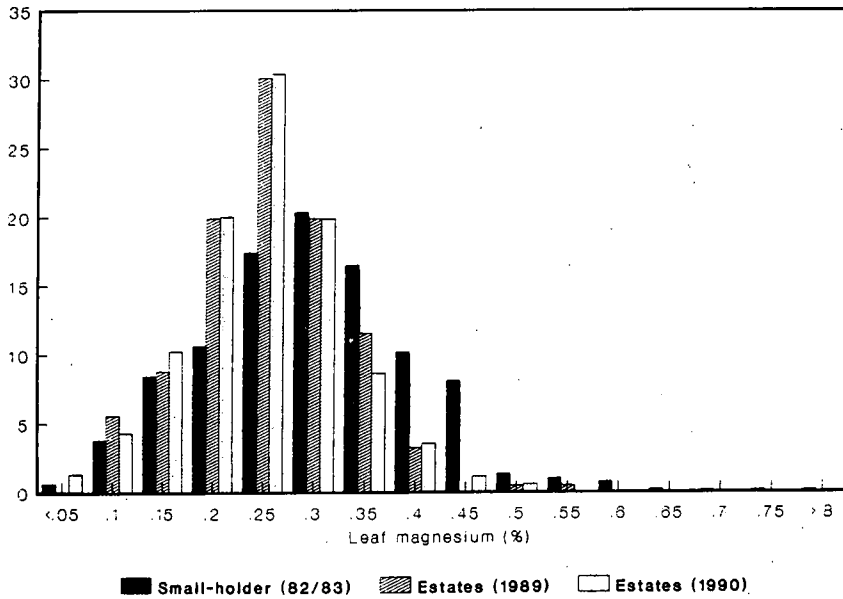
Fig. 1 - Status of nitrogen (N) in the 14th leaf, expressed as % occurrence (data from 1776 samples from small-holdings, 216 samples from estates - 1989 and 704 samples from estates - 1990).



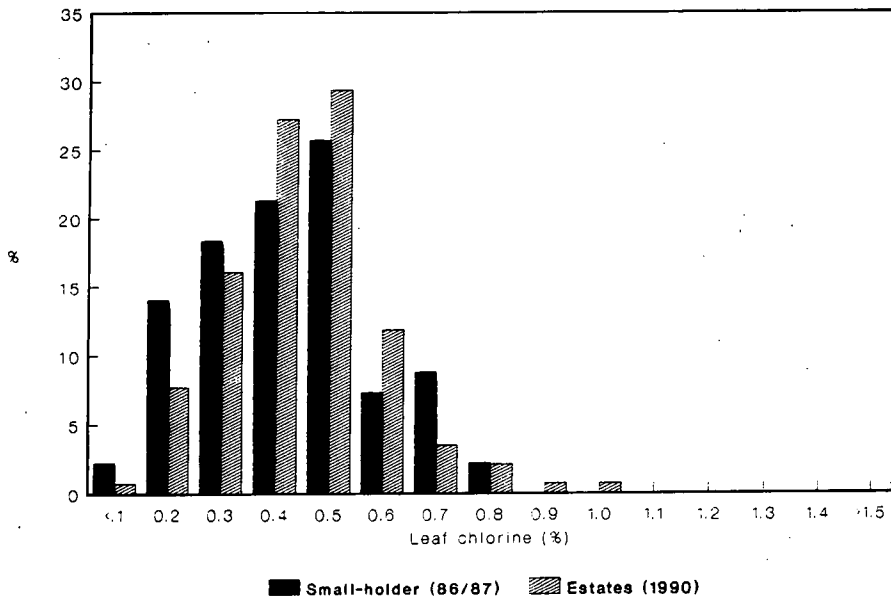
**Fig. 2 - Status of phosphorus (P) in the 14th leaf, expressed as % occurrence (data from 1776 samples from small-holdings, 216 samples from estates - 1989 and 704 samples from estates - 1990).**



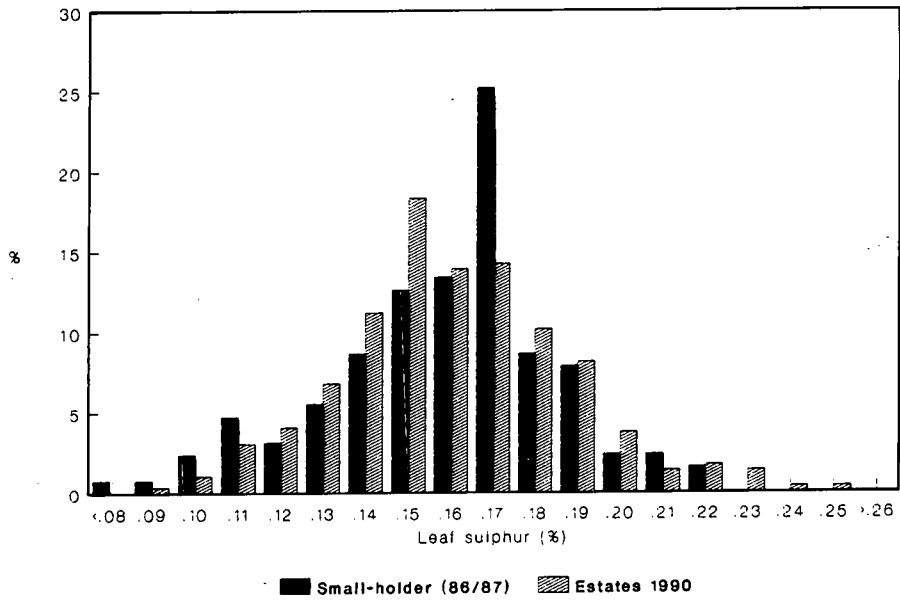
**Fig. 3 - Status of potassium (K) in the 14th leaf, expressed as % occurrence (data from 1776 samples from small-holdings, 216 samples from estates 1989 and 704 samples from estates - 1990).**



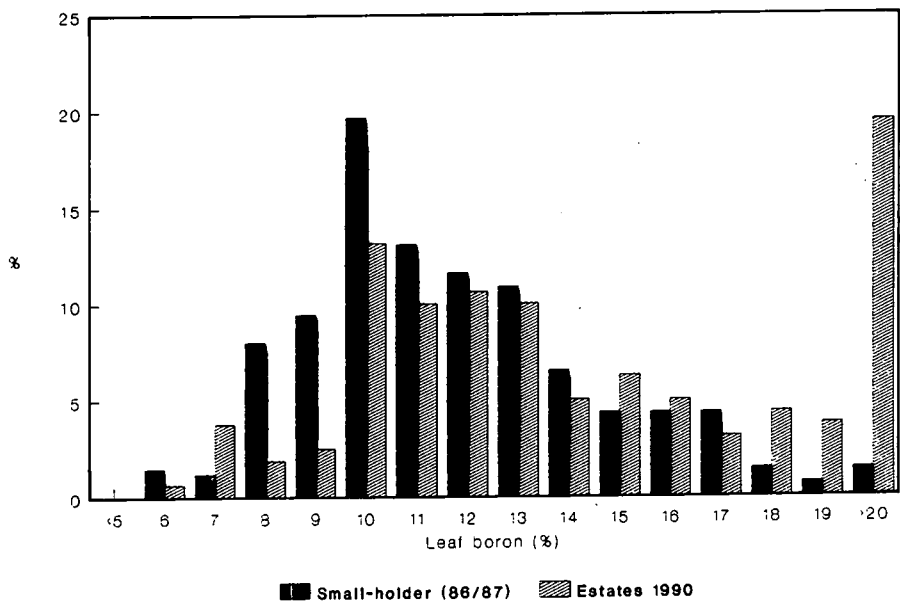
**Fig. 4 - Status of magnesium (Mg) in the 14th leaf, expressed as % occurrence (data from 1776 samples from small-holdings, 216 samples from estates - 1989 and 704 samples from estates - 1990).**



**Fig. 5 - Status of chlorine (Cl) in the 14th leaf, expressed as % occurrence (data from 136 samples from small-holdings and 295 samples from estates).**



**Fig. 6 - Status of sulphur (S) in the 14th leaf, expressed as % occurrence (data from 136 samples from small-holdings and 295 samples from estates).**



**Fig. 7 - Status of boron (B) in the 14th leaf, expressed as % occurrence (data from 136 samples from small-holdings and 295 samples from estates).**

# REPORT OF THE CROP PROTECTION DIVISION

Head - P A C R Perera, Ph D

## 1. GENERAL

The research programme of the division progressed satisfactorily, although restricted heavily by the limited research staff available. The collaborative research project with Peradeniya and Munster Universities on the insecticidal properties of extracts from selected Sri Lankan plants recorded significant findings. The division also participated in the multi-disciplinary research projects, on premature decline of palms, immature nutfall and earthworms in coconut soils, which are reported elsewhere.

## 2. RESEARCH PROJECTS

### PROJECT 8: POPULATION DYNAMICS OF THE PEST/PARASITOID COMPLEX OF THE COCONUT CATERPILLAR

#### Experiment 8.2.1 - Effect of nutrient status of plant on susceptibility to *Opistina arenosella* attack (1984).

The experiment was conducted in two parts; (a) seedlings grown in sand culture and (b) seedlings grown in nutrient solutions.

##### (a) *Seedlings grown in sand culture*

Two treatments, with 10 replicates for each treatment, were imposed by (a) using nutrient solutions to produce seedlings deficient in potassium and (b) using all nutrients. Leaf samples from the two sets of seedlings were analysed for foliar potassium. The mean values for potassium were 0.68% and 1.29%, for seedlings deficient in potassium and those supplied with all nutrients, respectively. The differences were highly significant ( $P < 0.001$ ).

Bioassay studies were then conducted by caging 20 freshly hatched *Opistina arenosella* larvae on each plant and recording differences in weight gain, survival, leaf area consumed and sex-ratio.

Although no statistically significant differences for the rate of development of *O. arenosella* larvae were recorded between the potassium-deficient seedlings and those provided with all nutrients for all parameters measured, the K-deficient treatments showed higher means for weight of larvae, survival of larvae, leaf area consumed per larva and female/male ratio.

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Contributions to the Multi-disciplinary Projects are reported separately.

(b) *Seedlings grown in nutrient solutions*

Significant ( $P < 0.01$ ) differences in the survival of larvae were recorded between the potassium-deficient seedlings and those provided with all nutrients with mean percent survival rates of 51.7 and 8.3, respectively. Comparisons of the other parameters were not possible due to the low survival on the balanced nutrition treatment (Table 1).

P A C R Perera, K F G Perera & K A S Chandrasiri

Table 1 - *Development and Survival of O. arenosella larvae on potassium deficient coconut seedlings (-K) and seedlings provided with all nutrient s(+All)*

Treatment	Replicate No	Leaf area consumed per larvae $\text{cm}^2 \times 10$	Percent pupated	Mean wt of pupa (g)	Sex ratio F:M	Percent Survival
-K	1	39.78	70.0	0.0170	2:5	70.0
	2	26.31	50.0	0.0179	2:3	50.0
	3	38.09	80.0	0.0237	3:5	80.0
	4	40.29	50.0	0.0219	2:3	50.0
	5	0	0	0	0	0
	6	23.57	60.0	0.0262	2:4	60.0
Total Mean		168.04	310.0	0.1067	11:20	310.0
		28.01	51.67	0.0213	0:55	51.67
+All	1	57.21	30.0	0.0238	1:2	30.0
	2	23.10	10.0	-	0:1	10.0
	3	0	0	-	-	0
	4	38.65	10.0	0.0195	0:1	10.0
	5	0	0	-	-	0
	6	0	0	0	-	0
Total Mean		118.96	50.0	0.0433	1:4	50.0
		19.82	8.33	0.0108	0:25	8.33

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

**Experiment 9.3 Pesticides from Sri Lankan plants for the control of coconut pests (Collaborative Project with the Universities of Peradeniya and Munster, Germany) (1990)**

During the year under review extracts from the plants *Albizia lebbek*, *Camellia sinensis*, *Pometia tomentosa*, *Phyllanthus debris*, *Nothopegia beddomei* and *Zanthoxylum rhetsa*, previously tested for insecticidal effects on the coconut caterpillar (*Opistha arenosella*), were tested on the red weevil (*Rhynchophorus ferrugineus*) larvae by incorporating the extract in an artificial diet.

The extracts were made by shaking the plant material with dichloromethane successively during two 24-hour periods and concentrating the combined extract to give the dichloromethane extracts. The residue was similarly shaken with methanol and concentrated to give the methanol extracts.

The extracts tested included the dichloromethane extracts of *A. lebbeck* and the methanol extracts of *C. sinensis*, *P. debilis*, *P. tomentosa*, *N. beddomei* and *Z. rhetsa*.

Dichloromethane extracts made from *Toddalia asiatica*, *Melia dubia* (leaves), *Mastixia montana*, *Melia dubia* (fruit flesh), *Swietenia mahogany* (twigs and leaves) and *Alstonia macrophylla* and methanol extracts made from *Toddalia asiatica*, *Melia dubia* (leaves), *Mastixia montana*, *Melia dubia* (fruit/flesh), *Swietenia mahogany* (twigs and leaves), *Swietenia mahogany* (stem/bark), *Schumacheria castamefolia*, *Lantboxylum tetraspermum*, *Anamirta cocculus*, *Melia dubia* (stem/bark), *Persea gratissima*, *Michaelia champaea* and *Alstonia macrophylla* were tested separately for insecticidal effects on the coconut caterpillar and red weevil larvae.

The insecticidal activity was monitored as anti-feedant and lethal effects and was assessed through weight changes and mortality for the red weevil and the coconut caterpillar.

Of the plant extracts tested, only two extracts, namely the dichloromethane extracts of the twigs and leaves of *Swietenia mahogany* and the dichloromethane extract of the fruit/flesh of *Melia dubia* showed significant insecticidal activity (Tables 2 to 5).

V Kumar (Peradeniya University), P A C R Perera & L Perera

## **PROJECT 11: BIOLOGICAL CONTROL OF BLACK BEETLE**

### **Experiment 11.1.11 - Studies on the composition of attractants in the impregnation box/pits; Makandura (1990).**

The objective of this experiment is to identify the composition of the medium that is most attractive to the black beetle for egg laying and larval development. The experiment comprises 15 treatments being combinations of 25, 50, 75 and 100% mixtures of soil, coir dust and cowdung which are replicated four times.

Each impregnation box was constructed by placing on the ground four planks of coconut timber at right angles to each other so as to enclose an area 75 x 75 x 30 cm. The enclosed area was filled with the medium corresponding to each treatment.

The medium in each box was examined monthly and all stages of the black beetle present were recorded and returned to the box. The experiment is in progress.

P A C R Perera & M Keerthi

Table 2 - The Effect of six plant extracts on the development rate of *Rhynchophorus ferrugineus*

Treatment	Plant Part	Weight gain (mg)			Total	Mean
		Rep 1	Rep 2	Rep 3		
T1 <i>Melia dubia</i>	Fruit flesh	00	3.00	11.60	14.60	4.86
T2 <i>Swietenia mahogani</i> (CH <sub>2</sub> Cl <sub>2</sub> )	Twigs & leaves	54.28	28.40	49.63	132.31	44.10
T3 <i>S mahogani</i> (MeoH)	Twigs & leaves	220.55	151.44	158.30	530.29	176.76
T4 <i>S mahogani</i>	Steam & Bark	307.24	270.12	225.90	803.26	267.75
T5 <i>Schumacheria castaneaefolia</i>	Stem & bark	280.46	157.97	225.50	663.93	221.31
T6 <i>Zanthoxylum tetraspermum</i>	Leaves	387.87	127.72	200.60	716.19	238.73
T7 LF12 + MeoH		339.96	122.32	212.10	674.38	224.79
T8 LE12 + Acetone		246.91	242.56	267.60	757.07	252.35
T9 Distilled Water		336.98	259.00	296.69	892.67	297.55

P < 0.001 LSD = 112.59

Table 3 - Mortality of *R. ferrugineus* larvae fed with six plant extracts

Treatment	Plant Part	Mortality %			Total	Mean
		Rep 1	Rep 2	Rep 3		
T1. <i>Melia dubia</i>	Fruit flesh	100	90	90	280	93.33
T2 <i>Swietenia mahogani</i> (CH <sub>2</sub> Cl <sub>2</sub> )	Twigs & leaves	50	20	20	90	30.00
T3 <i>S mahogani</i> (MeoH)	Twigs & leaves	30	50	70	150	50.00
T4 <i>S mahogani</i>	Steam & Bark	30	50	00	80	26.66
T5 <i>Schumacheria castaneaefolia</i>	Stem & bark	10	10	20	40	13.33
T6 <i>Zanthoxylum tetraspermum</i>	Leaves	10	50	60	120	40.00
T7 LF12 + MeoH		10	30	40	80	26.66
T8 LE12 + Acetone		30	40	40	110	36.66
T9 Distilled Water		00	30	20	50	16.66

P < 0.01 LSD = 23.32

Table 4 - The Effect of development rate of *O. arenosella* larvae fed with six plant extracts

Treatment	Plant Part	Weight gain (mg)			Total	Mean
		Rep 1	Rep 2	Rep 3		
T1 <i>Melia dubia</i>	Fruit flesh	-2.80	6.80	6.80	10.80	3.60
T2 <i>Swietenia mahogani</i> (CH <sub>2</sub> Cl <sub>2</sub> )	Twigs & leaves	7.35	10.63	13.40	31.38	10.46
T3 <i>S mahogani</i> (MeOH) leaves	Twigs & leaves	13.01	14.60	43.98	14.66	
T4 <i>S mahogani</i>	Stem & Bark	19.44	14.43	16.25	50.12	16.70
T5 <i>Schumacheria castaneaefolia</i>	Stem & bark	11.41	12.70	14.40	38.51	12.83
T6 <i>Zanthoxylum tetraspermum</i>	Leaves	16.54	7.87	17.70	42.11	14.03
T7 LF12 + MeoH		16.45	21.31	14.56	52.32	17.44
T8 LE12 + Acetone		12.85	11.57	17.12	41.54	13.84
T9 Distilled Water		19.87	12.00	15.13	47.00	15.66

P < 0.01    LSD = 5.75

Table 5 - Mortality of *O. arenosella* larvae fed with six plant extracts

Treatment	Plant Part	Mortality %			Total	Mean
		Rep 1	Rep 2	Rep 3		
T1 <i>Melia dubia</i>	Fruit flesh	90	70	-	160	80
T2 <i>Swietenia mahogani</i> (CH <sub>2</sub> Cl <sub>2</sub> )	Twigs & leaves	20	40	-	60	30
T3 <i>S mahogani</i> (MeoH)	Twigs & leaves	20	50	-	70	35
T4 <i>S mahogani</i>	Stem & Bark	70	20	-	90	45
T5 <i>Schumacheria castaneaefolia</i>	Stem & bark	00	20	-	20	10
T6 <i>Zanthoxylum tetraspermum</i>	Leaves	10	20	-	30	15
T7 LF12 + MeoH		00	10	-	10	05
T8 LE12 + Acetone		10	30	-	40	20
T9 Distilled Water		00	10	-	10	05

P < 0.05    LSD = 30.627

## PROJECT 17: PREMATURE DECLINE OF PALMS

### Experiment 17.6 - Studies on *Odontomachus* ('kadiya'), Bandirippuwa Estate (1989).

The experiment is in two parts as indicated below:

- (a) treatment of leaf scorch affected palms with insecticides to eliminate *Odontomachus* as a possible cause, and
- (b) introduction of *Odontomachus* to healthy palms, to study development of scorch symptoms.

These experiments carried untreated plots as controls.

On each experimental palm, the total number of leaves, the number of scorch-affected leaves, the number of bunches of nuts and the presence or otherwise of *Odontomachus* were recorded. The preliminary analysis of data collected over a period of one year did not show a positive correlation between the presence of *Odontomachus* and the incidence of leaf scorch. However, recording of data is being continued and a final analysis would be done in December, 1991.

*P A C R Perera & K A S Chandrasiri*

### 3. INCIDENCE OF PESTS AND DISEASES

During the year, only 10 reports of outbreaks of the coconut caterpillar were received, compared with 60 reports during the previous year. However 15 complaints of coconut scale infestations were recorded, of which 11 were from the North Western Province (Table 6).

Five reports of outbreaks of disease (two cases of stem bleeding and three leaf blight cases) were recorded. The planters were given advice on the relevant control measures.

