COCONUT RESEARCH INSTITUTE - REPORT FOR 1991

COCONUT RESEARCH BOARD

COCONUT RESEARCH INSTITUTE OF SRI LANKA

REPORT FOR 1991

COCONUT RESEARCH BOARD

REPORT OF THE

COCONUT RESEARCH INSTITUTE

FOR 1991

Editors

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

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

THE COCONUT RESEARCH BOARD

Mr Naomal S Dias (*Chairman*)

Lt Col A Amarasekara - up to February

Mr J L Amaratunga

Mr D V Jayasooriya

Vidya Jyothi Dr C R Panabokke

Mr G P P N Perera

Mr A S Ranatunga

Vidya Jothi Mr P R Wijewardena

Mr J Alwis (*Ministry Representative*) - from September

Mrs M B Ekanayake (*Treasury Representative*)

COMMITTEES OF THE COCONUT RESEARCH BOARD

1. Research Committee

Mr Naomal S Dias (*Chairman*)
Mr T R Jayawardena (*JEDB*)
Mr K Karunanayake (*CCB*)
Vidya Jothi Dr C R Panabokke
Dr U Pethiyagoda
Mr A S Amaratunga
Vidya Jothi P R Wijewardena
Prof Y D A Senanayake
Dr R Mahindapala (*Director CRI*)

2. Adminstrative Committe

Mr Naomal S Dias (*Chairman*)
Mr J L Amaratunga*
Mr R M C Bandarnayake
Dr R Mahindapala
Mr S Vithanage - from August

* Mr Amaratunge chaired the first meeting in the absence of the Chairman.

3. Estates Committee

Mr J L Amaratunga (*Chairman*)
Mr G P P N Perera
Mr D V Jayasuriya
Mr B R T de Tissera
Dr R Mahindapal

CONTENTS

COCONUT RESEARCH INSTITUTE OF SRI LANKA

THE STAFF*

(as at 31 December, 1991)

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 G Manamudali, B A, LICA

RESEARCH DIVISIONS

Agronomy Division

Head

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

Agronomist

D N S Fernando, B Sc Agric; Ph D (Reading)
H A J Gunathilake, B Sc Agric; Ph D (Wales)

Assistant Agronomists

K B Dassanayake, B Sc Agric
M T N Fernando, B Sc Agric
T G L G Gunasekera, 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 Abeysoma
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
W S M A Fernando
E M Gunaratne Banda
M D V Saparamadu
D B Benet Silvan
W E J Tissera

Clerk Typist

A A D N Athauda ***

Genetics and Plant Breeding Division

Head

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

Assistant Genetisists/ Plant Breeders

Mrs W M U Fernando, B Sc **
J M D T Everard B Sc, M Sc
A A F L K Perera, B Sc Agric

Lab and Field Assistants

W T H C Fernando
T M W Peiris
M Victor

Technical Assistants

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

Clerk

K P W Perera

Clerk/Typist

Miss I N Jayawardena

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
L L W Somasiri B Sc; Ph D (Aberdeen); C Chem; M I Chem C

Assistant Soil Scientists

Mrs M G F S Jayasundara, B Sc Agric ***
N A Tennakoon, B Sc Agric **
L P Vidhana Arachchi, B Sc Agric **

Senior Lab and Field Assistants

K Murugiah
B C E Perera

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
S Malavipathirana **
D P Panditharatne
U S S Perera
Miss J L J L Pinto
Miss G S Ranasinghe
R N Susantha
Miss M A Wasanthamala
Mrs D M D Wijebandara, B Sc

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)

Assistant Crop Protection Officers

Mrs L C P Fernando, B Sc Agric **
M M Keerthi, B Sc Agric
Mrs C N K Rajapaksa B Sc Agric **