### 4. CROP PROTECTION SERVICE

#### 4.1 Biological Control

**Insect Pests:** Laboratory-bred parasitoids for the control of the coconut caterpillar were released in the infested areas (Table 7).

Most of the coconut scale infestations recorded during the year were found to be adequately controlled by the parasitoid *Aphytis chrysomphali* and the Coccinellid predators, *Chilocorus nigritus* and *Pullus xerampelinus*. No further control measures were required in many cases.

Table 6 - Record of reported pest infestations/attacks

Pest	Province				Total
	WP	NWP	SP	NCP	
1. Coconut caterpillar <i>Opisina arenosella</i>	3	4	3	-	10
2. Black beetle <i>Oryctes rhinoceros</i>	3	3	-	-	06
3. Red Weevil <i>Rhynchophorus ferrugineus</i>	2	4	2	-	08
4. Coconut scale <i>Aspidiotus destructor</i>	3	11	-	01	15
5. Nettle grub <i>Parasa lepida</i>	-	-	-	-	-
6. Locust <i>Aularchis miliaris</i>	1	-	1	-	02
7. Mealy bugs	-	1	-	-	01
8. <i>Meredolus</i> sp.	-	1	-	-	01
9. Bats	1	-	-	-	01
10. Rats	-	-	1	-	01

Table 7 - Parasitoid release for coconut caterpillar control

Province	1	2	3	4	5	6	Total
Western	14,500	39,250	7,050	1,61,500	3,100	3,200	2,28,600
North Western	21,000	25,000	4,650	2,03,800	3,800	6,800	2,65,550
Southern	30,550	71,250	5,725	3,29,800	2,300	6,850	4,46,475
Eastern	3,000	4,500				900	8,400
<b>Total</b>	<b>69,050</b>	<b>1,40,500</b>	<b>17,425</b>	<b>6,95,100</b>	<b>9,200</b>	<b>17,750</b>	<b>9,49,025</b>

- |                                    |                                   |
|------------------------------------|-----------------------------------|
| 1 - <i>Goniozus nephantidis</i>    | 2 - <i>Bracon hebetor</i>         |
| 3 - <i>Eriborus trochanteratus</i> | 4 - <i>Trichospilus pupivora</i>  |
| 5 - <i>Brachymeria nosatoi</i>     | 6 - <i>Brachymeria nephatidis</i> |

**Weeds:** Many requests from coconut growers for the supply of *Pareuchaetes pseudoinsulata* for the control of the common weed, 'Podisinghomaran', (*Chromolaena odorata*) were received and 11,750 larvae and 480 adults were issued for release on estates in the North Western and Western provinces.

#### **4.2 Chemical Control**

A total of 9860 coconut palms severely attacked by the coconut caterpillar covering approximately 60 ha in the North Western, Western and Southern provinces were treated with the systemic insecticide, Monocrotophos 60% using the trunk injection technique. Demonstrations and advice on the trunk injection method were given to the officers of the Coconut Cultivation Board and coconut growers in the Southern province in order to control outbreaks of the coconut caterpillar in the area.

One estate in the North Western Province, severely damaged by the coconut scale and with low natural enemy populations, was treated with insecticides and trunk injections were done on 220 palms with Monocrotophos 60%. The infestations were thereby brought under control.

#### **5. EXTENSION ACTIVITIES**

The following lectures/demonstrations were given:

Dr P A C R Perera, on coconut pest control to two groups of Grama Arakshaka Niladharis on 31 January and 28 February.

Dr P A C R Perera on "New recommendations on the control of pests, diseases and weeds" to Assistant Regional Managers and Coconut Development Officers of the Coconut Cultivation Board on 05 March.

Dr P A C R Perera and Mr M M Keerthi on "Coconut pests and diseases and their control" to Trainee Assistant Superintendents on 15 and 16 May.

Dr P A C R Perera on "Principles of Crop Protection" and "Pests, diseases and disorders of coconut" to a group of middle-level management staff of coconut estates on 01 June.

Dr P A C R Perera on "Agrochemical usage in coconut" to Section B of the Sri Lanka Association for the Advancement of Science on 05 November.

Lectures and laboratory demonstrations on the work of the division were given to several groups of students from schools and universities.

#### **6. ACKNOWLEDGEMENTS**

We sincerely thank the Head and Staff of the Biometry Division for assistance with design of experiments and analysis of data; the Soils and Plant Nutrition Division for analysis of leaf samples; the staff of the Agronomy and Soils and Plant Nutrition Divisions for assistance in the earthworm survey; and the Commonwealth Institute of Entomology, London for insect identification.

# REPORT OF THE BIOMETRY DIVISION

Head - D T Mathes FIS

## 1. GENERAL

**Computerization:** The hard disc capacity of one of the computers, (ARC computer) was increased to 80 MB. The software packages, SIGEST, GENVAR and U-SP, developed by the Applied Statistics Research Unit of the University of Kent at Canterbury were installed. In addition, the Research Management Package, REFLEX and the Word Processing package, WORD PERFECT 5.1 were installed.

**Staff:** Mr T S G Peiris, Biometrician, served as the Secretary of Section B (Agriculture & Forestry) of the Sri Lanka Association for the Advancement of Science. Mr Peiris also served as a Visiting Lecturer at the Department of Statistics & Computer Science at the University of Colombo. Mr Peiris continued to function as the Chairman of the Waste Elimination Committee of the CRI until October.

## 2. BIOMETRICAL ASSISTANCE

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

Special assistance was provided to Mr N A Tennakoon and Mr L L W Somasiri in their M Phil and Ph D projects, respectively.

## 3. RESEARCH PROJECTS

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

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

The bimonthly recordings of vegetative and yield characters were carried out without interruption. Variation of yield parameters between the six picks of 1989 and 1990 is given in Tables 1 and 2. The total number of bunches for the year showed an increase of 11.5% over 1989. The first three picks recorded a decreased number of nuts per palm while the next three picks recorded an increase compared to that of 1989. The number of nuts per hectare too showed a similar pattern to nuts per palm. The recorded yield was 15414 nuts/ha, compared to 18329 nuts/ha recorded in 1989. The year showed a decrease of yield by 15.9% over 1989. The copra yield was 3,266.5 kg/ha which is a reduction of 12.7% over 1989.

*D T Mathes, R Fernando, W M L G Fernando, K Herath & P Fernando*

Table 1 - Average yield components in 1990 (Expt. 19.3)

Pick No.	1	2	3	4	5	6	Total
No. of bunches/palm	2.3 (2.2)	2.9 (2.0)	2.5 (2.3)	2.3 (2.1)	2.4 (2.5)	2.2 (2.0)	14.6 (13.1)
No. of nuts/palm	7.4 (16.7)	15.3 (22.5)	22.4 (30.8)	22.6 (21.8)	16.7 (15.3)	13.1 (8.7)	97.5 (115.8)
No. of nuts/ha	1173 (2642)	2422 (3558)	3548 (4879)	3567 (3452)	2636 (2423)	2068 (1375)	15414 (18329)
No. of nuts/bunch	3.3 (7.5)	5.3 (11.5)	9.0 (13.6)	9.9 (10.5)	7.1 (6.1)	6.0 (4.3)	

Figures in parenthesis are those recorded in 1989.

Table 2 - Average weight of husked nut and copra yield in 1989 (Expt. 19.3)

Pick	Weight of husked nut(g)		Copra * (kg/ha)	
	1990	1989	1990	1989
1	734	756	275.51	639.15
2	773	664	599.11	756.00
3	663	604	752.74	943.01
4	608	629	694.00	694.82
5	620	582	522.98	451.26
6	638	584	422.20	256.96
<b>TOTAL/Ave.</b>	<b>662</b>	<b>638</b>	<b>3266.54</b>	<b>3741.20</b>

\* Copra Yield = husked nut weight x 0.32

## **Miscellaneous studies**

### **(a) Effect of rainfall on coconut yield**

This programme was carried out using data from Ratmalagara Estate to study the effect of rainfall distribution on the pick-wise yield and the total yield in a given year. It appears that rainfall of different durations in the previous year affects the following year's crop. Influence of variable climatic parameters too are being investigated to study the effect on yield variation between and within years.

*T S G Peiris*

### **(b) CLIMAT: A user-friendly package to analyse climatological variables**

A simple and robust computer software package (CLIMAT) was developed to maintain a database for different climatic variables. It also has the facility to obtain necessary information of the variables, length of dry spells and wet spells between any interval in a given range.

*T S G Peiris, J D J S Kularatne & D T Mathes*

### **(c) Measurement of canopy size in coconut**

Work on determining the canopy size of coconut palms of different age groups at different locations commenced during the latter part of the year and will continue in 1991.

*M de S Liyanage, G M R Karunasekara, L Fernando & D T Mathes*

### **(d) Survey of coconut lands of the Janatha Estates Development Board (JEDB)**

A questionnaire was prepared to collect information from JEDB estates with a view to study the present productivity levels in different JEDB estates.

*D T Mathes, T S G Peiris & P S Liyanagama*

### **(e) Leaf area of adult coconut palms**

The measurements required for introducing equations for determining the leaf area of a frond in an adult palm were taken. Further work is in progress.

*C Jayasekara & D T Mathes*

#### 4. COMPUTER FACILITY

Computer assistance provided during the year includes the following:

- (a) The computer programme for the Differential Fertilizer Recommendation (DFR) was further modified.

*T S G Peiris & K S Jayasekara*

- (b) Work on an interactive programme for retrieval and analyses of summary data from field experiments was commenced.

*H P De Zoysa & D T Mathes*

- (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 the Meteorology Department and other institutions continued throughout the year.

*P Fernando, J S Kularatne & D T Mathes*

- (e) A basic training on the use and application of some statistical methodologies, SAS and Word Processing packages was provided on an individual basis, to some research staff.

*D T Mathes & S Kularatne*

- (f) Training was provided to all Technical Assistants of research divisions on the use, application and report generation using a database package and a statistical package.

*H P De Zoysa & D T Mathes*

- (g) A course of training was conducted for the research staff of the Institute in the use of the statistical package (SAS) and analysing randomised block designs and fitting regression models.

*T S G Peiris*

- (h) The division continued to assist in computerization of the Medical Aid Scheme. Assistance was also provided in processing job applications received by the Administration Division.

*T S G Peiris & J D J S Kularatne*

- (i) 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).

TSG Petals

## 5. YIELD RECORDING

The recording of yield data of experiments conducted by the research divisions at the following estates was continued satisfactorily. In all 205,937 nuts were recorded as against 250,581 recorded in 1989.

I	Bandirippuwa	VII	Puwakwatte
II	Ratmalagara	VIII	Sirikandura
III	Heemmeliyagara	IX	Poththukulama
IV	Kiniyama	X	Saddhatissa
V	Jasintha	XI	Walpita
VI	Muthugala	X	Marandawila

## 6. AGRI-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.

### 6.1 Bandirippuwa Estate

(a) **Rainfall (Table 3)** Rainfall recorded in all months. Very heavy rainfall was observed in October and November, amounting to 1081.4 mm against the total of 1911.5 mm for the year. The rainfall for the first half of the year was 634.4 mm. Reduced yields could be expected for the year 1991, compared to 1990.

(b) **Temperature (Table 4)** The monthly maximum temperature ranged from 29.3 to 32.4 °C as against 28.0 to 32.6 °C in 1989. The monthly minimum temperature ranged from 20.7 to 25.8 °C. On the whole, the temperature during the year was slightly higher compared to 1989.

(c) **Sunshine (Table 4)** Longer sunshine hours were observed during the early and latter part of the year. The average for the year was 7.1 h.

(d) **Soil Temperature (Table 5)** The average temperatures recorded at depths 5, 10, 20, 30, 60 and 120 cm during the morning were 28.6, 29.1, 29.7, 30.3, 30.4 and 30.3 °C while those for the afternoon were 32.6, 31.7, 30.9, 30.7, 30.4 and 30.3 °C respectively.

Table 3 - Rainfall (mm) for the last 10 years and in 1990  
(Bandirippuwa Estate)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	80-89	1990
											Ave.	
January	0.0	5.08	0.0	0.0	197.9	13.0	61.7	31.2	0.0	25.4	38.0	201.8
February	0.0	66.0	0.0	0.0	106.9	189.0	35.0	0.0	111.4	0.0	50.8	16.8
March	68.8	16.5	144.3	0.0	145.5	228.9	62.0	118.3	87.4	65.7	93.7	84.3
April	206.0	100.6	125.2	219.7	425.2	103.9	60.2	237.6	283.0	234.9	199.6	74.8
May	54.2	333.5	232.9	322.1	297.7	275.3	284.7	187.2	109.9	52.3	215.0	227.7
June	308.1	107.4	328.4	138.4	115.1	291.3	44.7	61.6	255.8	153.4	180.4	29.0
July	21.8	38.6	152.1	79.7	111.0	14.5	33.5	6.4	151.8	99.0	70.8	156.3
August	78.2	41.4	188.9	120.6	0.5	139.9	77.2	156.5	105.2	20.4	92.9	0.3
September	182.3	124.2	185.2	242.1	129.3	168.4	94.7	410.7	303.4	222.1	206.3	11.9
October	364.4	298.4	235.7	50.0	121.9	195.6	224.3	579.3	88.8	395.9	255.4	395.1
November	184.9	297.2	244.6	159.0	239.8	306.3	149.4	194.7	370.7	379.4	252.6	623.3
December	102.3	12.9	57.7	141.0	83.0	63.7	63.5	79.9	19.1	50.3	67.4	90.2
<b>Total</b>	<b>1571.0</b>	<b>1487.5</b>	<b>1895.0</b>	<b>142.6</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>1722.9</b>	<b>1911.5</b>

**Table 4 - Summary of meteorological observations in 1990  
(Bandirippuwa Estate)**

Month	Temperature °C		Evaporation per day	Relative Humidity %		Sunshine (h)
	max	min		a.m.	p.m.	
January	30.5	20.7	4.9	81	60	8.0
February	31.9	22.8	5.1	82	63	8.6
March	32.4	23.0	5.3	78	64	8.1
April	32.1	24.1	4.6	80	70	7.5
May	30.9	24.2	4.5	83	77	6.4
June	30.2	25.8	4.4	80	76	6.7
July	29.3	24.4	4.1	84	77	5.6
August	29.9	25.3	5.0	79	74	6.3
September	31.0	25.4	4.9	75	68	7.9
October	30.8	24.1	4.8	78	72	6.5
November	30.3	23.2	3.7	82	74	6.5
December	30.6	23.0	3.9	80	71	7.0
<b>Average</b>	<b>30.8</b>	<b>23.8</b>	<b>4.6</b>	<b>80</b>	<b>70</b>	<b>7.1</b>

### 6.2 Ratmalagara Estate (Table 6)

The total rainfall recorded for the year was 1465.5 mm. This is similar to that recorded for 1989. Except February and August, all other months recorded rainfall. More than 50% of the annual rainfall were experienced during November and December. Reduced crops during 1991 could be expected with some improvement towards the end of the year.

### 6.3 Isolated Seed Garden (Table 7)

Low rainfall has been recorded for February, June, August and September. The total rainfall for the year was 1180.1 cm, which is an improvement on 1989 rainfall. Low crops could be expected during 1991 with some improvement towards the tail end of the year.

Table 5 - Soil temperature (°C) at different depths  
(Bandirippuwa Estate)

	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
January	26.2	26.9	27.7	28.2	28.7	28.8	30.9	29.8	28.7	28.6	28.6	28.7
February	28.3	28.8	29.5	30.0	29.9	29.7	33.0	32.0	30.6	30.3	29.8	29.6
March	29.7	30.3	31.1	31.8	31.6	31.2	35.0	33.9	32.4	32.1	31.5	31.2
April	29.8	30.2	30.8	31.1	31.3	31.1	33.4	32.6	31.7	31.5	31.2	31.1
May	28.8	29.3	30.0	30.7	30.9	30.8	32.7	32.0	31.4	31.2	30.8	30.7
June	29.3	29.7	30.3	30.9	30.8	30.8	32.5	31.8	31.3	31.2	30.8	30.8
July	28.0	28.3	29.0	29.6	29.9	30.0	30.8	30.3	30.0	29.8	29.8	30.0
August	29.5	30.0	30.7	31.3	31.1	30.8	33.5	32.7	31.9	31.6	31.0	30.8
September	30.6	31.2	31.9	32.6	32.4	32.0	35.4	34.3	33.1	32.9	32.4	32.0
October	29.1	29.5	30.3	31.1	31.4	31.4	33.4	32.4	31.6	31.3	31.3	31.4
November	26.8	27.2	27.6	28.3	28.5	28.7	30.4	29.6	29.0	28.6	28.5	28.8
December	26.8	27.2	27.8	28.4	28.8	28.9	29.6	29.1	28.7	28.6	28.7	28.9
<b>Total</b>	<b>28.6</b>	<b>29.1</b>	<b>29.7</b>	<b>30.3</b>	<b>30.4</b>	<b>30.3</b>	<b>32.5</b>	<b>31.7</b>	<b>30.9</b>	<b>30.6</b>	<b>30.4</b>	<b>30.3</b>

Table 6 - Rainfall (mm) for the last 10 years and in 1990  
(Ratmalagara Estate)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	80-89 Ave.	1990
January	0.0	78.7	0.0	0.0	132.9	16.6	64.8	13.6	0.0	77.7	38.4	185.5
February	0.0	11.3	0.0	0.0	166.2	122.1	54.3	0.0	101.3	0.0	45.5	8.3
March	16.7	38.4	118.8	0.0	168.6	158.3	74.7	72.0	53.3	117.4	81.8	96.2
April	208.2	52.5	112.2	109.2	703.6	208.3	143.4	120.4	231.4	204.2	209.3	37.7
May	74.0	290.8	196.8	145.3	282.4	82.3	246.1	141.5	68.0	54.2	158.1	114.6
June	246.1	87.4	190.8	80.9	39.1	126.0	50.9	65.1	221.9	126.5	123.5	12.6
July	14.3	55.1	35.6	55.6	88.6	39.1	22.6	16.9	57.9	124.2	51.0	92.7
August	31.2	80.4	155.2	74.9	2.0	13.3	85.9	139.5	158.1	10.0	75.1	0.0
September	149.0	121.6	36.6	109.9	132.8	84.2	26.4	190.0	259.7	161.4	127.2	17.4
October	239.6	168.9	272.8	79.5	109.3	209.9	153.0	502.8	58.0	238.9	203.3	389.2
November	273.2	304.0	200.8	163.6	472.8	319.0	228.4	195.9	230.1	298.7	268.6	434.6
December	126.4	24.2	118.7	216.3	95.9	104.4	95.9	53.2	88.8	24.4	94.8	76.7
<b>Total</b>	<b>1378.7</b>	<b>1313.3</b>	<b>1438.3</b>	<b>1035.2</b>	<b>2394.2</b>	<b>1483.5</b>	<b>1246.4</b>	<b>1510.9</b>	<b>1528.5</b>	<b>1437.6</b>	<b>1476.6</b>	<b>1465.5</b>

Table 7 - Rainfall (mm) for the last 10 years and in 1990  
(Isolated Seed Garden)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	80-89 Ave.	1990
January	0.5	36.9	0.0	0.0	96.9	38.3	59.1	5.9	3.3	58.4	29.9	221.6
February	0.0	11.5	0.0	2.1	228.9	113.4	65.8	0.0	135.0	0.0	55.6	0.0
March	23.7	93.5	176.3	1.6	279.7	94.6	55.3	21.7	77.4	29.5	85.3	34.0
April	164.5	48.4	61.7	52.8	821.4	100.0	104.9	141.1	233.3	81.7	180.9	38.8
May	87.8	147.8	281.8	248.8	155.5	171.4	121.9	100.2	71.7	16.0	140.3	145.6
June	147.9	148.9	110.7	73.4	29.7	88.8	74.5	49.8	129.7	112.2	96.6	8.4
July	5.8	72.5	32.1	26.4	117.0	17.9	4.2	4.5	91.4	72.1	44.4	67.7
August	10.0	54.3	91.6	78.0	3.8	10.7	47.4	48.1	60.1	1.7	40.6	0.0
September	106.9	68.4	35.6	89.4	164.7	107.4	37.4	270.8	272.2	34.0	118.7	9.5
October	272.1	280.3	199.9	105.7	227.3	108.7	199.9	467.6	61.3	221.9	214.5	288.6
November	251.0	295.9	152.7	199.3	210.6	334.8	236.1	143.2	319.5	214.7	235.8	306.7
December	82.7	54.3	93.4	331.4	53.6	118.6	7.6	49.5	64.8	8.0	86.4	59.2
<b>Total</b>	<b>1152.9</b>	<b>1312.7</b>	<b>1235.8</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>1329.0</b>	<b>1180.1</b>

# REPORT OF THE TISSUE CULTURE DIVISION

Head - S M Karunaratne M Sc

## 1. GENERAL

The division continued its experiments in tissue culture as a priority area. The results obtained were most encouraging. The laboratory development continued, with the procurement of additional equipment.

In January, the Tissue Culture Unit was upgraded to a Research Division and the Officer-in-Charge, Ms S M Karunaratne was redesignated as Head of the Division.

Ms Karunaratne continued to serve the Institute of Fundamental Studies, Kandy as a Visiting Research Associate.

The Board of Study in Agricultural Biology, Postgraduate Institute of Agriculture, University of Peradeniya appointed Ms Karunaratne a member of the supervisory committee of the M Phil candidate, Ms M C Gunesekera.

## 2. RESEARCH PROJECTS

### PROJECT 18 : STUDIES ON THE VEGETATIVE PROPAGATION OF COCONUT

#### Experiment 18.1 - *In vitro* culture of immature zygotic embryos of local varieties of coconut (1986)

Investigations on development of technologies for clonal propagation of Sri Lanka tall coconut were continued, using immature embryo explants. Large numbers of somatic embryos were regenerated from the callus tissues derived from immature embryos, for further investigations on their germination. Some important factors which trigger germination of somatic embryos have been identified. Three coconut plants, each about 25 cm tall and a number of smaller plantlets of various developmental stages have been produced from callus derived from the immature embryo. These plantlets resembled the seedlings produced by germination of mature zygotic embryos *in vitro*. The leaf bases however, enlarged to form a haustorium-like structure during early stages of germination. Root formation in plantlets was observed to be heterogenous. Establishment of these plantlets in soil was not attempted.

This was the first batch of plantlets produced by tissue culture and further investigations are underway to accomplish consistent plant production from somatic embryos.

Culture of immature embryos from improved cultivars, Dwarf x Tall (CRIC 65) and Tall x Tall (CRIC 60) commenced during the year. All future experiments will be performed using these materials.

S.M.Karunaratne & C.K.Gamage

### **Experiment 18.2 - Investigations on development of vegetative propagules in coconut inflorescences *in vivo* (1983)**

A new plantation consisting of 68 young palms (var. *typica*) was selected at Bandirippuwa Estate. 2,4-Dichlorophenoxy Acetic Acid (2,4-D) and para-Chlorophenoxy Acetic Acid (pCPA) at 0.5, 1.0, 2.0, 4.0 and 6.0 mg per palm were applied monthly, through the spear leaf, during the first five months. This experiment had to be suspended in July due to staff shortage.

### **Experiment 18.3 - Culture of leaf explants of coconut *in vitro* (1983)**

An investigation on the study of morphogenetic potential of coconut leaf tissues in relation to their physiological maturity was undertaken. The leaf tissues lost morphogenetic capacity during juvenile-to-flowering transition. Further, out of a number of tender leaves in the crown of young palms, only one leaf was observed to be morphogenetically active. Further experiments are in progress.

Production of somatic embryos from leaf tissues was continued. Techniques developed to initiate germination of somatic embryos derived from immature embryo cultures were tested on leaf cultures.

*S.M. Karunaratne, C.K. Gamage & A. Koooor*

### **Experiment 18.5 - Application of embryo culture technology to select drought-tolerant coconut germplasm (1986)**

Preliminary investigations on the development of an *in vitro* technique were completed during the year. The technique responded differently depending on the genotype. When zygotic embryos derived from two known drought-susceptible cultivars of coconut, CRIC 65 and Dwarf (form *pumila*) were tested, 29% and 73% of embryos respectively, died due to stress damage caused by 170 mM NaCl and none survived a salt concentration above 230 mM. However, embryos originated from two putative drought-tolerant cultivars showed a higher survival rate when subjected to salt stress (see also Annual Report, 1989). At 170 mM salt, all the embryos had developed into seedlings and there were no casualties due to stress. In fact, percent germination of embryos was somewhat higher in 170 mM NaCl than in the control, which was devoid of NaCl. Percent survivors gradually declined with increase in salt concentration and about 18% survived 330 mM NaCl. The lower level of NaCl to eliminate drought-susceptible material appears to be 200-250 mM.

Further investigations have shown accumulation of Na<sup>+</sup>, K<sup>+</sup> and Cl<sup>-</sup> in seedling tissues, in response to high NaCl in the medium. Under these conditions, putative drought tolerant palms appear to tolerate the effects of stress by cellular adjustment.

Attempts have also been made to investigate the feasibility of reducing the cost and duration of the screening procedure. Experiments were commenced on appraisal of

survivors of stress by exposing them to low NaCl media and finally acclimatizing in the usual way. Eight seedlings which resisted stress developed by 200 mM NaCl were planted in the soil successfully.

The experiments are in progress.

*S.M. Karunaratne, Sunil Santha & A. Kovoov*

### **Experiment 18.6 - Establishment of *in vitro*-germinated seedlings in soil (1990)**

Establishment of palm seedlings/plantlets in soil is generally difficult. This experiment is aimed at enhancing the survival rate of seedlings/plantlets during acclimatization and subsequent transplanting.

For convenience, seedlings produced by *in vitro*-germination of mature zygotic embryos of Sri Lanka tall coconut have been used. The possible impact of the developmental stage (eg. number of photosynthetic leaves and the stage of development of the spear leaf and the root system) on the establishment of seedlings in soil will be investigated in this experiment.

*S.M. Karunaratne & Sunil Santha*

### **3. MISCELLANEOUS**

Ms. Chulanganee Perera, a final year student of the Faculty of Agriculture, University of Ruhuna conducted a short-term research project on "Some factors affecting callus proliferation from immature zygotic embryos of coconut". The report of this project was submitted in partial fulfilment of the requirements for Bachelor of Science in Agriculture, University of Ruhuna.

# REPORT OF THE PLANT PHYSIOLOGY DIVISION

Head - C Jayasekera, Ph D

## 1. GENERAL

During the year much emphasis was given to screening for drought tolerance in coconut. A screening method based on physiological parameters was developed, and screening of drought tolerant palms at ISG, Ambakelle was started.

The Plant Physiology Unit was upgraded to a Division with effect from 01 January and the Officer-in-Charge was redesignated as the Head, Plant Physiology Division.

A Technical Co-operation award from the International Atomic Energy Agency (SRL/5/026) worth US \$ 86,000 was received for a project on "Increased coconut production through improved distribution of assimilate and water use".

The division participated in two multi-disciplinary research projects, namely Immature Nutfall and Premature Decline. A considerable amount of work on these two projects was carried out, and they are reported separately. The Head of the Division functioned as the Leader in these two Projects.

## 2. RESEARCH PROJECTS

### PROJECT 16 - STUDIES ON THE PHYSIOLOGY OF THE COCONUT PALM

#### Experiment 16.6 - Studies on the effect of N,K,Cl, and abscisic acid on drought tolerant characteristics of coconut, glass house study (1988)

The first experiment established in 1988 was completed after imposing drying cycles. Significant increase ( $P=0.001$ ) in assimilate partitioning into shoot and root was observed at higher levels of potassium. Under soil moisture deficit conditions, N maintained the turgor potential by accumulation of proline within leaves, while the concentration of K and Cl was high. The results suggest that these ions themselves act as osmotica when they are adequately available.

A similar experiment using tall x tall seedlings was initiated to study the effect of N,K, and Cl on photosynthesis and water use efficiency of the seedlings, which could not be studied in the first experiment. In this study, increasing levels of N and K increased the rate of photosynthesis ( $P<0.001$ ). However, increasing chlorine reduced the rate of photosynthesis ( $P < 0.001$ ). The water use efficiency of coconut seedlings also decreased with increased supply of chlorine.

*C Jayasekera*

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Contributions to the Multi-disciplinary Research Projects are reported separately.

**Experiment 16.3 - Identification of physiological and biochemical characters of putative drought tolerant tall (Ambakelle Special) palms, Isolated Seed Garden, Ambakelle (1987)**

Recording of physiological parameters (viz. rate of transpiration, leaf water potential, soil water use, sugars and proline accumulation in leaves), which are used for screening drought tolerant palms, was continued at monthly intervals. Drought-tolerant palms recorded low transpiration rates when the soil was saturated with moisture and they maintained similar or slightly lower transpiration rates during dry periods. They recorded high water potentials than drought-susceptible ones throughout the year.

Regression analysis of results showed that four out of the 10 palms used in this study were drought tolerant. During the latter part of the severe drought prevailed this year, these palms were re-examined and it was observed that they were not affected by the drought, whereas drought-susceptible palms showed drooping and drying of lower leaves and immature nut fall.

Using this method, screening of a further 40 "putative" drought tolerant palms in field Nos. 1 & 2 at the Isolated Seed Garden was commenced in April. Soon after the severe drought this year, a further 680 palms which were either unaffected or slightly affected by drought were selected from field Nos. 4 and 8 to screen similarly for high yields and drought tolerance.

It is hoped that this screening programme will enable the identification of drought tolerant planting material.

*C Jayasekera, C S Ranasinghe, R D N Premasiri & P S A de Saram*

**Experiment 16.4 - Comparative study of drought tolerance in Special and tall X tall seedlings [Glass house study] (1987)**

The pot experiment established to compare genotype/environment interaction and heritability of drought tolerant character in self-pollinated "putative" drought tolerant palms and low-yielding drought sensitive palms was continued. The rates of photosynthesis and transpiration, stomatal diffusive resistance and leaf water potential were studied under field capacity conditions. One drying cycle was induced and the above-mentioned physiological parameters were studied during the drying cycle. Self-pollinated seedlings obtained from palms identified as relatively drought tolerant, were able to withstand six weeks drought without any physical damage. These seedlings recorded slightly higher rates of photosynthesis and transpiration than drought-susceptible seedlings during the latter part of the drying cycle.

*C Jayasekera, C S Ranasinghe & R D N Premasiri*

**Experiment 16.5 - Identification of physiological and biochemical determinants of drought tolerance in selected high yielding and low yielding dwarf palms, Isolated seed garden, Ambakelle (1987)**

As reported in 1989, the dwarf palms were uprooted, and the experiment was terminated.

*C Jayasekera & C S Ranasinghe*

**Experiment 16.7 - Studies on physiology and biochemistry of different varieties and forms of coconut (1989)**

Studies on the rate of photosynthesis, respiration, water use efficiency, leaf soluble protein and activity of major enzymes were postponed until the procurement of a portable photosynthesis meter and necessary biochemicals.

*C S Ranasinghe & C Jayasekera*

**Experiment 16.9 - Studies on vegetative growth and physiology of Ambakelle special seedlings grown under field conditions (1990)**

Records of the number of leaves produced, seedling height and girth at the collar were taken at quarterly intervals. Leaf area of the newly developed leaves was also measured at six-monthly intervals. Each seedling was given 2 kg of YPM/seedling/year in two split applications and 1 kg of dolomite.

*C S Ranasinghe & R D N Premasiri*

**Experiment 16.10 - Studies on the effect of canopy and root modification on yield of coconut (1990)**

The objectives of this study are to determine the optimum canopy area and root volume to maintain (a) normal vegetative growth (b) maximum yield, and (c) water relations of the coconut palm as water and nutrient uptake depend on the root volume and root activity as well as the canopy demand.

One hundred and eighty healthy palms were selected from the Raman block at Bandirippuwa Estate. The number of female flowers per inflorescence, nuts per bunch and the number of leaves were recorded in each palm. Based on the values of these parameters as at July, the palms were grouped into replicates to reduce errors due to plant variations.

The design of this experiment is a randomized block design with 10 treatments and three replicates per treatment. Three canopy and root pruning treatments were introduced giving nine treatment combinations.

Growth parameters such as the number of inflorescences produced, number of female flowers per inflorescence, number of nuts per bunch were recorded at bimonthly intervals to determine the effect of canopy and root pruning on yield parameters.

*C Jayasekera, R D N Premasiri & L R S Silva*

#### **Experiment 16.11 - Evaluation of field performance of embryo-cultured seedlings (1987)**

Of the four dwarf red and eight dwarf yellow seedlings, two from each colour form were lost due to the drought during the year. However, open pollinated tall seedlings as well as the dwarf green seedlings were not affected. Out of 14 open pollinated seedlings planted in May 89, six were lost due to pest damage.

Dwarf yellow and the dwarf green seedlings showed promising vegetative growth, compared to the same-aged open pollinated tall seedlings. The results are yet to be statistically analysed. Few open pollinated seedlings planted in 1987 and 1989 performed exceptionally well during the year.

All seedlings received 2 kg of YPM mixture in three split applications and 1 kg of dolomite.

*C Jayasekera & R D N Premasiri*

#### **PROJECT 25 - ESTABLISHMENT AND FURTHER GROWTH OF AMPUTATED POLY-BAGGED SEEDLINGS**

##### **Experiment 25.4 - Field performance of amputated poly-bagged seedlings (1989)**

Twenty five one year-old amputated poly-bagged seedlings and a similar number of same-aged bare-root nursery bed-raised seedlings were planted in Field No. 4 at Bandirippuwa Estate. The aim of this study is to compare vegetative growth and flowering in the two groups of seedlings.

Vegetative growth parameters such as height of the seedlings, number of leaves and girth at the collar were recorded at the time of planting. Fifty percent of the seedlings were affected by the severe drought experienced soon after planting and some of the nursery bed-raised seedlings were beyond recovery.

A further one acre field was prepared to plant more amputated seedlings. However, planting could not be done due to heavy rains and water-logging.

*C S Ranasinghe & L R S Silva*

### **3. EXTENSION ACTIVITIES**

Trainees from the National Institute of Plantation Management (NIPM), National Apprenticeship Board (NAB) and students following the Diploma in Agriculture at the Aquinas College were briefed on the activities of the division.

A large number of coconut growers visited the division in connection with the Coconut Day.

### **4. ACKNOWLEDGEMENTS**

The assistance of the staff of the Plant Physiology Division in conducting experiments and in the preparation of this report is gratefully acknowledged. Thanks are also due to Mr D T Mathes, Head, Biometry Division for designing experiments and for analyses of data.

## MULTI-DISCIPLINARY PROJECTS

### PROJECT 17: PREMATURE DECLINE OF PALMS

(Project Leader - C Jayasekara Ph D)

**Participating Divisions:** *Plant Physiology Division*  
*Agronomy Division*  
*Soils & Plant Nutrition Division*  
*Crop Protection Division*

**General Remarks:** Leaf Scorch Decline is a disorder of coconut palms first observed in the Southern region of Sri Lanka in early 1950's and is now prevalent in other coconut growing areas. Scorching of leaflets commencing from the lower whorls, reduction in size of the fronds, tapering of the trunk, reduced yields and decline in vigour are the symptoms. Extensive microbiological studies have not revealed a definite causative agent. Studies on nutrients have also not shown any discernible trends.

This multi-disciplinary research programme was undertaken to study the physiological and metabolic aspects of Leaf Scorch Decline. Reduced or altered physiological or metabolic activity within the canopy or in the root system may induce progressive decline in vigour of affected palms.

#### **Experiment. 17.1 - Studies on internal water relations of Leaf Scorch Decline (LSD) palms (1987)**

Studies on water relations of palms affected with Leaf Scorch Decline (LSD) at Bāndirippuwa estate were continued. Leaf water potential, rate of transpiration and stomatal diffusive resistance were measured at quarterly intervals. The data collected on these parameters followed a trend in keeping with increasing severity of symptoms, as reported in the Annual Report of 1989.

Water relations studies were also carried out for LSD-affected palms in the rehabilitation trial conducted by the Agronomy Division at Walpita Estate. Prior to imposing treatments, 10 palms from each category of symptoms and ten healthy palms were chosen for this study. Mean leaf water potential, transpiration rate and stomatal diffusive resistance of these palms are given in Table 1. These data further confirmed the presence of low leaf water potential and transpiration rate as well as high stomatal diffusive resistance in LSD-affected palms.

Table 1 - Rate of transpiration, stomatal diffusive resistance and leaf water potential of healthy and LSD-affected palms at Walpita Estate (each value is a mean of 10 palms)

Category	Leaf water potential bar	Rate of transpiration $\mu\text{g cm}^{-2} \text{ s}^{-1}$	Stomatal diffusive resistance $\text{s cm}^{-2}$
Healthy	13.5 $\pm$ 1.6	2.17 $\pm$ 0.5	12.00 $\pm$ 1.5
Incipient	12.3 $\pm$ 2.3	1.47 $\pm$ 0.3	20.50 $\pm$ 6.2
Mild	14.2 $\pm$ 1.8	1.64 $\pm$ 0.3	20.00 $\pm$ 5.6
Moderate	14.0 $\pm$ 2.9	1.45 $\pm$ 0.3	21.00 $\pm$ 4.5

Water uptake through roots was studied by immersing exposed but intact roots for a known period of time in bottles filled with water and sealing the mouth. It was noted that not more than 5 ml of water were taken up by the exposed roots during 24 h.

This study will continue.

*C Jayasekara, C S Ranasinghe & L R S Silva*

#### **Experiment 17.2 - Studies on the root system of Leaf Scorch Decline palms (1987)**

Studies on root morphology of LSD palms could not be carried out during the year.

Anatomy of roots of healthy and LSD affected palms was studied using macerated vascular tissues. Significant anatomical differences between healthy and LSD-affected palms were not observed. The cortical region of the roots of the LSD-affected palms was found to be dark brown in colour, perhaps due to the accumulation of secondary metabolites such as poly-phenolic compounds.

This experiment is in progress.

*C Jayasekara, C S Ranasinghe & L R S Silva*

#### **Experiment 17.3 - Determination of net assimilation rate, foliar organic and inorganic nutrients in LSD palms (1987)**

The total soluble sugars, starch and proline content in leaves of healthy, mild and moderate LSD-palms were analysed. The total soluble sugars and proline concentration in the 1st, 6th and 14th leaves increased with increasing severity of symptoms.

Severely affected palms had low levels of sugars and proline in their leaves. Leaf macro-nutrients were analysed on two consecutive years and the results were reported in previous Annual Reports. Leaf micro-nutrients were also analysed.

*C S Ranasinghe, C Jayasekara & P S A de Saram*

**Experiment 17.4 - Studies on the effect of root pruning and incorporation of organic manure on LSD palms (1989)**

This experiment was reported under "Studies on rehabilitation of tapering palms and palms showing Leaf Scorch Decline using cultural practices, Walpita estate, Kotadeniyawa" in the Annual Report for 1989.

During the year, LSD palms were reselected and grouped on the severity of symptoms as incipient, mild and moderate. Palms were selected from lateritic areas as well as from non-lateritic areas. Healthy palms were also selected.

The following treatments were imposed to each group of palms:

- T 1 Opening two quarter circle trenches on opposite side of each palm and filling with Gliricidia.
- T 2 Opening two quarter-circle trenches and filling with cattle manure.
- T 3 Opening two quarter-circle trenches and filling with same soil.
- T 4 Opening two quarter circle trenches and filling with coir dust.
- T 5 Control

Pre-experimental data on nut yield, bulk density of soil, leaf nutrient levels and water relation parameters were taken.

This experiment is in progress.

*K B Dasanayake, C Jayasekara & M Bastian*

**Experiment 17.5 - Studies on nutrients, water and physical aspects of Leaf Scorch Decline in coconut (1990)**

Preliminary studies on macro-nutrients have already been reported in previous Annual Reports. Analyses for leaf micro-nutrients (Cl, S, and B) from Walpita and Poththukulama stations were completed. These results do not show a deficiency of Cl, S and B in young leaves of LSD-affected palms, regardless of their LSD severity. However, a significant decrease in chlorine level in lower leaves, specially in the withered portion of the affected leaves, was observed. This could be perhaps due to the transport of Cl ions to other parts of the plant because of their free mobility within tissues. Accumulation of B in withered portion of LSD affected leaves was also observed.

Leaf chlorine and sulphur levels decreased with increasing severity of symptoms.

Studies were carried out on water conductance of roots under a constant suction of 0.03 M Pa using 5 cm root segments. Preliminary results show a wide variation in root resistance to water uptake by primary, secondary and tertiary roots of the coconut palm. Roots from LSD-affected palms exhibited a higher resistance to water uptake, compared with roots from healthy coconut palms.

The studies are in progress.