Clerk

Mrs Anula de Zoysa

Technical Assistants

K A S Chandasiri
A H Norman
D C L Pathirana
K F G Perera
P H A P Siriwardena

Lab & Field Assistants

W E A Fernando
A S M Premalal

Senior Field Assistant

D M Jayakody

Biometry Division

Head

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

Senior Biometrician

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

Technical Assistants

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

Lab and Field Assistants

A Dasanayake
W M L G 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

Senior Field Assistant

E R Fernando

Tissue Culture Division

Officer-in-Charge

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

Research Assistant

Miss L K Periyapperuma, B Sc **
Miss W N I S C Fernando, M Sc

Technical Assistants

Miss C K A Gamage
E S Santha

Plant Physiology Division

Head

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

Assistant Physiologists

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

Technical Assistants

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 **

Assistant Information Officer

J L J G Pinto

Clerk/Typist

R A L C Fernando

Coconut Information Centre & Library

Librarian/Project Leader

M J C Perera, ALA

Libraray Assistants

Mrs P D U C Dharmapala
Miss T I I Peiris

Assistant Librarian

Mrs P A S F Perera, B Sc

Documentation Assistant

D B Jayasinghe

Clerk/Typist

Miss S N Gunathilake

Machine Operator

W G L Rodrigo

ADMINISTRATION

Deputy Director (Administration & Finance)

D G Manamudali B A; LICA

Establishment Unit

Personnel Officer

P Daluwatta

Administrative Assistants

T Gunadasa
M Leelaratne, B A

Supplies Officer

M A Somadasa

Secretary to the Chairman

Mrs T M H Fernando

Clerks

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

Stenographers (English)

Mrs M P Premaratne
Mrs S Z Suhair

Supplies Assistant

W F T Fernando

Clerk/Typists

Mrs P C A Fernando
Mrs M M M Fernando
Miss W S R Fernando
B R Fernando
Miss U I Gunasekera
K D Jathiratne
Miss K P S Jayatilleke
W A W Wijesuriya
Y H Wijesena

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

Chief Accountant

R M G D Rajapakse

Accountant

D R C M Handalage

Accounting Assistant

A S Nanayakkara

Book Keepers

B M Jayathilakabanda
Mrs K M A Nonis

Store Keeper

M B Upali

Assistant Shroff

H B Thalgahagoda

Stenographer (E)

Miss A Herath

Assistant Shroff

H B Thalgahagoda

Stenographer (E)

Miss A Herath

Clerk/Typists

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

Clerk

Mrs C Munasinghe

Accounts Clerks

Miss A S M S Abeywickrema
Miss R H M Dilhani
E A P Edirisinghe
W P C Fernando

Engineering Unit

Resident Engineer

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

Foreman (Electrical)

M D Bernard Praxidus

Foreman (Mechanical)

M J M D S Jayawardena

Foreman (Buildings)

R M Dayaratne

Draughtsman

Mrs R M S Ratnayake

Clerk/Typists

Mrs K A P Chandani
C B B P Fernando
P P Fernando, B A

Estate Management Division

Manager

P S Liyanagama, B Sc Agric

Assistant Manager (Farms)

K P de Silva
A Thavaratnarajah

Clerk/Typists

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

Field Assistants

P P Jayasundara
J S Roberts

Pothukulama Research Station

Superintendent

D M Pathirana

Supervisors

M Chandrasoma
T M Keerthiratne

Estate Clerk

B L Senaghosha

Ratmalagara Estate

Superintendent

G Vithanage

Supervisor

Bandirippuwa Estate

Superintendent

M R L A Perera

Field Officer

G B A Wijesekara

Field Assistant

W B Silva

Supervisors

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

Clerk/Typist

H H J E Appuhamy

Maduruoya Seed Garden

Superindentent

A N Ekneligoda

Supervisor

W M P Weerasekara

Passekudah Research and Demonstration Station

No staff.