*K S Jayasekara, C Jayasekara & R D N Premasiri*

## **PROJECT 27: STUDIES ON EARTHWORMS IN COCONUT CULTIVATION**

**(Project Leader - P A C R Perera, Ph D)**

**Participating Divisions:**        *Crop Protection Division*  
   *Agronomy Division*  
   *Soils & Plant Nutrition Division*

**General Remarks:** Earthworms are known to contribute towards the improvements to soil physical conditions and nutritional status. Deep-seated fertile soil is brought to the surface by earthworms, and thus help in recycling of nutrients. In the recent times, a decline in earthworm population has been noticed in coconut plantations.

This multi disciplinary project aims at elucidating the role of earthworms in coconut culture, and some preliminary studies were undertaken to survey coconut lands to determine the presence or otherwise of earthworms. Once the results of this study are available, further work would be planned.

### **Experiment 27.1 - Preliminary survey on distribution and seasonal variation of earthworms in coconut soils, coconut triangle (1990)**

The survey was restricted to the lands in the coconut triangle and covered six agroclimatic zones [two from the intermediate lowlands (IL1 and IL2) and four from the wet lowlands, (WL1 to WL4)]. Sampling was done at 40 randomly selected locations, each point being the centre of a grid fitted over a one inch map. At each sampling point, counts of earthworm casts on the surface of a 0.25 m<sup>2</sup> area, demarcated by a metal quadrat, were recorded. Counts of earthworms in the soil enclosed by the quadrat were recorded up to a depth of 30 cm from the surface using the formalin extraction method. These counts were recorded separately for areas within the manure circle and at the centre of the planting square and were repeated at two other points within the locality.

Three sets of survey data have now been collected corresponding to the relatively dry season of July to September and the wet season of October to December.

Preliminary analysis of the data collected gave significant ( $P < 0.05$ ) differences in mean numbers of earthworms between the manure circle and the centre of square. Near significant differences were also recorded for mean numbers of earthworms between the different agroclimatic zones, the range being 52.2 (IL1) to 290.6 (WL1).

The experiment is in progress.

*P A C R Perera, M M Keerthi, M G F S Jayasundara, H P S Jayasundara & T Mudalige*

### **PROJECT 28 - IMMATURE NUTFALL**

**(Project Leader - C Jayasekara Ph D)**

**Participating Divisions:**

*Biometry Division*

*Soils & Plant Nutrition Division*

*Crop Protection Division*

*Plant Physiology Division*

**General Remarks :** Once the coconut palm attains its reproductive maturity, vegetative growth and reproductive phase occur simultaneously. Vegetative growth and yield depend on the photosynthetic capacity and partitioning of assimilates into respective organs of the palm. The net rate of photosynthesis of palms vary with environmental factors as well as palm characters. During the course of the development of nuts, shedding of female flowers has been observed during the first few months after fertilization. After the first four months button nut fall is negligible and by that time, about 35% of the button nuts remain in spadices to develop into mature nuts. This process is affected by many factors, and the information available on relative effects of plant physiological, metabolic, plant nutritional and environmental factors on nut development and pollination characteristics of female flowers is meagre. This project was undertaken to study these factors and understand causes of immature nutfall. Several experiments were initiated in a 14-year old D x T hybrid plantation at Bandirippuwa Estate.

#### **Experiment.28.1 - Diurnal and seasonal variation of immature nutfall (1990)**

This is an observational trial commenced in April. Fallen immature nuts were counted daily from the opening of an inflorescence in six dwarf x tall hybrid palms. The counting was done at 8.00, 12.00 and 16.00 hrs.

The mean immature fallen nuts per bunch during a three -month period is shown in Table 2.

Table 2 - Mean immature nuts fallen during a three-month period

Palm Number	Immature nut fall (mean/bunch)			Total
	8.00 hrs	12.00 hrs	16.00 hrs	
69	31	13	12	56
70	34	13	10	57
71	59	25	26	110
111	15	7	7	29
112	27	15	14	56
113	67	16	24	56
Mean	38	15	15	69

These preliminary results show that 38 female flowers had fallen during the 16 hr period (16.00-8.00 hr) as against 30 during the 8 hr period (8.00-16.00 hr).

*T S G Peiris, K Herath, D T Fernandopulle & P Fernando*

#### Experiment 28.2 Studies on nutrient and water relations in immature nutfall of coconut (1990)

Six palms were selected for this experiment. Platforms were constructed to facilitate *in situ* measurements in the canopy of physiological parameters.

When the soil was saturated with moisture after the Oct/Nov monsoonal rains, the leaf water potential, rate of transpiration and stomatal diffusive resistance were measured for all accessible fronds in the six palms at 09.00, 11.00, 14.00 hrs. Leaf area of individual fronds was also calculated.

The rate of transpiration is very much dependent on the amount of light intercepted by the fronds, diffusion pressure deficit of the atmosphere and the wind velocity during the day. Taking into account the exposure of the canopy to sunlight for 8 h, the estimated water loss from three coconut palms was calculated. The data are presented in Table 3.

Table 3 - Estimated canopy transpiration for three coconut palms within a day in November when soil was fully saturated with water.

Palm Number	2268	2808	2756
1. Total leaf area of the canopy (m <sup>2</sup> )	159.17	96.23	101.60
2. Leaf water potential at 11.00 am (bar)	11.35	15.36	7.36
3. Estimated total canopy transpiration during a day (l/canopy/day)*	121.00	53.00	80.00

\* Considering 8 h exposure to sunlight.

Five Al access tubes (2 m long) were installed 1 m away from the bole of five coconut palms which were selected for detailed physiological studies. Preliminary results show that root water uptake was initially confined to top 0-50 cm layers of soil during the first two weeks after the rains have fully charged the soil profile to field capacity. After two weeks, roots extracted most of the soil water from layers below 1 m depth. Evapotranspiration as determined by the changes in the soil water levels (ie: roots water uptake) was found to vary with the evaporative demand of the atmosphere exerted on the canopy.

The studies are in progress.

*C Jayasekara, K S Jayasekara, C S Ranasinghe, R D N Premasiri & L R S Silva*

### **Experiment 28.3 - Studies on insects associated with coconut inflorescence, their relative abundance and seasonal distribution within the coconut triangle, Various sites (1990)**

Sticky traps were set up near coconut inflorescences, and records of insects caught on these were made. Analysis of data would be done when the dry season catches are recorded.

*P A C R Perera, M M Keerthi, T Mudalige & D C L Pathirana*

**Experiment 28.4 - Dry matter production in leaves and specific mass transfer into developing bunches (1990)**

As a preliminary study, light interception at different canopy levels was measured at different times of the day for the six palms selected for experiment 28.2. Sixty five to 70% percent of the sunlight intercepted at the upper canopy level are partly utilized and partly dissipated, whereas 10 % of the total sunlight is available to the lower most whorl of the canopy. A statistical method to calculate the frond area and the total canopy area by using a minimum sampling technique was developed as a preliminary study for this experimental programme.

The study continues.

*C Jayasekara, P S A de Saram & L R S Silva*

# REPORT OF THE INFORMATION SERVICES DIVISION

Assistant Information Officer - J L J G Pinto

## 1. GENERAL

The division continued to assist coconut growers in many ways. The demand for advisory visits increased during the year, and every effort was made to provide the required services. A large number of state-owned estates was visited to advise on their agricultural standards.

## 2. PUBLICATIONS

### 2.1 Technical Publications

Volume 7 of COCOS was published, and at the end of the year the Annual Report for 1988 was in print.

### 2.2 Extension Publications

The following publications were issued during the year.

<i>Pol Pawath</i>	-	Volume 12 No.2
<i>Coconut Bulletin</i>	-	Volume 6 No. 2

Due to heavy demand the following issues were re-printed.

<i>Coconut Bulletin</i>	-	Volume 1 No. 2
<i>Coconut Bulletin</i>	-	Volume 2 No. 2
<i>Pol Pawath</i>	-	Volume 7 No. 4
<i>Pol Pawath</i>	-	Volume 8 No. 1
<i>Pol Pawath</i>	-	Volume 8 No. 2

The first draft of a Guide book on Coconut Cultivation embodying the recommendations made by the CRI during the last six years was prepared by Dr R Mahindapala and Mr J L J G Pinto.

### 2.3 Advisory Circulars

The Advisory Circulars Nos. A7, A8, A9 and B8 in the new series on Soil and Moisture Conservation and on Mammalian Pests of Coconut, respectively were prepared and were being printed at the end of the year.

## 3. ADVISORY ACTIVITIES

The division continued to provide free technical advisory assistance to coconut estates of 20 ha and above. Several estates were inspected and the necessary advisory

assistance was provided. The total number of estates registered with the CRI at the end of the year was 310.

Advisory assistance was also provided to many growers from both small-holder and estates sector who personally called over at the Institute.

In addition to coconut growers, requests for advisory circulars were received from a large number of school children especially from those who offer agriculture as a subject at the General Certificate of Education (Ordinary and Advanced levels) and from undergraduates. All such requests were promptly complied with.

#### **4. TRAINING PROGRAMMES AND STUDY TOURS**

##### **4.1 Training Programmes**

The following training programmes were conducted during the year:

- (a) Attachment training for two batches of students from the National Apprenticeship Board from 01 March to 31 December.
- (b) Attachment training under Practical Orientation Programme to three students from Joseph Vaz College, Wennappuwa, Miss W A N Fernando, W O P S Fernando and Mr K B P S Nandasena who had gained admission to universities.
- (c) CRI component of the Induction Course of the National Institute of Plantation Management for Trainee Assistant Superintendents of Janatha Estates Development Board and Sri Lanka State Plantations Corporation, from 03 May to 23 May.
- (d) Assistance was given to two students from Sri Jayewardenapura University and Kelaniya University to collect data on coconut for compilation of reports for their final degrees.
- (e) Due to heavy demand from the private sector estates, consequent to the CRI undertaking the responsibility of providing technical assistance to that sector, a training programme on coconut cultivation practices was conducted for a batch of 31 middle level management staff of coconut estates from 28 May to 05 June. As the number of applicants was excessive, the trainees were selected on first-come-first-served basis. These trainees were awarded a Certificate of Participation at the end of the training.

With this course of training, the CRI was able to provide an opportunity for the middle-level management staff of private estates to undergo training at the CRI and to acquaint themselves with the new recommendations.

## 4.2 Study Tours

The following study tours were organised:

- (a) A batch of 55 final year (Agriculture) students from Aquinas College of Higher Educational, Colombo, 26 February.
- (b) A group of Project Officers of the Department of Education, 21 March.
- (c) A group of Coconut Development Officers and Field Officers of the Coconut Cultivation Board, 27 August.
- (d) A batch of Entomology students from the Faculty of Agriculture, University of Peradeniya, 14 September.
- (e) A batch of agriculture students from the Technical College, Kuliypitiya, 07 September.
- (f) A group of members from Sarvodaya Agriculture Forestry and Environment Programme, Ratmalana, 05 October.
- (g) Members of the Coconut Development Authority and Coconut Cultivation Board, 13 October.
- (h) A group of small-holders of the FAO Fertilizer Project, 30 October.
- (i) Two batches of final year agriculture students from Acquinas College of Higher Education, Colombo, 3 and 12 November.
- (j) A batch of students following M Sc (Weed Science) at the University of Colombo, 27 November.

## 5. SEMINARS/LECTURES/FIELD DAYS/EXHIBITIONS

**5.1 COCONUT DAY:** For the first time, the CRI organised and successfully conducted a COCONUT DAY. This was held at the Institute premises on 25 November. The main objective was to promote efficient use of fertilizer in coconut lands. All registered estate owners and those in the coconut trade were invited. Opportunities were also made available for the visitors and their families to familiarize themselves with the activities of the CRI. The agricultural trade was also given the opportunity to display and market their products relevant to coconut. The day was well patronised, and over 2,000 persons visited the CRI.

**5.2 Research discussions:** A series of informal discussions amongst research divisions on new recommendations and research highlights was organized.

**5.3 Field Days:** A Field Day was conducted at Ratmalagara Estate, Madampe for Coconut Estate Managers of the National Livestock Development Board on 20 July.

**5.4 Mobile Services:** The Institute participated in the following Mobile Services during the year:

Mobile Service of the Ministry of Plantation Industries at Puttalam, 02 February.

Mobile Service of the Ministry of Coconut Industries at Kurunegala, 20 February.

Mobile Service of the Ministry of Plantation Industries at Kegalle, 01 June.

Mobile Service of the Ministry of Plantation Industries at Ratnapura, 21 July.

Presidential Mobile Secretariat at Puttalam, 16-18 March

**5.5 Exhibitions:** The Institute participated in the 'Gam Udawa' Exhibition, 1990 at Pallakelle, 23 June - 03 July.

## **6. PHOTOGRAPHY**

Transparencies and photographs required for technical divisions were prepared and supplied.

## **7. MUSEUM**

The Museum premises was renovated and maintained satisfactorily, and Illuminated Museum Boxes and a model of triangular planting system were added during the year.

# REPORT OF THE LIBRARY & COCONUT INFORMATION CENTRE

Librarian/Project Leader - M J C Perera, A L A

## 1. GENERAL

The Library and the Coconut Information Centre (CIC) continued to perform its functions. A major programme of renovations to the Library was undertaken in November, with financial assistance of the World Bank-funded Agricultural Research Project. The services provided by the Library were severely curtailed from November, in view of the renovations.

External funding for the operation of the CIC ceased with effect from April. Most of the services originally provided by the CIC were continued with funding from the CRI. With the termination of external funding, the post of Documentation Officer was abolished, and the incumbent was absorbed into the services of the Library.

## 2. ACQUISITIONS

The Library stock recorded a total of 4,694 books at the end of the year. During the year, 78 books provided under the Agricultural Research Project were added to the collection. One hundred and two (102) periodical titles including 13 Annual Reports were received during the year, of which 60 titles were received on exchange basis and 29 on subscription.

Two hundred and twenty seven (227) new items were added to the literature collection on coconut, including five postgraduate theses. During the year requests were made to various organizations for literature, of which 21 responded.

## 3. SERVICES

**3.1 Routine Services:** The Library continued its routine activities of acquiring and processing of new material received and lending services. Information needs of the research staff were fulfilled using in-house as well as outside resources. Out of 26 inter-library loan requests made on behalf of the staff, 18 were met. Research staff were also regularly alerted for information relevant to their studies. The Library continued to supply the content pages of journals to the member libraries of the Agricultural Information Network Group (AGRINET) and also continued to receive the same service for the research staff of the Institute. The Current Awareness Services for literature on coconut were regularly provided to the Asian and Pacific Coconut Community for publication in their newsletter, 'Cocomunity'.

In addition, the resources of the Library and the Coconut Information Centre were made available to outsiders on request. Out of the 22 such requests for inter-library loans 18 were supplied. Twelve literature searches were carried out in response to requests received for information on coconut and 16 requests received from outsiders for photo-duplicates of documents were responded to. Local and foreign research

personnel, industrialists and students have also made use of the Library and the Coconut Information Centre resources during their visits.

**3.2 Retrospective Literature:** In order to create a public awareness on the use of organic fertilizers due to increase in price of chemical fertilizers, a retrospective bibliography on organic fertilizers containing 144 references based on local work was compiled.

**3.3 Directory of Coconut Research Workers:** The International Directory of Coconut Research Workers was updated during the year. At the end of the year, it recorded entries for 559 research workers and ongoing research projects. An attempt was made to compile a Selective Dissemination of Information (SDI) profile for those included in the Directory. A large number which responded by sending their SDI profiles preferred for free services.

**3.4 Training:** An internship training on routine library management was provided to Mrs S Z Rasheen, an Engineer from the Department of Buildings from 05-08 February, 1990.

#### **4. FURNITURE & EQUIPMENT**

As part of renovations of the Library, 30 units of metal book shelves were purchased. In addition, wire binding equipment and a heavy duty stapling machine were procured.

#### **5. PUBLICATIONS**

A bibliography on organic manure for coconut was compiled.

One thousand copies of a booklet 'Easy Access to Coconut Information' describing the work of the Coconut Information Centre was published and distributed among individuals and research organizations.

#### **6. PRINTING**

Two thousand copies of the Report of the Coconut Research Board for 1986, 1987, 1988 and 1989 for submission to the Parliament were prepared. Further, 8,450 copies of different types of forms were printed for the Institute.

# REPORT OF THE ESTATES MANAGEMENT DIVISION

Manager (Estates) - P S Liyanagama, B Sc (Agric)

## 1. GENERAL

The division administered the following estates, seed gardens etc. The administration of the Isolated Seed Garden was handed over to the division effective 01 January.

1. Bandirippuwa Estate, Lunuwila
2. Rathmalagara Estate, Madampe
3. Poththukulama Research Station, Pallama
4. Walpita Estate, Walpita
5. Isolated Seed Garden, Ambakelle
6. Makandura Seed Garden, Gonawila
7. Maduru Oya Seed Garden, Bogaswewa, Dimbulagala
8. Minneriya Research & Demonstration Farm, Minneriya
9. Passekudah Research & Demonstration Farm, Kalkudah

These properties were maintained in good order. The recommended cultural practices were carried out. Noxious weeds were kept well under control. Soil and moisture conservation measures such as cover cropping and husk burying were given priority attention.

Fences and boundaries were well maintained and the internal road systems were well kept, maintaining satisfactory security. Conditions in all the properties, excepting in Passekudah Farm where management was disrupted due to disturbances in the North and East.

Data recording systems were successfully implemented deriving control on costs and field operations.

Rainfall had been below normal for the second consecutive year. This will greatly reduce the nut yields in ensuing years.

An unprecedented drought was experienced from August to October mainly in the Puttalam district. In spite of all preventive measures there were a few casualties at the Isolated Seed Garden and Poththukulama Research Station.

The area statement, census of palms and general performance of the estates is given in Table 1. The rainfall and distribution at these stations are given in Table 2. The general performance of the estates and seed gardens is in Table 3.

The Soils & Plant Nutrition Division carried out foliar analysis and provided Differential Fertilizer Recommendations (DFR) for estates and seed gardens. In future, the division will depend on this service for fertilizer application, and it is hoped that this procedure will allow efficient management of palm nutrition and fertilizer costs.

Table 1 - Area Statement, Census of Palms and Crop Disposal  
relating to estates and seed gardens

### 1. Area Statement (ha)

	B/E	R/E	ISG	PRS	W/E	MK	MO	MIN	PAS	TOTAL
Coconut - Mature	72.0	55.3	91.3	62.0	16.2	0	0	0	8.0	304.8
Immature	51.9	43.1	48.2	19.6	-	53.9	38.9	12.2	24.3	292.1
<b>TOTAL</b>	<b>123.9</b>	<b>98.4</b>	<b>139.5</b>	<b>81.6</b>	<b>16.2</b>	<b>53.9</b>	<b>38.9</b>	<b>12.2</b>	<b>32.3</b>	<b>596.9</b>
Nursery	1.6	-	1.0	-	-	-	-	-	-	2.6
Roads & Buildings	22.3	2.0	3.0	2.5	1.6	2.0	4.0	-	3.7	41.1
Vacant land	.3	2.8	3.0	-	-	-	42.1	38.4	8.0	94.6
Other	-	7.3	-	1.8	-	2.4	-	-	3.4	14.9
Jungle Barrier	-	-	309.8	-	-	-	-	-	-	309.8
<b>Total</b>	<b>148.1</b>	<b>110.5</b>	<b>456.3</b>	<b>85.9</b>	<b>17.8</b>	<b>58.3</b>	<b>85.0</b>	<b>50.6</b>	<b>47.4</b>	<b>1059.9</b>

### 2. Census of Palms

Bearing Palms	8513	7570	12317	6676	1990	5251	164	478	1200	44159
Young Palms	6523	7466	5286	2176	371	4916	5659	1941	1889	36227
Seedlings	2139	-	2491	1805	-	-	-	-	-	6435
Dead Palms	84	56	637	37	85	-	-	-	-	899
Vacancies	766	1084	5516	820	74	-	2030	-	2100	12390
<b>Total</b>	<b>18025</b>	<b>16176</b>	<b>26247</b>	<b>11514</b>	<b>2520</b>	<b>10167</b>	<b>7853</b>	<b>2419</b>	<b>5189</b>	<b>100110</b>

### 3. Crop Disposal

Sold	324475	329005	-	321505	73991	-	-	2451	N/A	1051327
Converted to Copra	6866	39398	175324	22014	16381	2522	-	4135	-	266640
Research	1880	11081	430	-	-	-	-	-	-	266640
Seednuts	-	19658	257194	108	-	13395	-	-	-	290355
Staff issues	48090	10597	14763	6454	2184	716	-	1353	-	84157
Rejections	12824	14744	8989	10760	2605	416	-	555	-	50893
Awaiting Sale	141509	125876	1433	74871	71510	419	-	659	-	416277
<b>Total</b>	<b>535644</b>	<b>550359</b>	<b>458133</b>	<b>435712</b>	<b>166671</b>	<b>17468</b>	<b>-</b>	<b>9053</b>	<b>-</b>	<b>2173040</b>

Table 2 - Rainfall (A) (mm) and number of Wet Days (B) in 1990  
(corresponding figures for 1989 are given in parenthesis)

	Bandirippuwa Estate				Rathmalagara Estate				Isolated Seed Garden			
	A		B		A		B		A		B	
January	201.8	(24.5)	5	(5)	185.6	(77.7)	6	(5)	221.6	(58.4)	5	(2)
February	16.8	(0)	1	(0)	8.3	(0)	1	(0)	0	(0)	0	(0)
March	84.3	(65.7)	8	(4)	96.2	(117.4)	5	(6)	34.0	(29.5)	5	(4)
April	73.8	(234.9)	8	(14)	37.7	(204.2)	6	(8)	38.8	(81.7)	5	(5)
May	227.7	(52.3)	16	(15)	114.6	(54.2)	13	(13)	145.6	(16.0)	9	(8)
June	29.0	(153.4)	5	(19)	12.6	(131.5)	4	(16)	8.4	(112.2)	1	(112)
July	156.3	(99.0)	13	(10)	92.7	(124.2)	10	(17)	67.7	(72.1)	10	(5)
August	.3	(20.4)	1	(7)	0	(10.0)	0	(7)	0	(17)	0	(1)
September	11.9	(222.1)	7	(14)	17.4	(161.4)	2	(12)	9.5	(34.0)	1	(6)
October	395.1	(395.9)	23	(16)	389.2	(238.9)	17	(16)	288.6	(212.3)	17	(12)
November	623.3	(379.4)	17	(18)	434.6	(298.7)	14	(18)	306.7	(224.3)	14	(16)
December	90.2	(50.3)	10	(2)	76.7	(24.4)	8	(3)	59.2	(8.0)	8	(2)
<b>Total</b>	<b>1911.5</b>	<b>(1693)</b>	<b>114</b>	<b>(124)</b>	<b>1465.5</b>	<b>(1442.9)</b>	<b>86</b>	<b>(118)</b>	<b>1180.1</b>	<b>(850.2)</b>	<b>75</b>	<b>(73)</b>

Table 2 (Contd.)- Rainfall (A) (mm) and number of Wet Days (B) in 1990  
(corresponding figures for 1989 are given in parenthesis)

	Poththukulama Estate				Walpita Estate				Makandura Seed Garden			
	A		B		A		B		A		B	
January	203.4	(53.8)	5	(2)	65.8	(1.9)	8	(2)	198.4	(21.4)	5	(2)
February	0	(0)	0	(0)	27.0	(0)	2	(0)	-	-	-	-
March	30.4	(2.3)	3	(1)	136.3	(93.3)	8	(4)	138.9	(139.1)	8	(3)
April	28.9	(146.0)	2	(5)	89.1	(230.0)	3	(8)	91.0	(207.1)	4	(9)
May	160.5	(8.8)	10	(1)	199.3	(185.7)	14	(14)	175.1	(84.8)	15	(11)
June	9.1	(93.7)	11	(8)	87.2	(431.8)	10	(15)	48.8	(224.2)	9	(17)
July	79.5	(62.4)	4	(4)	190.3	(280.0)	12	(7)	224.9	(150.3)	15	(11)
August	0	(0)	0	(0)	0	(35.2)	0	(4)	0	(23.1)	0	(5)
September	2.0	(34.0)	1	(2)	21.0	(173.8)	2	(13)	10.2	(165.6)	2	(15)
October	358.3	(142.7)	16	(11)	331.0	(209.2)	19	(14)	416.3	(224.3)	21	(14)
November	284.4	(301.2)	10	(14)	592.2	(315.7)	5	(18)	694.1	(272.6)	13	(10)
December	56.9	(14.2)	4	(2)	157.0	(82.2)	5	(2)	103.3	(69.6)	6	(2)
<b>Total</b>	<b>1213.4</b>	<b>(9839.30)</b>	<b>56</b>	<b>(50)</b>	<b>1896.2</b>	<b>(2047.8)</b>	<b>95</b>	<b>(99)</b>	<b>2100.8</b>	<b>(1582.1)</b>	<b>98</b>	<b>(99)</b>

Table 2 - (Contd.) Rainfall (A) (mm) and number of Wet Days (B) in 1990  
(corresponding figures for 1989 are given in parenthesis)

	Maduruoya Seed Garden				Minneriya R & D Farm			
	A		B		A		B	
January	276.75	(218.70)	7	(7)	236.91	(142.10)	5	(3)
February	34.0	(0)	3	(0)	73.25	(2.20)	3	(1)
March	66.00	(50.04)	1	(5)	148.22	(66.15)	6	(3)
April	54.50	(35.56)	3	(4)	152.14	(166.35)	5	(6)
May	80.75	(59.19)	6	(5)	168.56	(116.13)	4	(4)
June	0	(29.47)	0	(2)	0	(32.09)	0	(2)
July	31.25	(151.39)	2	(8)	20.82	(172.97)	1	(5)
August	101.75	(115.07)	4	(2)	105.10	(0)	6	(0)
September	174.50	(88.90)	7	(5)	162.92	(86.73)	3	(4)
October	313.75	(109.30)	12	(8)	222.21	(129.11)	10	(4)
November	108.75	(254.51)	8	(15)	104.86	(310.90)	3	(16)
December	581.25	(159.52)	15	(13)	337.61	(56.59)	17	(2)
<b>Total</b>	<b>1823.25</b>	<b>(1371.65)</b>	<b>68</b>	<b>(74)</b>	<b>1732.60</b>	<b>(1281.32)</b>	<b>68</b>	<b>(50)</b>

Table 3 - *General Performance of the Estates etc. - 1990*

	BE	RE	ISG	PRS	WE	MK	MO	MIN	PAS	TOTAL
Total extent (ha)	148.1	110.5	456.3	85.8	17.8	58.3	85.0	50.6	47.4	1059.8
Planted extent (ha)	123.9	98.4	139.5	81.6	16.2	53.8	38.0	12.1	35.2	599.6
Bearing extent (ha)	72.0	55.3	91.3	62.0	16.2	-	-	-	-	296.8
Immature extent	51.9	43.1	48.2	19.6	-	53.8	38.9	12.1	35.2	302.8
Total Crop - 1989	512595	634929	1225700	801501	192474	-	-	-	-	3367199
Total Crop - 1990	535644	550359	458133	435712	166671	-	-	-	-	2146519
Difference (%)	+4.5	-13.3	-62.6	-45.6	-13.4	-	-	-	-	-36.3
Nuts/palm - 1989	54.0	83	121	119	90	-	-	-	-	-
Nuts/palm - 1990	62.9	73	42	65	84	-	-	-	-	-
Difference (%)	+16.5	-12.0	-65.3	-45.4	-6.7	-	-	-	-	-
COP (Rs.)	1163	1293	3498	2100	1921	-	-	-	-	-
NSA (Rs.)	2374	2194	3699	2188	2360	-	-	-	-	-

BE, Bandirippuwa Estate; RE, Rathmalagara Estate; ISG, Isolated Seed Garden; PRS, Pothukulama Research Station; WE, Walpita Estate; MK, Makandura Seed Garden; MO, Maduru Oya Seed Garden; MIN, Minneriya Farm; PAS, Passekuda Farm; COP, Cost Of Production/1000 nuts; NSA, Net Sale Average/1000 nuts.

## 2. BANDIRIPPUWA ESTATE, LUNUWILA

(Superintendent: Mr M R L A Perera)

District:	Puttalam
Electorate:	Wennappuwa
Agro-climatic zone:	Semi-wet Intermediate

A major part of the estate is under young plantations and only 72 ha or 60% of the planted area is in production.

**Rainfall:** The total rainfall indicates an increase of 11.4% over that of 1989. However it remained below average for the second consecutive year.

**Nut Yields:** The total nut yield for the year (535 644) was 4.5% more than that of the previous year and 27.8% more than the previous five years' average. It was also 34% more than the estimated crop for the year.

**Disposal of crop:** The crop was disposed mainly through brokers as husked nuts for processing.

### Field Operations:

**.1 Manuring:** Bearing palms (6651) were manured during Maha season with the DFR (dosage per palm: Urea - 1.5 kg; E R P - 0.6 kg; S P - 0.2 kg; M P - 2.1 kg; Dolomite - 3.0 kg)

Seedlings (5744) were manured with YPM @ 1.8 kg in split applications in May/June and Oct./Nov. seasons. Dolomite was applied once at 1 kg per seedling. Seedlings (1931) of the Genetics & Plant Breeding trials too were manured with YMP + Dolomite as per their recommendations.

**.2 Weed Control:** Ground conditions were maintained in good order. Weeding was done in four rounds mostly employing Rotaslasher. Cheddies in cover-cropped areas were removed manually. Manure circles were kept free of weeds using herbicides.

**.3 Soil and moisture conservation:** Contour drains were desilted and reconditioned where necessary. No new drains were opened. Manure circles were mulched with fallen fronds at regular intervals and the seedlings were mulched with coir dust. Husk burying and establishment of cover crops were hampered due to dry weather conditions prevailed during May/June season. However during Oct./Nov., 758 semi-circular husk trenches of 90 x 60 x 60 cm were done in field nos. 7 and 9. Pueraria cover was established in field nos. 1, 4, 6 and 8.

**.4 Fences:** Perimeter fences approx. 20 km was well maintained. Very few incidents of wilful damages were reported. One thousand three hundred metres of the old fence with wooden posts in field nos. 7 and 9 were replaced using concrete posts. Fences were kept free of creeping weeds using herbicides.

Table 4 - Analysis of yield data, Bandirippuwa Estate; 1985 to 1990

Pick	1985	1986	1987	1988	1989	Five year's Average	Percent	1990
1	81496	86180	39942	24867	52656	57028	13.6	42837
2	105327	112322	63033	36112	85714	80502	19.2	87261
3	122662	82023	76837	52772	129704	92800	22.2	131336
4	114394	90490	69247	45161	114458	86750	20.7	120216
5	93811	56088	39699	28130	82255	59997	14.3	106617
6	76116	37534	18996	29505	47808	41991	10.0	47377
<b>Total</b>	<b>593806</b>	<b>464637</b>	<b>307754</b>	<b>216547</b>	<b>512595</b>	<b>419067</b>	<b>100.0</b>	<b>535644</b>
No of bearing palms	13289	11834	9940	9940	9500	10901	-	8513
Nuts / palm	44.7	39.3	31.0	21.3	54.0	50.9	-	62.9
Nuts / ha	7068	6211	4901	2905	8440	8168	-	9943

**.5 Roads and paths:** Field roads were maintained in good order. Roads in field nos. 7, 8 and 9 were resurfaced and repaired using 95 cubes of gravel. Roads were kept free of weeds using herbicides.

**.6 Replanting:** 2.7 ha in field no. 8 was replanted with 530 seedlings of CRIC - 60. In field nos. 2, 6 and 7 vacant lands and vacancies were planted with 770 seedlings (CRIC 60) in Oct./Nov. season. Rest of the new clearings were maintained in good order. Dud palms (262) were removed in field nos. 1, 2, 3, 4, 5, 6, 7 and 8. Old palms in field no. 3 (200) and field no. 5 (300) were uprooted and removed.

**.7 Buildings, machinery etc:** Vehicles and equipment were satisfactorily maintained. Superintendent's office was renovated with certain modifications. The estate was supplied with a knap-sack sprayer, a bicycle, a rotaslasher, a knap-sack grass cutter and a steel cabinet during the year.

**.8 Costs and returns:** The Cost of Production (COP) for the year was Rs. 1163/- per 1000 nuts produced and the Net Sales Average (NSA) was Rs. 2374/- per 1000 nuts.

The general performance of the estate improved vastly after a long non-profit making period and the estate realised a substantial profit for the year.

### 3. RATHMALAGARA ESTATE, MADAMPE

(*Superintendent: Mr G Vithanage*)

District:	Puttalam
Electorate:	Chilaw
Agro-climatic zone:	Semi-dry Intermediate Zone

Excepting for a reserved jungle block of about 3.2 ha the rest of the plantable land is under coconut.

**Rainfall:** The total rainfall was marginally more (+ 1.5%) than that of the previous year. Yet it was poorly distributed with lesser number of rainy days.

**Coconut yields:** Yields in 1991 are expected to be less. An analysis of yield data is given in Table 5.

**Disposal of crop:** Crop was disposed mainly as fresh nuts through brokers. Nuts from the dwarf palms and buyers' rejections were converted to copra but the out-turn was poor.

#### Field Operations:

**.1 Manuring:** All bearing palms (7570) were manured with N P K and Mg as per DFR. All young palms were manured with YPM and Mg at six-monthly intervals. Foliar analysis indicated severe deficiency in Mg requiring application of 3 kg dolomite/palm. Seedling were each given 2 kg dolomite. Young palms in field nos. 2, 3, 5, 7 and 8 were given a surface application of cattle manure at 30 kg/palm.

Table 5 - Analysis of yield data, Ratmalagara Estate; 1985 to 1990

Pick	1985	1986	1987	1988	1989	Five year's Average	Percent	1990
1	109226	133639	74024	44186	83743	88963	12.6	48320
2	109455	157982	114359	61368	94867	107605	15.3	62945
3	159840	203283	119910	122224	127673	146586	20.8	114903
4	187083	160857	174100	108062	128100	151640	21.5	130380
5	220007	127404	94998	58159	118477	123809	17.5	133423
6	133047	91678	61590	63298	82069	86336	12.3	60388
<b>Total</b>	<b>918658</b>	<b>874843</b>	<b>638981</b>	<b>457297</b>	<b>634929</b>	<b>704940</b>	<b>100.0</b>	<b>550359</b>
Nuts / palm	79	75	56	59	83	70	-	73
Nuts / ha.	11954	11373	8307	9436	11757	10565	-	10142

**.2 Weed Control:** Weeds were kept well under control. Slashing with tractor and uprooting cheddies were done in four rounds for the year. Noxious weeds such as 'Illuk' were contained using glyphosate. Gramoxone was used to maintain manure circles free of weeds.

**.3 Soil and moisture conservation:** Special attention was paid this year for moisture conservation. Husk burying programme was successfully completed with 2056 pits of 1.5 x 0.9 x 0.9 m in field nos. 2, 3, 4, 5, 7, 8 and 9. Coir dust was used as an interlayer with husks in field no. 8.

Manure circles were mulched with fallen fronds and weed trash regularly. During the intense drought experienced from August to October all young palms were mulched with 5 cm thick layer of coir dust and the seedlings were watered regularly. The effect of drought was minimal. Puereria was established in 15 ha in field nos. 4 and 7.

**.4 Fences:** 1800 m of the western perimeter fence bordering the main road were replaced with new concrete posts. Another 800 m of the fence were renovated. Creeping weeds were controlled using herbicides.

**.5 Roads and paths:** All field roads were well maintained and the necessary repairs were effected. Road drains were desilted and surface run-off along the roads prevented. Weeds were controlled chemically.

**.6 Replanting:** About one hectare of neglected land in field no. 8 was planted with CRIC 60 (poly-bagged) seedlings.

**.7 Buildings, machinery etc:** Vehicles (jeep, motor cycle, tractors, trailers, bowsers etc.) and implements were maintained in good order. MF 240 tractor no. 37/1891 was overhauled by the State Trading (Tractor) Corporation. The estate received a new 1MT 459 tractor, a knap-sack sprayer and a bicycle. All buildings were colour-washed and minor repairs were done locally.

**.8 Costs and returns:** The Cost of Production and the Net Sales Average were Rs. 1293/- and Rs. 2194/- per 1000 nuts respectively.

**.9 Others:** Compost pits were introduced and the compost was used for manuring infills. About 6000 seedlings of forest trees were planted along the boundary fence and road sides.

In the poly-bag nursery, 4783 seednuts were laid, and 2349 seedlings were issued with a balance of 1381 seedlings. Another 5400 seednuts were laid in poly-bags for issue in 1991.

**4. ISOLATED SEED GARDEN, AMBAKELLE**  
(*Superintendent: Mr S M Wijeratne Banda*)

District: Puttalam  
Electorate: Chilaw  
Agro-climatic zone: Semi-dry Intermediate Zone

*Note:* Further information on the ISG appears in the report of the Genetics & Plant Breeding Division.

**Rainfall:** Total rainfall for the year (1180.1 mm) was 38% more than that of the preceding year (850.2 mm). Yet the distribution was very poor with a long dry spell from mid-July to mid-October, resulting in the death of 60 adult palms. All young palms were saved by bowser irrigation with water drawn from Deduru Oya river.

**Seednut production:** The seednut production showed a reduction by 62.6% (Table 3), due mainly to adverse weather conditions. The production from tall and dwarf palms is given in Tables 6 and 7. The crop disposal details are in Table 8.

Table 6 - *Production from tall palms and dwarf palms, Isolated Seed Garden*

Pick	Tall		Dwarf	
	1989	1990	1989	1990
1	144714	72768	41951	19409
2	159975	66632	63620	14592
3	162983	86346	53780	11759
4	179154	46069	40419	3813
5	177112	60090	55318	3234
6	120167	70620	26507	2801
<b>Total</b>	<b>944105</b>	<b>402525</b>	<b>281595</b>	<b>55608</b>
Bearing palms	7065	8089	3104	27700
Nuts/palm	134	50	91	20

Percentage drop in yield over 1989: Tall = 57.4%; Dwarf = 80.3%

**Field Operations:**

**.1 Manuring:** All bearing palms (10859) were manured as per the DFR. Leaf analysis revealed Mg deficiency in all fields, and accordingly, dolomite at the rate of 3.8 kg/palm of were applied. Field nos. 1, 2, 3, 4, 5, 6, 7, 8 and 10A were manured in May/June and the rest were done in Oct./Nov. Young plantations were manured at six-monthly intervals with YPM as recommended.

**Table 7 - Total nut yield for 1989 and 1990 and the 10-year average (1979-1988); Isolated Seed Garden.**

Pick	1989	1990	Average 1979-1988
1	186665	92177	95389
2	223595	81224	138833
3	216763	98106	158352
4	219573	49882	136615
5	232430	63324	124211
6	109519	73421	99083
<b>Total</b>	<b>1225700</b>	<b>458133</b>	<b>752483</b>
Bearing palms	10169	10859	
Nuts/palm	121	42	

Drop in yield over 1989 - 62.6%

**Table 8 - Crop disposal details; Isolated Seed Garden.**

Mode of disposal	Tall	Dwarf	Total
Seednuts delivered	226348	24981	251329
Cured into copra	146914	28410	175324
Issued to nursery	5865	-	5865
For research			
G & PB Div.	223	-	223
P P Div.	84	-	84
Others	123	-	123
Residents issue	14763	-	14763
Rejections	8205	784	8989
Bal. for disposal	-	1433	1433
<b>Total</b>	<b>402525</b>	<b>55608</b>	<b>458133</b>

**.2 Weed Control:** Weeds did not pose a major problem owing to the dry weather conditions prevailed during the year. Glyphosate was very effectively used for the control of Illuk in 75 ha of land fields nos. 1, 2, 3, 4, 6, 11A, 11B, 12, 13 and 14. The co-ordination of chemical and mechanical control measures proved to be effective and economical. Manure circles were kept free of weeds using gramoxone.

**.3 Soil and moisture conservation:** A total of 7840 m of drainage drains in field nos. 2, 3, 4, 11A, 11B, 12 and 13 were desilted. Although 5000 husk pits (1.5 x 0.9 x 0.9 m) were programmed for the year, only 862 pits in field no. 8, 170 pits in field no. 4 and 104 pits in field no. 5 could be completed in May/June. In Oct./Nov. 900 semi-circular husk trenches (0.9 x 0.6 x 0.6 m) were completed around the seedlings in fields nos. 11A and 11B.

Regular mulching was continued with fallen fronds and weed trash. Husk mulch too was used in seedlings. With the onset of the drought the seedlings were supplied with an additional surface mulch of coir dust, 3 to 5 cm in thickness, extending to about 45 cm beyond the standard manure circle. Cover-crop programme was not a success due to the poor rainfall. However, in October, 9 ha of *Puereria* were established in field no. 11A.