W M U Ratnayake

Estate Clerk

R P Victor

Walpita Estate

Officer-in-charge

I A N Hemasiri

Makandura Estate

Superintendent

L J C Perera

Supervisor

M S Perera

Isolated Seed Garden

Superintendent

S M Wijeratne Banda

Field Officer

D L J Nettasinghe

Supervisor

U C Hettiarachchi

Lab & Field Assistant

U V M Fernando

Minneriya Research and Demonistration Farm

Officer-in-Charge

I A N Hemasiri

Clerk/Typist

J A R Reginald

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 1991

R Mahindapala, Ph D

GENERAL

The severe drought experienced in the coconut triangle in 1990 caused significant crop reduction in 1991. Excepting in the wetter areas of the coconut triangle, there was, in general, considerable crop reduction compared to 1990, and in certain areas crops were drastically reduced.

The recommended soil moisture conservation methods using husk and coir dust appeared to be inadequate to overcome the soil moisture deficit conditions prevailed in 1990. This was evident from symptoms of acute moisture stress observed in a number of well-managed estates which adopt regular and methodical soil moisture conservation measures. This aspect perhaps requires further research coverage. Admittedly, droughts as experienced in 1990 occur rarely, but the current recommendations to overcome such problems appear to be inadequate. On the other hand, in some of the deep sandy loam soils in the drier parts of the coconut triangle, coconut did not show moisture stress. This indicates that such soils which have an inherent capacity to conserve considerable amount of moisture perhaps do not need moisture conservation practices to the extent indicated in the recommendations. These observations call for a critical re-examination of the general recommendations on soil moisture conservation, perhaps with a view to formulating area-specific recommendations based on climate and soil type, as against the current practice of generalized recommendations.

Planting of coconut in the drier parts of the coconut triangle which experienced very harsh climatic conditions, is being discouraged. The necessity to demarcate areas unsuitable for coconut in the northern parts of the coconut triangle was felt and a programme was undertaken to carry out the preliminary demarcation based on the soil types and rainfall patterns.

The CRI continued to provide technical assistance to the estates sector and the services offered have become popular. It has been possible to establish a close rapport with this sector and also to train their staff.

A major review of the Tissue Culture Programme was undertaken in order to critically review the progress made so far and to decide on the future directions of work.

The Inter-Institutional Research Programme on Intercropping and Animal Husbandry, funded by the Council for Agricultural Research Policy, progressed

well. This programme provided a frame work for collaborative work amongst different institutions with interest in coconut. Several cropping models in farmers' fields were maintained under this project.

Activities relating to the selection, collection and transport of seednuts were transferred to the Coconut Cultivation Board in January. Under this arrangement the CRI will assist the Coconut Cultivation Board in the selection and periodic review and re-selection of plus palms.

The progress of Makandura Seed Garden had been very satisfactory. In the sixth year of planting, over 100,000 nuts were harvested. A programme was undertaken to remove all poor palms at this seed garden. Although the general agricultural conditions of the Maduruoya Seed Garden were satisfactory, poor management of certain newly-planted areas caused much concern. Special efforts were initiated to overcome these problems and to improve the agricultural conditions in this seed garden, from which seednuts were harvested for the first time during the year.

The Passekudah Research and Development Farm continued to be out of control due to escalating disturbances in the area.. The farm could not be visited by the staff from the head office and considerable damage to the plantation and buildings has been reported.

All field experiments continued satisfactorily. Majority of these experiments are in estates belonging to the Janatha Estates Development Board. The institute's staff continued to work in close collaboration with the staff of the JEDB in the conduct to these experiments.

The restrictions placed on travel due to the escalation of fuel prices and economies called for continued to be a major impediment to the smooth implementation of the research programme. Nevertheless, in keeping with the government policy, it has been possible to achieve the targetted saving in fuel use. Alternative cheaper measures such as the use of motor cycles and three-wheelers were intensified in order to reduce travel costs.