**.4 Fences:** Perimeter fence was maintained in good order. About 5000 m of fence in the Northern boundary (Attangane, Welipeless, Ambakelle) were re-erected. Another 763 m of the southern perimeter were repaired and planted with about 5000 *glicicidia* stakes to reinforce the fence.

**.5 Roads and paths:** About 7000 m of estate roads and paths were well maintained. Access road from the main road upto the gate (1000 m) was re-surfaced and cambered providing road-side drains. A new road (1200 m) was opened along the northern and western boundary of field no. 14 and a new path (660 m) was opened through field no. 11A. Three culverts were constructed using hume pipes. Roads were kept free of weeds using herbicides.

**.6 Young Plantations:** One thousand four hundred and eleven vacancies were filled using Ambakelle Special seedlings. Young plantation (48.2 ha) were maintained in good order. Seedlings were irrigated with 45 litres of water once in 10 days throughout the drought. Both reservoirs in did not have water during the dry period and water had to be transported about 10 km from Deduru Oya. There were no casualties of seedlings due to the drought.

**.7 Buildings, Machinery etc:** All the buildings excepting the office and Superintendent's bungalow were colour-washed. Vehicles and machinery were maintained in good order. One tractor 37/90 (MF 240) was under repair at State Trading (Tractor) Corporation. Another two, 36/2642 (MF 135) and 36/2643 (MF 135) were undergoing repairs at a private garage.

**.8 Others:** One thousand and five hundred trees were planted in perimeter and road sides to promote the tree planting campaign. Another 7000 seedlings of forest trees were raised for future planting.

General conditions of the seed garden was satisfactory with visible improvements on cultural practices.

**.9 Costs and returns:** The Cost of Production was Rs. 3498/- while the Net Sales Average was Rs. 3699/- per 1000 nuts.

## **5. POTHTHUKULAMA RESEARCH STATION, PALLAMA**

(*Superintendent: Mr D M Pathirage*)

District:	Puttalam
Electorate:	Anamaduwa
Agro-climatic zone:	Semi-dry intermediate zone

**Rainfall:** The total rainfall recorded is 28.8 % more than that of preceding year with similar distribution. A severe drought was experienced from mid-July to mid-October.

**Analysis of yield data:** Nut yields were 45.6% less compared with the preceding year. There was a drop of 30.2% against the average yield of the previous five years. This drop in yield is attributed to the dry weather conditions prevailed during the previous year. Yields in 1991 too will continue to remain low. An analysis of yield data is in Table 9.

**Disposal of crop:** Crop was disposed mainly as fresh nuts through brokers.

### **Field Operations:**

**.1 Manuring:** All bearing palms were manured with DFR. Immature palms were manured with urea based YPM in two six-monthly applications, as recommended. Dolomite was applied at the rate of 1.5 kg/seedling.

**.2 Weed Control:** Ground conditions were satisfactorily maintained by performing four rounds of weeding. Noxious weeds such as Illuk and Mana were kept under control using glyphosate. Manure circles were maintained using gramoxone.

**.3 Soil and Moisture Control:** All available husks were buried in pits (2438 pits of 1.5 x .9 x .9 m and 381 trenches). Another 117 pits (1.5 x 0.9 x 1.2 m) were done on a trial basis. Adult palms were regularly mulched using fallen fronds, weed trash etc. Seedlings were mulched with husks and coir dust. Adult palms, 150 in field no. 11A and 100 in no. 6 were applied with a thin layer of coir dust in the manure circle. In about 0.8 ha in field no. 12 fibre dust was applied on the ground surface and incorporated by running a harrow lightly. During the dry spell irrigation water was transported from Deduru Oya using tractor-drawn bowsers.

**.4 Fences:** The perimeter fence was maintained in good order. No incidents of wilful damages were reported. Fence was reinforced by planting gliricidia stakes along the perimeter. Boundary fence bordering the temple was repaired.

Table 9 - Analysis of yield data, Pothukulama Research Station: 1985 to 1990.

Pick	1985	1986	1987	1988	1989	Five year's Average	Percent	1990
1	92480	79934	78887	64625	102372	83660	14	54563
2	128213	75245	97815	52576	141944	99159	16	56999
3	211778	100534	142204	90009	200060	148921	24	93558
4	135320	81132	87893	87978	140051	106475	17	67201
5	147100	71424	81701	77212	127718	101031	16	86140
6	91702	74762	76842	84528	88336	83234	13	77251
<b>Total</b>	<b>806593</b>	<b>483031</b>	<b>565342</b>	<b>446928</b>	<b>801501</b>	<b>622480</b>	<b>100</b>	<b>435712</b>
Nuts/palm	111	69	83	67	119	90	-	65
Nuts/ha	16602	9942	11637	9200	16499	12776	-	6561

Table 10 - Analysis of yield data, Walpita Estate: 1985 to 1990.

Pick	1985	1986	1987	1988	1989	Five year's Average	Percent	1990
1	17926	20843	16958	4937	19472	16027	9.3	13566
2	24116	24741	47925	8904	32012	27540	16.0	11206
3	58925	43911	44643	15312	47632	42085	24.5	31185
4	43722	48049	33634	25944	39391	38148	22.2	35287
5	40291	33114	22092	23311	35895	30940	18.0	42606
6	28943	18837	7074	12634	18072	17012	10.0	32821
<b>Total</b>	<b>213923</b>	<b>188985</b>	<b>172326</b>	<b>91042</b>	<b>192474</b>	<b>171752</b>	<b>100.0</b>	<b>166671</b>
Bearing palms	2156	2157	2099	2094	2129	2127	-	1990
Nuts/palm	99.2	87.6	82.1	43.5	90.4	80.8	-	83.8
Nuts/ha	13210	11668	10641	5620	11888	10608	-	10295

**.5 Roads:** Field roads and paths (4613 m) were kept in good order. A new access road (838 m) was completed and a gate was installed at the new entrance. A new boundary road of 2492 m was opened in the new clearings along the eastern boundary. The road in field No. 12 was resurfaced with gravel. Roads were kept free of weeds using herbicides.

**.6 Improvements:** One hundred and forty vacancies were filled in field nos. 6 and 13 with CRIC-60 seedlings. Twenty dud palms were uprooted and removed. Paddy field was cultivated using six bushels of BG 379/2 seed paddy. Weather was favourable and a good harvest is expected.

The double avenue planting in field no. 6 (2.4 ha) was intercropped with banana using 295 suckers of var. *kolikuttu* and 375 var. *ambul*. This plantation was somewhat water-logged and drains were opened to let out excess water.

**.7 Buildings, machinery etc:** All buildings were colour-washed. The roof of the copra/fertilizer stores was painted with anti-corrosive paint. All vehicles and equipment were kept in good order.

**.8 Tree planting campaign:** Trees (*Acacia* - 2000; *Margosa* - 1000; *Gliricidia* - 1500) were planted along the perimeter and roadsides. Another 2 200 of *Margosa* and 800 *Acacia* planted were raised in poly-bags for future planting.

**.9 Costs and returns:** Cost of Production was Rs 2100/- per 1000 nuts whilst the Net Sales Average was Rs. 2188/-.

## 6. WALPITA ESTATE, WALPITA

(Officer in charge: Mr N Gamage)

District:	Gampaha
Electorate:	Divulapitiya
Agro-climatic zone:	Semi-wet Intermediate Zone

This is a small property of about 18 ha in extent established in 1948 as a Progeny Trial. The area under coconut is 16.19 ha, and an analysis of yield data is given in Table 10. Most of the intercropping trials and demonstrations of the Agronomy Division are conducted here.

*Area intercropped (ha)*

	Bearing	Non-bearing	Total
Cacao	2.02	-	2.02
Pepper	0.20	0.93	1.13
Coffee	0.80	-	0.80
Cinnamon	0.18	-	0.18
Banana	-	0.83	0.83
Mixed	0.20	-	0.20
Total	3.40	1.76	5.16

## Field Operations:

- .1 Manuring:** The entire plantation was manured according to the DFR.
- .2 Weed Control:** Ground conditions remained satisfactory with weeds well under control. Three rounds of weeding by uprooting and slashing had been done during the year. Spread of cover crops helped in keeping the weeds under control.
- .3 Soil and moisture conservation:** All available husks were buried in 360 pits of standard size. Adult palms were mulched regularly with fallen fronds and the seedlings were mulched with husks. Cover crops were well maintained resulting an effective ground cover.
- .4 Fences:** The boundary fence was maintained in good order. About 335 m of the fence in the southern boundary of block 'B' was replaced using new barbed wire. Similarly, 125 m of the fence in block 'A' too were repaired using new barbed wire. Gliricidia stakes were planted at 25 cm intervals along the repaired fence.
- .5 Roads and paths:** About 2.5 km long roads and paths were kept in good order. Weeds along the roads were controlled using herbicides.
- .6 Buildings, machinery etc:** All the buildings were maintained well. Office building was repaired and colour-washed. A 7m x 3m shed was constructed for curing copra. A new trailer was supplied to the hand tractor.
- .7 Costs and returns:** The Cost of Production was Rs. 1921/- whilst the Net Sales Average was Rs 2360/- per 1000 nuts. The revenue from intercrops is as follows:

	<i>Quantity</i>	<i>Value (Rs)</i>
Cacao (dry beans)	605 kg	25 118 77
Cinnamon (peelings)	22 kg	4 698 18
Pepper (dry seeds)	171 kg	13 680 00
Coffee (dry beans)	107 kg	3 745 00
Pepper (seedlings)	457 Nos	2 285 00
Total Revenue		<b>50 026 95</b>

Total cost on intercrops was Rs 39 599.98 realising a profit of Rs 10 426.97.

- .8 Others:** 500 seedlings of mahogany were planted along the perimeter.

## 7. MAKANDURA SEED GARDEN, GONAWILA

(Superintendent: Mr L J C Perera)

District: Kurunegala  
 Electorate: Katugampola  
 Agro-climatic zone: Semi-wet Intermediate Zone

This seed garden was established in 1984 with the financial assistance of the Asian Development Bank and the International Fund for Agricultural Development. The entire plantable area of the Seed Garden is put under coconut to produce CRIC-60 and Anbakelle Special varieties. (See Report for 1988 for planting details.)

Flowering data and yields are given in Table 11.

Table 11 - Flowering and harvesting details: Makandura Seed Garden.

Field	Flowering (palms)					Harvest (nuts)		
	1987	1988	1989	1990	Total	1989	1990	Total
1S	1	169	470	305	945	78	7203	7281
1B	-	1	137	290	428	-	554	554
2S	-	52	422	673	1147	65	2201	2266
2B	-	-	65	320	385	-	119	119
3S	2	102	290	385	779	51	2882	2933
3B - I	-	2	37	72	111	-	58	58
3B - II	-	-	31	84	115	-	-	-
4S	-	65	358	308	731	31	2510	2541
4B - I	-	68	310	204	582	-	1941	1941
4B - II	-	-	7	21	28	-	-	-
<b>Total</b>	<b>3</b>	<b>459</b>	<b>2127</b>	<b>2662</b>	<b>5251</b>	<b>225</b>	<b>17488</b>	<b>17693</b>

S, Seed palms; B, Barrier palms

### Field Operations:

.1 **Manuring:** The entire seed garden was manured in two split applications as per the DFR. Seedlings (425) were manured with YPM plus dolomite as per the normal recommendations.

.2 **Weeding:** Ground conditions were maintained satisfactorily with two main rounds of weeding. Cheddies were removed by uprooting. Owing to the well established cover crop (Pueraria), the expenditure on weeding was considerably reduced. Manure circles were kept free of weeds using herbicides.

.3 **Soil and moisture conservation:** Out of an envisaged 1300 husk pits, 700 were completed in field No. 4. Palm bases were mulched with coir dust and weed trash in

two cycles after each fertilizer application. Well established cover crop effectively contributed to conserve soil and moisture.

**.4 Roads and fences:** Roadways (4186 m) were kept free of weeds by application of herbicides in three rounds. 475 m<sup>3</sup> of gravel were used to recondition the roads in field nos. 1 and 4. Perimeter fence (846 m) in field nos. 2, 3 and 4 was redone using concrete posts. The entire perimeter fence (3096 m) was maintained in good order.

**.5 Pests and diseases:** Good hygiene was maintained throughout. No incidents of pests and diseases were reported.

**.6 Others:** Palms were irrigated using bowsers during the dry weather in August - September. There were no casualties due to drought. However, 96 seedlings succumbed to water-logged conditions due to excessive rains in Oct./Nov. season. Under the tree planting campaign 700 timber trees and 2000 gliricidia stakes were planted along the perimeter and road-sides. Acacia seedlings (8500) were raised in a nursery for future planting.

**.7 Buildings, Machinery etc.:** All buildings were maintained in good order. An old poultry shed in field no. 4 was converted into a fertilizer store, using only Rs. 10,000/- for modifications. Vehicles and equipment were maintained well.

#### **8. MADURU OYA SEED GARDEN, BOGASWEWA**

*(Superintendent - Mr A N Ekneligoda)*

District	-	Polonnaruwa
Electorate	-	Polonnaruwa
Agroclimatic zone	-	Dry zone

This seed garden was established under the East Coast Rehabilitation Project of the Coconut Development Authority, financed by the European Economic Commission. Work on the seed garden commenced in the latter part of 1985. Twenty eight hectares were planted with CRIC 60 by end 1990.

**Rainfall:** The seed garden received a rainfall of 1823.3 mm which is 33% more than that of the preceding year. Yet there is no improvement on distribution of the same.

## **Field Operations:**

**.1 Manuring:** Owing to the dry weather prevailed no manuring could be done during Yala. Hence the total annual dose of YPM and 1 kg of dolomite per seedling were applied in Maha.

**.2 Weed Control:** Ground conditions were satisfactorily maintained. A well established cover crop had effectively controlled the weeds. Rotaslasher was used in the rest of the areas to check the weed growth. Manure circles were kept free of weeds using gramoxone and more stubborn weeds were controlled using glyphosate.

**.3 Soil and moisture conservation:** Existing covers in about 25 ha were well maintained. Seedlings were mulched using paddy straw. Contour and drainage canals were well maintained. Husk burying could not be done due to non-availability of husks.

**.4 Fences:** In spite of frequent damage by wild elephants, the perimeter fence was kept in good order.

**.5 Roads:** Internal roads and paths were well maintained. Herbicides were used to keep them free of weeds.

**.6 Pests and diseases:** Five seedlings were attacked by red weevil. Recommended curative and prophylactic measures were taken.

**.7 Nursery:** A pre-nursery was laid in March with 3,500 nuts of CRIC 60 from Ambakele to meet the requirements for future planting.

**.8 Flowering etc.:** Two palms flowered in 1989 and another 108 in 1990. Twelve nuts were harvested from one palm that flowered in 1989.

**.9 Damages by wild animals:** Damage by wild elephants continued. Wild boar became a further manace causing extensive damage to the young palms. These have now reached alarming proportions and their control has become difficult as there are no fire-arms.

**.10 Buildings etc.:** A fresh contract was awarded to construct an office building and quarters for the Superintendent. Progress of work was not satisfactory. The

Contractor was warned to expedite work. Vehicles and machinery were maintained in good order.

Levels of irrigation canal provided to the seed garden were corrected by the Mahawelia Authority to enable free flow of water.

**9. RESEARCH AND DEMONSTRATION FARM, MINNERIYA**  
(Officer in charge - Mr M S Perera)

District	-	Polonnaruwa
Electorate	-	Minneriya
Agro-climatic zone	-	Dry Zone

Minneriya Research and Demonstration Farm was established in 1982 under the East Coast Rehabilitation Project of the Coconut Development Authority.

**Rainfall:** The farm received 1732.60 mm of rainfall distributed in 68 days. This is an increase of 35% over the previous year. Except for June and July, the rainfall distribution during the rest of the year was quite satisfactory.

Yield data are given in Table 12.

Table 12 - Yield data, Research & Demonstration Farm  
Minneriya

Pick	1989	1990
1	-	252
2	-	1511
3	2564	2340
4	1358	1498
5	311	2012
6	102	1440
<b>Total</b>	<b>4335</b>	<b>9053</b>

**Field operations:**

.1 **Manuring:** Bearing palms were manured with APM at 3 kg and 1 kg dolomite. Seedlings were manured with YPM as per recommendations.

**.2 Weed Control:** During the first half of the year weed control was done using rotaslasher. In the latter part manual labour was used as the tractor was out of commission. "Illuk" in field nos. 1 and 2 were controlled using glyphosate.

**.3 Soil and moisture conservation:** The cover crop was maintained satisfactorily. Manure circles were mulched using weed trash.

**.4 Irrigation:** Rainfall was satisfactory and irrigation was required only during June and July.

**.5 Fences:** A new fence was erected in about 5 ha of newly cleared land.

**.6 Roads:** Roads were maintained using herbicides.

**.7 Pests and diseases:** Recommended preventive measures were taken. Elephants and wild boars continued to damage the plantation. Absence of fire-arms aggravated the situation.

**.8 Buildings, machinery etc.:** Buildings and machinery were maintained in good order. The 4-wheeled tractor met with an accident in June and was under repair until the end of the year. A new bicycle was received.

#### **10. RESEARCH & DEMONSTRATION FARM, KALKUDAH.**

*(Officer in charge - Mr A Thavaratnarajah)*

District	-	Batticaloa
Electorate	-	Kalkudah
Agro-climatic zone	-	Dry Zone

**Activities:** The farm could not be visited by the officers from head office as there was no improvement of the situation in the area. Terrorist activities were intensified in June and the farm had to be abandoned on 18 June after which the farm buildings and properties were severely damaged and subsequently looted by unknown elements.

# REPORT OF THE AGRICULTURAL RESEARCH PROJECT

Project Co-ordinator - M Jeganathan, M Phil

## 1. ACTIVITIES

### 1.1 Manpower Development Programme

**Long-term Training :** The following officers continued with their postgraduate studies:

Mr L L W Somasiri, Plant Nutrition, Aberdeen, UK, Ph D; Mr R A J R Perera, Agricultural Economics, North Carolina, USA, M.S; Ms W M U Fernando, Population Genetics, Birmingham, UK, Ph D; Ms L K Weerakoon, Tissue Culture, Illinois State, USA, M S.

Three officers left the island for postgraduate studies during the year:

Mr T G L G Gunasekera, Crop Management, North Wales, UK, M Phil; Mr N A Tennakoon, Soil Microbiology, Aberdeen, UK, Ph D; Mr H P S Jayasundera, Biological Nitrogen Fixation, Reading, UK, M Phil.

Mr H A J Gunathilake completed the fellowship award on 22 April.

Mr L L W Somasiri's fellowship was upgraded for a Ph D degree, on a split programme. He returned to the island on 29 March to undertake field studies on coconut soils for a period of 18 months.

**Short-term Training :** Ms M A S Fernando, Technical Assistant, Genetics and Plant Breeding Division completed a six-week training from 16 June to 13 August, in coconut breeding work, pollen collection, processing and storage and in the use of routine maintenance of modern equipment for this purpose, arranged by the Philippine Coconut Authority.

### 1.2 Council for Agricultural Research Policy - Special Programmes

Dr R Mahindapala, Director, Mr T S G Peiris, Biometrician and Mr M Jeganathan, Project Co-ordinator, ARP attended a workshop on Management Information System/Programme Budgeting System (MIS/PBS) held on 21 February, in Colombo.

Mr T S G Peiris, Biometrician, participated as the representative of the plantation sector research institutes in the Asian Regional Workshop on Management Information Systems for Agricultural Research, held at the National Academy of Agricultural Research Management (NAARM) Hyderabad, India from 17 to 29 September. The Workshop was jointly organized by the International Service for National Agricultural Research (ISNAR), Netherlands and the NAARM, India.

### **1.3 Strengthening of Research Station Facilities**

**Laboratory/Field Equipment and Spares:** A Soil Core Boring Machine was received.

**Procurement of Books and Periodicals:** Forty three books were received.

### **1.4 Civil Works**

The contract for the water distribution system and storage tank (Bandirippuwa Estate) was awarded to Global Associates Ltd., Gampaha and the sites were handed over on 05 July. Work on the tank, water distribution system and rehabilitation of wells were in progress.

The contract for the construction of the facilities building, screen house and improvements to the library, auditorium and the guest house was awarded to United Tractor and Equipment Ltd. Colombo and the sites were handed over on 24 October. Work on the facilities building and screen house was in progress at the end of the year.