Regrettably, no progress had been made by the authorities in resolving the salary anomalies created a few years ago when the salaries of the Institute staff were revised. The undue delay experienced in this regard has been very disappointing and has been of much concern to the staff. Also, problems were encountered in providing schooling facilities in certain schools in the nearby town of Wennappuwa for children of staff resident at Bandirippuwa Estate. This too has been a major cause of distress, particularly amongst scientific staff. It is fervently hoped that matters of this nature will be resolved by authorities in order to create a more

conducive working environment for the staff, and in particular the scientific staff, who form the core of the Institute.

2. THE COCONUT RESEARCH BOARD

During the year, the Board the functioned under the chairmanship of Mr Naomal S Dias. Lt. Col. A S Amarasekera resigned from the Board in February. Messrs D V Jayasuriya and G P P N Perera, proprietary coconut planters with wide knowledge and experience on various aspects of the industry, were appointed to the Board in March and April, respectively.

The Board held 17 meetings during the year, and the membership and attendance at meetings are given below.

Mr Naomal S Dias (Chairman)	(Attendance 11/11)
Lt. Col. A S Amarasekera (up to February)	(Attendance 11/11)
Mr J L Amaratunga	(Attendance 1/2)
Mr D V Jayasuriya (from March)	(Attendnace 11/11)
Vidya Jyothi Dr C R Panabokke	(Attendnace 6/11)
Mr G P P N Perera	(Attendance 6/8)
Mr A S Ranatunga	(Attendance 10/11)
Vidya Jyothi Mr P R Wijewardena	(Attendnace 6/11)
Mr J Alwis * (from September) (Ministry Representative)	(Attendance 2/11)
Mrs M B Ekanayake ** (Treasury Representative)	(Attendance 8/11)

* Observer member

** Ex-officio member

All meetings of the Board excepting 229th, 230th and 231st meetings were held at the Coconut Research Institute, Lunuwila. Two meetings (229, 230) were held at the Coconut Development Authority, Narahenpita, Colombo and the 231st meeting was held at the Isolated Seed Garden (ISG) Ambakelle. The members also undertook an inspection tour of the ISG when the Board meeting was held there, and reviewed the planting programme, water resources and other activities.

Mr D N B Perera, Deputy Director (Administration & Finance) continued to function as the Secretary to the Board. Dr R Mahindapala, Director, CRI participated in all Board meetings, and functioned as the Secretary at the 232 meeting when Mr Perera was indisposed.

3. COMMITTEES OF THE COCONUT RESEARCH BOARD

3.1 Research Committee

The Research Committee held two meetings and undertook an inspection tour of field trials in Puttalam district to review the progress of the implementation of the research programme.

Prof. Y D A Senanayake, Director of the Postgraduate Institute of Agriculture was appointed to the Research Committee in February. The membership of the committee and attendance at meetings are as follows.

Mr Naomal S Dias (Chairman)	(Attendance 2/2)
Mr T R Jayewardena (JEDB)	(Attendance 1/2)
Mr K Karunanayake (CCB)	(Attendance 1/2)
Vidya Jyothi Dr C R Panabokke	(Attendance 1/2)
Dr U Pethiyagoda	(Attendance 2/2)
Mr A S Ranatunga	(Attendance 1/2)
Vidya Jyothi Mr P R Wijewardena	(Attendance 1/2)
Prof. Y D A Senanayake	(Attendance 2/2)
Dr R Mahindapala (Director,CRI)	(Attendance 2/2)

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

Seven members (NSD, TRJ, CRP, UP, ASR, PRW, RM) participated in the inspection tour of field experiments in Chilaw/Puttalam areas.

3.2 Administrative Committee

The Administrative Committed met three 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 meeting are given below.

Mr Naomal S Dias (Chairman)	(Attendance 2/3)
Mr J L Amaratunga *	(Attendance 3/3)
Mr R M C Bandaranayake	(Attendance 2/3)
Dr R Mahindapala	(Attendance 3/3)
Mr S Vithanage (from August)	(Attendance 1/1)

* Mr Amaratunga chaired the first meeting in the absence of the Chairman.

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

3.3 Estates Committee

The Estates Committee met five times during the year, and continued to monitor data recording systems, cost control methods and the progress of field work.

The Committee's special attention was drawn to the deteriorating management conditions at the Maduru Oya Seed Garden, and the Board requested the Committee to visit this property regularly to monitor progress.
A group of members from the Committee made eight visits to the Board's properties (two visits to Bandirippuwa Estate; one visit each to Isolated Seed Garden, Pothukuluma Research Station, Ratmalagara Estate, Minneriya Research & Development Farm, Maduru Oya Seed Garden and the Adaptive Research Farm, Thabbowa).

The membership and attendance at the meetings are given below:

Mr J L Amaratunga (Chairman)	(attandance 5/5)
Mr G P P N Perera	(attendance 4/5)
Mr D V Jayasuriya	(attendance 4/5)
Mr B R T de Tissera	(attendance 3/5)
Dr R Mahindapala	(attendance 3/5)

The Chairman, CRB too participated in a number of meetings and field visits, on invitation.

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 D P Panditharatne were 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 Naomal Dias (Chairman)	(attendance 8/10)
Dr R Mahindapala *	(attendance 9/10)
Mr D T Mathes	(attendance 8/10)
Mr D P Panditharatne	(attendance 10/10)
Mr R M G D Rajapakse	(attendance 6/10)
Mr D G Manamudali (Secretary)	(attendance 10/10)

* Chaired the 44 and 47 meetings, in the absence of the Chairman.

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

An interest rate of 14% was declared for members for 1990.

.2 Board of Trustees - Medical Aid Scheme

The Board of Trustees met regularly to attend to matters relating to the administration of the Medical Aid Scheme, which continued to provide relief and assistance to the members. Dr D N S Fernando and Mr M R L A Perera were the Board's nominees in the Board of Trustees.

The Board's contribution to this scheme was about Rs. 640,000. The accounts of the scheme for 1991 were audited by a firm of Accountants.

The membership and attendance at meetings are given below:

Dr R Mahindapala (Chairman)	(attendance 12/12)
Mr D N B Perera	(attendance 10/12)
Dr D N S Fernando	(attendance 09/12)
Mr M R L A Perera	(attendance 12/12)
Mr P Daluwatta (Secretary)	(attendance 12/12)

The membership at the end of the year was 390.

The Medical Aid Scheme conducted a dental clinic for the members and their families on 28 September.

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 the improvement of water-holding capacity and organic matter status in coconut soils, establishment and management of replantings/under-plantings and coconut-based farming systems progressed satisfactorily. At the end of the year, there were 17 experiments conducted by the Division.

Long-term studies on cover cropping indicated that well-managed creeping cover, *Pueraria phaseoloides* was the most promising species for effective moisture conservation and improvement of organic matter. In another trial on the evaluation of the performance of *Gliricidia sepium* as a green manure crop, trees established from seedlings performed better than those from cuttings, giving a fresh leaf biomass yield of 2.25 kg/tree/year. In studies on the establishment of coconut new/replantings, growth of seedlings between Gliricidia hedge-rows was found to be better than those in Leucaena and control plots. In another trial, there was an improvement in the growth of coconut seedlings in plots with *Pueraria* cover.

In trials on the integrated farming systems with cattle, coconut continued to benefit from the recycled nutrients giving as much as 25% increase in nut yield. In the fuelwood trial, *Leucaena* in double rows produced the highest wood yield of 7.9 MT/ha. Further, there was no reduction of coconut yield due to intercropping with *Leucaena*. Mulberry too appeared well-adapted as an intercrop in mature coconut stands in the intermediate zone, giving a fresh leaf yield of 15.6 MT/ha. Among multipurpose tree species, gliricidia and *Leucaena* performed well as intercrops under coconut.

On-farm cropping models established in the farmers fields continued to perform well. A new model using coconut and cashew was established in a property of the Sri Lanka Cashew Corporation at Kamandaluwa. In the models established in the farmers' fields, pineapple, banana and ginger gave a substantial income within a short period despite high initial investment required for these crops.