### **1.5 Diagnostic Team**

The composition of the Diagnostic Team was reconstituted as follows:

Mr A S Ranatunga, Consultant; Mr D T Mathes, Head, Biometry Division; Dr M de S Liyanage, Head, Agronomy Division; Mr K S Jayasekara, Officer-in-Charge, Soils & Plant Nutrition Division; Mr M T N Fernando, Assistant Agricultural Economist.

### **1.6 Management Information System/Program Budgeting System**

The 1991 research programme and the estimates were submitted to CARP on 27 March with information on MIS/PBS.

### **1.7 World Bank Mission**

Mr Iver Serejski and Dr Gunter Steinacker visited the Institute on 12 July to review the progress of the ARP, under the sixth Supervision Mission.

## **2. INTER-INSTITUTIONAL RESEARCH PROGRAMME (IIRP) - COCONUT INTERCROPPING**

The fifth and sixth meetings of the IIRP were held on 31 May, and 21 December respectively, to monitor the progress of the IIRP.

The main objective of the programme would be to maximise land use, particularly in small-holdings, with a view to:

- (a) increase productivity, maximise income and increase the economic viability of holdings, and

- (b) develop mixed farming models to suit farmers resources, soil and climatic conditions of the farm.

The programme will have several sub-programmes with the following objectives:

- (a) integration of livestock, pasture and coconut and evaluation of the whole-farm concept.
- (b) evaluation of coconut-based farming systems.
- (c) evaluation of grass/legume associations.
- (d) evaluation of perennial, semi-perennial and annual crops under a range of soil and climatic conditions.
- (e) formulation of appropriate cultural and management packages for expanding intercropping in different areas in Sri Lanka.

The experiments envisaged and the progress of work during 1990 under this programme are as follows:

#### **Veterinary Research Institute/Coconut Research Institute**

**Expt. 1** - Integrated livestock/pasture/coconut whole-farm evaluation studies.

**Expt. 2** - Effect of stocking rates on the nut yield, pasture and animal productivity of mixed pastures grown under coconut in different agro-ecological zones of Sri Lanka.

Both experiments will be conducted at the same site. Selection of farms and field work has been completed with one farm for each of the wet, wet intermediate, dry intermediate and dry zones. Pasture and grass/legume combination are being established.

**Expt. 3** - Evaluation of different grass/legume associations.

Different grass/legume associations have been established at Ratmalagara Estate, Madampe, (a sub-station of the CRI) in November.

**Expt. 4** - Survey of mineral status of the cattle and pastures grown under coconut in the four agro-ecological zones.

The survey programme has commenced.

**Expt. 5** - Animal physiology and behaviour study in the different breeds and cross breeds of cattle in the area.

Field studies could not be initiated.

**Expt. 6** - Coconut-based farming systems in small-holdings in the different agro-ecological zones.

Three sites have been selected from each agro-ecological zone (wet, wet intermediate, dry intermediate and dry), giving a total of 12 sites for the establishment of on-farm trials. Of these, two farm models and three crop models have been established and their progress is satisfactory.

#### **Department of Export Agriculture (DEA)**

**Expt. 7** - Screening of different varieties of coffee, cacao and pepper.

Coffee & Pepper: Three locations in the Kurunegala district and one in the Gampaha District have been identified. Field planting was completed in Maha.

Cacao: Two locations have been selected in the Kurunegala District. Field Planting was completed in Maha.

**Expt. 8** - Evaluation of fertilizer requirements for coffee and pepper.

Pepper: Field planting has been completed at two sites (Kurunegala district) during Maha.

**Expt. 9** - Study on the spacing for coffee and pepper:

Field planting in four sites, two for coffee and two for pepper has been completed.

**Expt. 10** - Feasibility of growing arecanut/vanilla under coconut.

Studies could not be initiated.

**Expt. 11** - Formulation of control measures for bacterial disease of betel.

Observational trials in two sites (Kurunegala District) have been established.

#### **Regional Agricultural Research Centre (RARC), Department of Agriculture, Makandura**

**Expt. 12** - Studies on the environmental influence on the adaptability of several root and tuber crops and fruit crops as intercrops in coconut lands.

Selection of experimental sites on well defined land units and sub units in three agroclimatic zones was in progress as follows:

- (a) Kurunegala District Division 01 (Intermediate)
- (b) Kurunegala District Division 02 (Dry)
- (c) Gampaha District 03 (Wet)

Root and tuber crops (cassava, sweet potato, ginger and turmeric) and fruit crops (banana, pineapple and lemonime) are being tested in each of the location.

*Location 01* (Kurunegala District, Intermediate Zone) Root and tuber crops have been established and growth parameters are being recorded.

*Location 02* (Kurunegala District, Dry Zone) Identification of sites is in progress.

*Location 03* (Gampaha District, Wet Zone) Identification of sites is in progress.

**Expt. 13** - The optimum plant density for banana under coconut.

**Expt. 14** - Mixed crop model for coconut.

**Expt. 15** - Fertilizer requirements for inter and mixed cropping situations for the new spacings and crop combinations.

Experiments 13 and 14 are yet to be initiated. Work on Expt. 15 will commence depending on the findings of Expts. 13 and 14 above.

In the studies conducted by the DEA and RARC, the CRI collaborates in monitoring the nutrient status of coconut using leaf analysis, application of fertilizer and maintaining yield records of coconut.

**University of Ruhuna, Coconut Research Institute, Veterinary Research Institute and the University of Peradeniya (Faculties of Medicine, Veterinary Medicine and Animal Science).**

Integration of coconut with cattle grazing natural herbage, fed tree legume forage and straw-based rations.

Collaboration of scientists from the four institutions will seek to achieve the following objectives:

- (a) to generate new scientific information on an integrated farming system of coconut with cattle grazing natural herbage maintained on different planes of nutrition.
- (b) study the effect of grazing cattle on the production of coconut.
- (c) study the effect of grazing cattle and their nutritional supplementation on the seasonal botanical composition, intake and nutritive value of natural herbage under coconut.
- (d) to re-examine the possibility of reducing the inorganic coconut fertilizer by using excreta of grazing cattle maintained on different planes of nutrition (with and without straw, tree legume fodder and supplements).

- (e) study the effect of straw-based supplementation on the performance of cattle grazing natural herbage under coconut. This will be done as a function of time so that the most critical periods for supplementation could be determined. Performance of cattle to be judged by feed intake, live weight changes, and reproduction (first oestrus, fertility, data on first calf born and first milk yield). Animals will be 4 1/2 - 5 years old at the end of 3 year project period.
- (f) to study the effect of nutrition on other animal parameters. Nutritional effect on reproduction, possibly the most important one, will be studied on a priority basis. The effect of nutrition on diseases etc., could be studied by other interested scientists, if necessary, but without affecting the other identified objectives and without additional funds.
- (g) through above objectives, a general assessment of returns per unit of land from different systems (coconut alone, coconut and cattle with and without straw, legume fodder and supplements) could be made.
- (h) Calves obtained from farmers of the area to represent the cattle population in the area will make the farmers more interested in the performance of their animals under different planes of nutrition. Due to expected obvious visual effects on the body condition and reproductive status of cattle, it can be used as a demonstration of different feeding methods under coconut to farmers, quite apart from the above objectives.

**Progress:** The University of Ruhuna maintained records of climatic parameters (precipitation, minimum and maximum temperatures), monthly composition of the natural herbage, data on live weight changes of animals, straw intake, analysis of blood and rumen fluid for minerals, and records on oestrus and artificial insemination.

In respect of the coconut component, the CRI maintained yield records in terms of nuts and copra. Pre-manurial soil and leaf samples were collected and the samples were being analysed. The changes in the nutrient status of soil and palms will be monitored annually.

Land was surveyed and fenced and gliricidia established along the fences with a view to setting up a second set of 15 paddocks.

# REPORT OF THE ADMINISTRATION DIVISION

Deputy Director (Adm. & Fin.) - D N B Perera B Sc

## 1. GENERAL

The division continued to assist the research divisions in routine administrative and financial matters and related affairs, including maintenance work.

**Cadre:** The staff position of the Coconut Research Institute at the end of December, 1990 was as follows:

Grade	Unclassified	Sp Cl	Cl I	Cl II	Cl III	Cl IV	Total
Executive	02	-	07	12	20	08	49
Technical	-	08	23	32	-	-	63
Intermediate	-	02	02	03	-	-	07
Clerical	-	10	15	22	-	-	47
Operative	-	13	12	25	-	-	50
Minor	-	48	42	52	-	-	142
Ungraded							
Drivers	-	06	13	19	-	-	38
Watchers (12 hr)	-	-	-	-	-	-	17
Total	02	87	114	165	20	08	413

Appointments, retirements, resignations, deaths of officers and internal promotions are reported separately.

**Administration:** The general administrative functions were continued. Internal promotions due for the years 1987, 1988 and 1989 were finalized and the back-log of promotions was cleared.

The total expenditure during the year was Rs. 46,598,187/= comprising Rs. 8,034,233/= as capital expenditure and Rs. 38,563,954/= as recurrent expenditure. The revenue during the year was Rs. 42,094,717/=.

## 2. WELFARE

### (a) Financial Aid

**2.1 Provident Fund:** The loans from the Provident Fund to employees amounted to Rs. 2,064,257.00.

**2.2 Distress Loans:** Distress loans to employees amounted to Rs. 3,624,860.00.

**2.3 Transport Loans:** Transport loans to employees amounted to Rs. 1,120,000.00.

**2.4 Loans to Relieve Indebtedness:** Loans to employees to relieve indebtedness amounted to Rs. 160,000.00.

**2.5 Medical Aid:** A sum of Rs. 502,109.00 was reimbursed by the Medical Aid Scheme to its members.

**(b) Other facilities to employees**

1. Providing uniforms to Office Attendants, Drivers, Conservancy labourers, Mechanics and Watchers.
2. Providing facilities to purchase material from the Department of Textiles on instalment basis.
3. Providing facilities to purchase electrical items from M/S Singer Company on instalment basis.
4. A loan of Rs. 25,000/= was granted to the Multi-Purpose Co-operative Society, without interest, payable within four instalments for purchasing necessary items for Christmas.
5. Grants of Rs. 5,000/= and Rs. 2,500/= were given to the Recreation Club and the Art Circle respectively, to promote their activities during the year.
6. The Medical Aid Scheme organized an eye clinic in collaboration with the Eye Donation Society and a Dental Clinic in collaboration with the Dental Institute for the benefit of the staff and their families.

**3. OTHER ACTIVITIES OF THE ADMINISTRATION DIVISION**

**3.1 Transport Section:** The Transport Section administered the drivers and maintained the following fleet of vehicles.

Cars 06	Buses 03	Jeeps/Double Cabs 19
Vans 04	Lorries 05	Three Wheeler 01

**3.2 Accounts Unit:** The usual accounting functions were satisfactorily carried out during the year. The Accounts Unit provided training facilities for students from the Technical College.

Four members of the staff were trained in application of computer for salary preparation.

**3.3 Engineering Unit:** The Engineering Unit continued to provide maintenance services for the Institute's buildings and other amenities. The civil and other works amounting to Rs. 1,408,563.43 were undertaken during the year. The expenditure incurred on electricity and water supply scheme at Bandirippuwa Estate and other

Stations was Rs. 1,688,247.44. A sum of Rs. 1,121,367.23 was incurred for the satisfactory maintenance of the vehicles and Rs. 198,009.43 for the upkeep of Machinery. Some of the civil works undertaken were as follows:

1. Fabricate and install security grills and doors for Engineering Unit workshop.
2. Repairing the roof of the laboratory complex of the Soils & Plant Nutrition Division.
3. Repairing the Accounts Office.
4. Construction of Grade III quarters and Office/Stores and Garage at Maduru Oya Seed Garden.
5. Construction of Grade III quarters at the Isolated Seed Garden, Ambakelle.

## STAFF MATTERS

### 1. Appointments

Mr J M D T Everard, as Research Assistant on 01 February  
Mr M M Keerthi, as Research Assistant on 12 February  
Mr W P C Fernando as Accounts Clerk on 01 March  
Ms A S M S Abeywickrame as Accounts Clerk on 05 March  
Mr E A P Edirisinghe as Accounts Clerk on 05 March  
Mr A S Nanayakkara as Accounting Assistant on 12 March  
Mr K H A Chandrasiri as Electrician on 13 March  
Mr W A S S Weerasinghe as Electrician on 13 March  
Mr W P W Peiris as Electrician on 16 March  
Mr J R C R Perera as Electrician on 16 March  
Mr S K Wijewickrama as Electrician on 01 May  
Miss D C L Pathirana as Technical Assistant on 01 August  
Miss J L J L Pinto as Technical Assistant on 01 August  
Mr L J C Perera as Superintendent on 01 August  
Miss G S Ranasinghe as Technical Assistant on 01 August  
Miss M A Wasanthimala as Technical Assistant on 01 August  
Mr J D J Abeysekara as Technical Assistant on 15 August  
Mr R B Attanayake as Technical Assistant on 17 September  
Mr M S R Jayatillaka as Technical Assistant on 15 October  
Mr R N Susantha as Technical Assistant on 18 October  
Mr P D Perera as Electrician on 01 December

### 2. Retirements

Mrs R M Kumarihamy, Garden Labourer on 01 March  
Mrs M A Gnanawathie, Garden Labourer on 16 March  
Mr J E A Dalpathodo, Office Assistant on 21 July  
Mr M A Somadasa, Supplies Officer on 03 December  
Mr D M C B Dissanayake, Clerk/Typist on 28 December

### 3. Resignations

Mrs D M R Fernando, Book Keeper on 01 January  
Mr K S N M Fernando Lab/Field Attendent, on 01 February  
Mr U R A Fernando, Lab/Field Attendent on 26 February  
Mr N S Jayalath, Technical Assistant on 19 March  
Mr K P A Fernando, Field Attendant on 01 April  
Mr Y H N Jayatissa, Lab/Field Attendent on 20 June  
Mr M Premadasa, Lab/Field Attendant on 31 August  
Miss L M N Janz, Receptionist on 11 September  
Mr W W S A Fernando, Lab/Field Attendent on 01 October  
Mrs M I K Rahatungoda, Assistant Accountant on 15 November  
Mr K Piyatilake, Mechanic on 20 November  
Mr B G Jayapala, Watcher on 31 December

#### 4. Deaths

The following deaths are recorded with regret.

Mr S A C N A Appuhamy, Labourer on 12 January  
Mr P R Fernandopulle, Internal Audit Officer on 19 July.

#### 5. Vacation of Post

Mr J H P Chandradasa, Lab/Field Attendent on 07 February  
Mr W J P N Fernando, Painter on 24 May  
Mr S K Wijewickrama, Electrician on 30 July  
Mr T H M D P Peiris, Supervisor on 31 July

#### 6. Promotions

##### *Executive Grade*

Mr P Kariyawasam, Seed Production Officer to Class II on 07 March  
Miss M B M N Dias, Research Officer to Class II on 16 June  
Dr R R A Peries, Research Officer to Class II on 31 July  
Dr D N S Fernando, Research Officer to Class II on 01 August

##### *Technical Grade Class I to Special Class*

Miss N H R M de Silva, Senior Technical Assistant on 01 January, 1989  
Mrs W P K K Fernando, Senior Technical Assistant on 01 January, 1989.

##### *Intermediate Grade Class I to Special Class*

Mrs S Z Suhair, Stenographer (English) on 01 January, 1989

##### *Clerical & Allied Grade Class I to Special Class*

Mr R P Victor, Clerk on 01 January, 1987  
Mr A I F Fernando, Clerk on 01 January, 1987  
Mr K D Jathiratne, Clerk/Typist on 01 January, 1988  
Mr K P W Perera, Clerk on 01 January, 1988  
Mrs C Munasinghe, Clerk/Typist on 01 January, 1989  
Mrs A R S Hettiarchchi, Clerk/Typist on 01 January, 1989  
Mr A A D N Athauda, Clerk/Typist on 01 January, 1989

##### *Operative Grade Class I to Special Class*

Mr D S Wijetunga, Lab & Field Assistant on 01 Jan., 1987  
Mr D T Fernandopulle, Lab & Field Assistant on 01 Jan., 1987  
Mr U T G Fernando, Lab & Field Assistant on 01 Jan., 1988  
Mr H Bandappuhamy, Lab & Field Assistant on 01 Jan., 1988

Mr W M L G Fernando, Lab & Field Assistant on 01 Jan., 1988  
Mr A Wilson, Lab & Field Assistant on 01 Jan., 1988  
Mr P P Jayasundara, Lab & Field Assistant on 01 Jan., 1989  
Mr D Amarasinghe, Lab & Field Assistant on 01 Jan., 1989  
Mr A Dassanayake, Lab & Field Assistant on 01 Jan., 1989

*Drivers Grade Class I to Special Class*

Mr D P Ranasinghe, Driver on 01 Jan., 1988

*Minor Grade Class I to Special Class*

Mr W Gunaratne, Cattle Keeper on 01 Jan., 1987  
Mr W P Fernando, Lab & Field Attendent on 01 Jan., 1987  
Mr K J S Perera, Lab & Field Attendent on 01 Jan., 1987  
Mr A A Karunasekera, Office Attendent on 01 Jan., 1987  
Mr F H A J R Silva, Lab & Field Attendent on 01 Jan., 1987  
Mr N G Premasiri, Lab & Field Attendent on 01 Jan., 1988  
Mr H M Manelhamy, Lab & Field Attendent on 01 Jan., 1988  
Mr M A Dayawansa, Lab & Field Attendent on 01 Jan., 1988  
Mr K D D Appuhamy, Lab & Field Attendent on 01 Jan., 1988  
Mr P Ukkubanda, Lab & Field Attendent on 01 Jan., 1988  
Mr P W A Fernando, Lab & Field Attendent on 01 Jan., 1988  
Mr M P D Plasidus, Lab & Field Attendent on 01 Jan., 1989  
Mr H D J Canisius, Office Attendent on 01 Jan., 1989  
Mr D J M Leelaratne, Office Attendent on 01 Jan., 1989  
Mr R P Ranbanda, Lab & Field Attendent on 01 Jan., 1989  
Mr K L Ranasinghe, Lab & Field Attendent on 01 Jan., 1989  
Mr N M H Wijewardene, Office Attendent on 01 Jan., 1989  
Mr R M S Dharmasena, Circuit Bungalow Keeper on 01 Jan., 1989

*Technical Grade Class II to Class I*

Mr U S S Perera, Technical Assistant on 01 Jan., 1987  
Mr A M U Wijeratne, Technical Assistant on 01 Jan., 1987  
Mr K F G Perera, Technical Assistant on 01 Jan., 1987  
Mr R D N Premasiri, Technical Assistant on 01 Jan., 1987  
Mr D P Panditharatne, Technical Assistant on 01 Jan., 1988  
Mrs K M A Nonis, Book Keeper on 01 Jan., 1988  
Mr H P de Zoysa, Technical Assistant on 01 Jan., 1988  
Mr A S Nanayakkara, Book Keeper on 01 Jan., 1989  
Mr K A S Chandrasiri, Technical Assistant on 01 Jan., 1989  
Mr H A Abeysoma, Technical Assistant on 01 Jan., 1989

*Intermediate Grade Class II to Class I*

Ms T I I Peiris, Library Assistant on 01 Jan., 1987  
Ms M P Premaratne, Stenographer (English) on 01 Jan., 1988

*Clerical & Allied Grade Class II to Class I*

Mr K D Jathiratne, Clerk/Typist from 01 Jan., 1987  
Mr K P W Perera, Clerk from 01 Jan., 1987  
Mr B M D Bandara, Clerk from 01 Jan., 1987  
Ms A A de Zoysa, Clerk from 01 Jan., 1987  
Ms J K F Perera, Clerk/Typist from 01 Jan., 1987  
Mr W P R Fernando, Clerk/Typist from 01 Jan., 1988  
Mr B R Fernando, Clerk/Typist from 01 Jan., 1988  
Mr W G L Rodrigo, Machine Operator on 01 Jan., 1988  
Mr M R U Attanayake, Internal Audit Clerk on 01 Jan., 1988  
Ms M M M R Fernando, Clerk/Typist on 01 Jan., 1989  
Ms C M B I Salvatura, Clerk/Typist on 01 Jan., 1989  
Ms P C A Fernando, Clerk/Typist on 01 Jan., 1989  
Ms H M W S Athauda, Clerk/Typist on 01 Jan., 1989

*Operative Grade Class II to Class I*

Mr P D B Silva, Lab & Field Assistant on 01 Jan., 1987  
Mr M D V Saparamadu, Lab & Field Assistant on 01 Jan., 1987  
Mr E M Gunarathbanda, Lab & Field Assistant on 01 Jan., 1987  
Mr W K K Herath, Lab & Field Assistant on 01 Jan., 1989  
Mr A Jayathilake, Lab & Field Assistant on 01 Jan., 1989  
Mr W L B Silva, Lab & Field Assistant on 01 Jan., 1989

*Drivers Grade Class II to Class I*

Mr T M Ariyadasa, Driver on 01 Jan., 1987  
Mr K K M Antony, Driver on 01 Jan., 1987  
Mr S R Appuhamy, Driver on 01 Jan., 1989  
Mr R K Gunawardana, Driver on 01 Jan., 1989

*Minor Grade Class II to Class I*

Mr S Samaratunga, Cattle Keeper on 01 Jan., 1987  
Mr K Venayagam, Cattle Keeper on 01 Jan., 1987  
Mr W P Peiris, Cattle Keeper on 01 Jan., 1987  
Mr L Vanculanburg, Cattle Keeper on 01 Jan., 1988  
Mr M A Wahid, Pollination Labourer on 01 Jan., 1988  
Mr W P C Fernando, Office Attendant on 01 Jan., 1988  
Mr A G Nandasena, Office Attendant on 01 Jan., 1988  
Mr H A G Perera, Office Attendant on 01 Jan., 1989  
Mr K L V Fernando, Office Attendant on 01 Jan., 1989  
Mr S Siripala, Labourer on 01 Jan., 1989  
Mr R P Somasiri, Mechanical Helper on 01 Jan., 1989  
Mr M A S Fernando, Pollination Labourer on 01 Jan., 1989

## 7. Transfers

Mr H A Marasinghe Lab/F Attd. and Mr M A Hemachandra, Lab/F Attd. were temporarily transferred from Genetics & Plant Breeding Div. to Tissue Culture Div. on 01 January.

Mr H M Anura Kumara (Watcher) to Bandirippuwa Estate on 25 January (reinstated).

Mr M R L A Perera (Superintendent) from Makandura Seed Garden to Bandirippuwa Estate on 15 May.

Mr S M Wijeratne Banda (Superintendent) from Poththukulama Research Station to Isolated Seed Garden, Ambakelle on 20 August.

Mr D M Pathirage (Superintendent) from Isolated Seed Garden to Poththukulama Research Station on 20 August.

Mr M F H G I Appuhamy (Technical Assistant) from Bandirippuwa Estate to Agronomy Division on 16 May.

Mr D L J Nettasinghe (Field Officer) from Rathmalagara Estate to Isolated Seed Garden on 01 January.

Mr G B A Wijesekara (Field Officer) from Isolated Seed Garden to Bandirippuwa Estate on 01 January.

Mr U C Hettiarachchi (Supervisor) from Bandirippuwa Estate to Isolated Seed Garden on 01 January.

Mr T M Keerthiratne (Supervisor) from Maduru Oya Seed Garden to Poththukulama Research Station on 01 January.

Mr W M U Rathnayake (Supervisor) from Makandura Seed Garden to Rathmalagara Estate on 01 January.

Mr M J David (Supervisor) from Poththukulama Research Station to Rathmalagara Estate on 01 January.

Mr I A N Hemasiri (Supervisor) from Rathmalagara Estate to Makandura Seed Garden on 01 January.

Mr T H M D P Peiris (Supervisor) from Bandirippuwa Estate to Makandura Seed Garden on 01 January.

Mr M J David (Supervisor) from Rathmalagara Estate to Bandirippuwa Estate on 16 May.

Mr T M Kirihamy (Driver) Transport Unit to Poththukulama Research Station on 16 May.

Mr W L S S Fernando (Tractor Driver) from Maduru Oya Seed Garden to Bandirippuwa Estate on 01 January.

Mr W L D Fernando (Tractor Driver) from Bandirippuwa Estate to Maduru Oya Seed Garden on 01 January.

Mr M L Amarasena (Tractor Driver) from Transport Unit to Bandirippuwa Estate on 12 January.

Mr W L D Fernando (Tractor Driver) from Maduru Oya Seed Garden to Bandirippuwa Estate on 01 March.

Mr G M R Karunasekera, Experimental Officer from Establishments to Biometry Division in March.

Mr P A P Appuhamy (Electrician) from Engineering Unit to Rathmalagara Estate on 29 March.

Mr T M Chandrasena Peiris (Tractor Driver) from Bandirippuwa Estate to Maduru Oya Seed Garden on 10 April.

Mr J S Roberts (Field Assistant) to Bandirippuwa Estate on 25 April (reinstated).

Mr M L Amarasena (Tractor Driver) from Bandirippuwa Estate to Isolated Seed Garden on 23 May.

Mr R M Tennakoon (Field Attendant) from Isolated Seed Garden to Genetics & Plant Breeding Division on 08 May.

Mr K G Dhanapala (Field Attendant) from Isolated Seed Garden to Maduru Oya Seed Garden on 13 June.

Mr R M Tennakoon (Lab/F. Attd) from ISG to the Seed Production Unit on 15 June.

Mr J D J Abeysekara (Technical Assistant) from Head Office to the Isolated Seed Garden on 01 October.

Mr M Nadarajah (Field Attendant) from Passekudah Research and Demonstration Farm to Head Office on 20 December.

Mr V Sittamparapillai (Labourer) from Passekudah Research and Demonstration Farm to the Head Office on 20 December.

## **8. Overseas leave on no-pay**

Dr P Kanagaratnam, Senior Crop Protection Officer (Canada)  
Mr D G George, Senior Technical Assistant (Saudi Arabia)  
Mr D M Jayakody, Senior Field Assistant (Oman)  
Mr S Weerakoon, Driver (Italy)  
Mr M A J Livera, Driver (Italy)  
Mr A C S Ibrahim, Driver (Saudi Arabia)

## **9. Training & Visits**

Mrs L C P Fernando, Assistant Crop Protection Officer, continued her postgraduate studies at the University of Queensland, Australia.

Mrs C N K Rajapakse, Assistant Crop Protection Officer, continued her postgraduate studies at Texas A & M University, Texas, U.S.A.

Mr H A J Gunatilake, Asst. Agronomist, continued postgraduate studies at the University College of North Wales, UK.

Mr R A J R Perera, Asst. Agricultural Economist, continued postgraduate studies at the North Carolina State University, U S A.

Ms L K Periyapperuma, Assistant Botanist, continued her postgraduate studies at the Illinois State University, U.S.A.

Ms S P Suriyapperuma continued her postgraduate studies at the University of Rhode Island, USA.

Ms W M U Fernando, Assitant Geneticist & Plant Breeder continued her postgraduate studies at the University of Birmingham, UK.

Mr L P Vidhana Arachchi, Asst. Soil Scientist continued his postgraduate studies at the Universiti Sains Malaysia, Malaysia.

Mr L L W Somasiri, Asst. Soil Scientist continued his postgraduate studies (University of Aberdeen) on the split programme, at the CRI.

Mr N A Tennakoon, Assistant Soil Scientist left for postgraduate studies at the University of Aberdeen, UK on 17 July.

Mr T G L G Gunasekera, Asst. Agronomist, left for postgraduate studies at the University College of North Wales, U K on 01 May.

Mr H P S Jayasundara, Asst. Agronomist, left for postgraduate studies at the University of Reading, U K on 27 September.

Mr P A Henry Nimal, Assistant Information Officer, left for postgraduate studies at the University of Reading on 28 July.

Mr M J C Perera, Librarian participated in the Regional Workshop on 'A Model Library for a Third World Research Institute' from 02 to 03 January at the Institute of Fundamental Studies, Kandy.

Mr T W Fernando, Senior Technical Assistant participated in a "Workshop on Use, Maintenance, and Repair of pH meters" on 03 May held at the Ceylon Institute of Scientific and Industrial Research (CISIR), Colombo sponsored by the Natural Resources, Energy and Science Authority (NARESA).

Mrs N H R M de Silva, Senior Technical Assistant and Mr D P Panditharatne, Technical Assistant participated in the "Workshop on Use, Maintenance, and Repair of Analytical Instruments" from 7 to 24 August held at the CISIR, Colombo, sponsored by the British Council.

Mr T W Fernando, Senior Technical Assistant participated in a "Workshop on Water Analysis" from 12 to 14 December held at the University of Colombo sponsored by the Institute of Chemistry.

Mrs P A S F Perera, Assistant Librarian, participated in a training course on Information Technology & Computerized Library Services at the Asian Institute of Technology, Thailand from 27 May to 27 July.

Ms M A S Fernando, Technical Assistant underwent a two months practical training in plant breeding, pollen processing and germplasm conservation at the Philippine Coconut Authority facilities at Davao and Zamboanga from 16 June. Funds for this training was provided through the Agricultural Research Project.

Dr R R A Peries attended the IBPGR training programme in Collection, Conservation and Utilization of coconut germplasm at the Albay and Zamboanga Research Stations of the Philippine Coconut Authority from 25 November to 8 December.

Mr M M Keerthi, Assistant Crop Protection Officer, followed a course of training on Tropical bee-keeping at the Universiti Pertanian Malaysia, Serdang, from 02 - 10 September.

Mrs W P K K Fernando, Technical Assistant, underwent training in Chromatographic and Electrophoretic methods, at the Department of Botany, University of Western Australia, Nedlands Australia, under a Colombo Plan award from 06 July, 1990.

Mr. W E R C Fernando, Lab and Field Assistant underwent a training programme on "Microcomputers and Associated Software" conducted by the Department of Census and Statistics under SIAP/UNDP supported training programme.

Mr K B Dassanayake attended a two-weeks training workshop in technical writing and presentation, organized by the Faculty of Agriculture, University of Peradeniya at Hotel Topaz, Kandy from 03-14 December.

## 10. Participation of CRI Staff in other Statutory Bodies, Committees etc.

### ***Dr R Mahindapala***

Member, Board of Governors, National Institute of Plantation Management.

Member, Board of Management, Postgraduate Institute of Agriculture, University of Peradeniya.

Member, Working Committee on Agriculture and Animal Husbandry, Natural Resources, Energy and Science Authority of Sri Lanka.

Member, Committee appointed by the Coconut Research Board to examine the Selection, Collection and Transport of seednuts.

Member, Committee on the Revision of Coconut Planting Subsidies.

Member, Committee on Biological Control of Salvinia, Natural Resources, Energy & Science Authority of Sri Lanka.

Member, Editorial Committee, Natural Resources, Energy and Science Authority of Sri Lanka.

Joint Secretary, Institute of Biology.

### ***Mr K S Jayasekera***

Member, Fertilizer Coordinating Committee of the National Fertilizer Secretariat.

Member, Fertilizer Advisory Committee

### ***Mr M Jeganathan***

Member, Drafting Committee on Fertilizer, Sri Lanka Standards Institution.

### ***Mr T S G Petris***

Secretary, Section B, Sri Lanka Association for the Advancement of Science.

Visiting Lecturer, University of Colombo.

### ***Dr P A C R Perera***

Member, Sri Lanka Pesticides Formulary Committee

Joint Secretary, Institute of Biology.

Committee Member, Plant Protection Society of Sri Lanka

Visiting Lecturer in Forest Entomology, University of Sri Jayewardenepura.

## 11. Academic and Professional Achievements

**Mr. H P de Zoysa**, Technical Assistant (Biometry Division) was awarded B Sc (Statistics, Pure and Applied Mathematics) by the University of Peradeniya. He also successfully completed the Part 1 of the Australian Computer Society (ACS) examination.

**Dr P A C R Perera** was admitted as a Member of the Institute of Biology, Sri Lanka with effect from 28 September.

**Dr D N S Fernando** was awarded the Ph D degree in Crop Ecology by the University of Reading, U.K. on 06 July.

**Dr M de S Liyanage** was awarded the Ph D degree in Ecophysiology by the University of Colombo on 01 November.

**Dr R R A Peries** was awarded the Ph D degree by the University of Queensland, Australia on 31 July.

**Dr R R A Peries** was awarded the book prize for the best poster entitled "Compensation in grain yield with induced unculm in grain sorghum in south east Queensland, Australia" at the Annual Congress of the Postgraduate Institute of Agriculture on 9 November.

## 12. Overseas Visits

**Mr A A Fernando**, Senior Field Assistant, Soils and Plant Nutrition Division participated in a study tour on Fertilizer Usage in India from 24 September to 06 October.

**Mr K S Jayasekera**, Officer-in-Charge, Soils and Plant Nutrition Division undertook a familiarization tour of coconut research facilities in Kerala, India from 10 to 17 December.

**Mrs S M Karunaratne**, Head, Tissue Culture Division participated in a Networking meeting on Plant Tissue Culture in the U S A from 16 to 20 July.

**Mr P S Liyanagama**, Manager (Estates) undertook a familiarization tour on Estate Management Practices in Malaysia from 08 December to 22 December.

**Dr M de S Liyanage**, Head, Agronomy Division participated in a FAO/IAEA Research Co-ordination meeting in Vienna, Austria from 29 October to 02 November.

**Dr M de S Liyanage**, Head, Agronomy Division participated in the Asian Farming Systems Research & Extension Symposium in Bangkok, Thailand from 19 to 22 November.

Vidya Jyothi **Dr C R Panabokke**, and **Mr J L Amaratunga**, Members of the Coconut Research Board, undertook a familiarization tour of coconut research facilities in Kerala, India from 10 to 17 December.

**Mr T S G Peiris**, Biometrician, Biometry Division participated in the Asian Regional Workshop on Management Information Systems (MIS) for Agricultural Research, held at the National Academy of Agricultural Research Management (NAARM), Hyderabad, India from 17 to 29 September.

**Mr T S G Peiris**, Biometrician, Biometry Division attended a Conference on Statistical Science held at the University Teknologi, Malaysia from 25 to 31 August.

**Mr M J C Perera**, Project Leader, Coconut Information Centre participated in the meeting of the Project Steering Committee of the IDRC/APCC Integrated Coconut Information Programme, Philippines from 23 to 25 October.

**Mr M R L A Perera**, Superintendent, Bandirippuwa Estate, undertook a familiarization tour on Estate Management Practices in Malaysia from 08 December to 22 December.

**Dr R R A Peries**, Officer-in-Charge, Genetics & Plant Breeding Division visited CSIRO, Australia to discuss possible collaboration in the Germplasm Conservation programme from 10 to 23 December.

STAFF PUBLICATIONS AND COMMUNICATIONS  
AT SCIENTIFIC MEETINGS

(CRI authors are shown in bold type)

**Theses**

1050 **Fernando, D N S** (1990) Studies on Pasture understorey in coconut. Ph D thesis, University of Reading, England.

1051 **Liyanage, M de S** (1990) Eco-physiological studies on shade tolerance in nine grain legume cultivars. Ph D thesis, University of Colombo, Sri Lanka.

**Peries, R R A** (1990) Water use, water use efficiency and yield in dryland grain sorghum. Ph.D thesis, The University of Queensland, Australia.

**Other publications/communications**

1052 **Appuhamy, P A H N** (1990) Development of Coconut Small Holdings in Sri Lanka. Paper presented to the British Council. July 1990, Colombo.

1053 **Jayasekera C** (1990) A Screening method for drought tolerance in coconut (*Cocos nucifera* L) based on physiological parameters. Paper presented at the International Conference on Current Developments in Salinity and Drought Tolerance of Plants, Atomic Energy Agricultural Research Centre, 07-11 January, 1990, Tando Jam, Pakistan.

**Jayasekera C & D Doley** (1990) Effect of water stress on photosynthesis and changes in the chloroplast ultra structure with special reference to crystal inclusion in *Chrysalidocarpus lutescence* palms. Paper presented at the International Conference on Current Developments in Salinity and Drought Tolerance of Plants, Atomic Energy Agricultural Research Centre, 07-11 January, 1990, Tando Jam, Pakistan.

1054 **Jayasekera, C** (1990) High performance liquid chromatographic analysis of carbohydrates in king coconut and ordinary coconut water. Paper presented at the Regional Workshop on Carbohydrates and Carbohydrate-containing Natural Products, sponsored by IFS, IPCS, UNESCO, TWAS, and University of Peradeniya, 12-16 July, 1990, University of Peradeniya, Sri Lanka.

1055 **Jayasooriya, B, K S Jayasekara & C Ranbanda** (1990) Muthurajawela Marsh Land Development - Coconut Cultivation study. (in Sinhala) Economic Research Division, Coconut Development Authority, Colombo 1. pp 15.

1056 **Jeganathan M** (1990) Studies on potassium-magnesium interaction in coconut (*Cocos nucifera*). *Plant and Soil* 124; 265 - 271.

**Jeganathan M** (1990) Field Experiments with plantation crops - changing scenario. Paper presented at the Annual Sessions of the Soil Science Society of Sri Lanka, November, 1990, Gonawila. 5901

**Karunaratne, S M** (1990) Somatic embryogenesis from leaf and immature embryo explants of coconut. Paper presented at the Networking meeting for PSTC grantees, USAID, July, 1990, USA. 4901

**Liyanage, M de S** (1990) Intercropping of pepper under coconut. Paper presented at the Seminar on intercropping pepper under coconut, Hotel Ramada Renaissance, Colombo. 21 June. 1062

**Liyanage M de S, H P S Jayasundara & K C P Perera** (1990) Studies on growth and biomass productivity of selected multipurpose tree species. Proc. Reg. Workshop on multipurpose tree research & development (ed. H P M Gunasena) pp 27-36. 251

**Liyanage, M de S, H P S Jayasundara & K C P Perera** (1990) Effect of leaf mulches from several nitrogen fixing trees on soil microclimate. Proc. Reg. Workshop on Multipurpose Tree Research & Development (ed H P M Gunasena) pp 18-26. 301

**Liyanage, M de S, H P S Jayasundara & W S M A Fernando** (1990) Gliricidia as a supplementary dry season fodder for dairy cattle. Nitrogen Fixing Tree Research Reports 8; 138-139.

**Liyanage, M de S, H P S, Jayasundara, D N S Fernando, & W S M A Fernando,** (1990) Integration of legume-based pasture and cattle into the Coconut Farming System in Sri Lanka. Symposium on Asian Farming Systems Research & Extension. AIT Bangkok; 19-22 November.

**Mudalige, R G, C S Ranasinghe & C Jayasekera** (1990) The effect of N, K and Cl on water relations and vegetative growth of coconut seedlings. Paper presented at the Annual Sessions of Sri Lanka Association for the Advancement of Science, December, 1990, Colombo. 1901

**Peiris, T S G** (1990) Minimizing Coconut Picks for Field Experiments in Coconut, Proceedings of the Conference on Statistical Science, University Teknologi, Malaysia 26-30 August. 501

**Peiris, T S G, J D J Kularatne & D T Mathes** (1990) "CLIMAT" : A User Friendly Programme to Analyse Climatological Variables for Agricultural Purposes. Paper presented at the Annual Sessions of the Sri Lanka Association for Advancement of Science, December, 1990, Colombo. 555

**Peries, R R A** (1990). Coconut Germplasm Conservation in Sri Lanka: Past, Present and the Future. Status report presented at the IBPGR training programme on Collection, Conservation and Utilization of Coconut Germplasm PCA-ARC, Philippines 25 November to 8 December, 1990. 555

**Peries, R R A, M A Foale & S Fukai (1990).** Water use efficiency of dryland grain sorghum grown on a vertisol. Proceedings of the Annual Congress of the Postgraduate Institute of Agriculture, University of Peradeniya, November, 1990.

**Peries, R R A, M A Foale & S Fukai (1990).** Compensation in grain yield with induced unculm in grain sorghum in South East Queensland, Australia. Poster presented at the Annual Congress of the Postgraduate Institute of Agriculture, University of Peradeniya November, 1990. (Adjudged the best poster in the session with a book award of Rs. 2500/- in value).

**Perera, M R L A, P S Liyanagama & R Mahindapala (1989)** Makandura Seed Garden *Coconut Bulletin* 6; 6-7.

**Perera, M J C (1990)** A decade of Information Service from the Coconut Research Institute. Paper presented at the Regional Workshop on "A Model Library for a Third World Research Institute", held at the Institute of Fundamental Studies, 02-03 January, 1990.

**Snaydon, R W, D N S Fernando & R Sangakkara (1989).** The effect of coconut palm on pasture understorey. *In Proc. 16th International Grassland Congress* pp 438-440.