4.2 Genetics & Plant Breeding Division

Several new research projects were commenced during the year. A hybridization programme was initiated at Isolated Seed Garden, Ambakelle, using pollen parents selected for stable nut size and nut number under changing weather conditions.

Long-term multi-locational cultivar evaluation trials (five sites) and progeny trials (six sites) were maintained satisfactorily. Fruit component analysis were commenced in the evaluation of cultivar trials at Bandirippuwa and Thammenna, where the hybrids continued to perform better than other cultivars.

The germplasm collection and conservation programme which suffered a set-back in 1989/90 was recommenced and collections were made in the Kurunegala and Hambantota districts. A pollination programme was also continued at an estate in Akuressa to build up a population of Malaysian tall coconut palms, from a few remaining early introductions to this country.

Germplasm explorations also led to the identification of a dwarf brown form of coconut of the variety *nana*, hitherto not used in breeding work.

Several short-term nursery investigations were completed to study the interaction, if any, of the source of seednuts and nursery site. No such interaction was observed. Several other nursery trials were also conducted.

4.3 Soils & Plant Nutrition Division

Eleven field experiments and nine laboratory/glasshouse studies on nutritional, soil physical, and water use aspects of coconut were conducted satisfactorily. Several new experiments on water balance in coconut plantations were commenced. A field trial was established to determine the nutrient requirements during the seedling phase of coconut.

Analysis of leaf nutrient data and coconut yield from certain locations in the FAO Fertilizer Project continued to show low response in leaf nutrients and yield to the general fertilizer recommendations. These results demonstrated the need for a location specific-general fertilizer recommendations.

Potassium and magnesium deficiencies continued to be seen in nutritional studies on coconut, and the available statistics show an increased use of dolomite in the coconut sector, consequent largely to the efforts of the CRI in popularization its use for the supply of magnesium in coconut cultivation.

Interesting results were obtained in the use of green manures in coconut cultivation. Application of gliricidia loppings increased the soil nitrogen levels in the top soil rather than in the sub-soil. However, application of *Pueraria* loppings did not increase the soil nitrogen appreciably.

Studies on water use by coconut in sandy loam soils gave useful results. With the commencement of the dry period, root water uptake was initially confined to the top 0-50 cm layer of the soil. After two weeks, roots extracted water mainly from soil layers below 1 m depth.

A "Mulch Rake" was developed and introduced to the coconut growers to facilitate the removal of mulch prior to the application of fertilizer. This implement

would further reduce the cost of fertilizer application.

The division continued to assist the estates sector by providing Differential Fertilizer Recommendations (DFR) based on leaf analysis. During the year, 98 large coconut estates covering an area of approximately 3,400 ha were provided with this service. Equipment failure hampered this programme considerably.

4.4 Crop Protection Division

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

The collaborative project on Pesticides from Sri Lankan plants for the control of coconut pests was continued and 39 plant extracts were tested, but none recorded significant insecticidal activity. However of the 10 fractions of the extract from *Melia dubia*, one fraction which recorded significant insecticidal activity was further tested as columns and activity has now been isolated to a column.

Studies on the composition of the medium to be used in the impregnation box/pit for the biological control of black beetle indicated that a 25% coir dust and 75% cattle manure mixture was the most attractive of the media studied.

A survey on the presence and distribution of nematodes in the different agroclimatic zones of the coconut triangle was completed. The largest representation was observed in the wet zone lowland areas (WL 4) with an average rainfall of over 2,000 mm per annum.

Chlorpyrifos was identified as a suitable alternative for aldrin in the control of termites. However, more frequent applications of this insecticide are required.

4.5 Tissue Culture Division

Investigations on the development of a cloning technique for coconut were continued using immature embryo explants, a procedure which showed promise in earlier experiments. Callus formation and subsequent somatic embryo formation were observed. A number of small shoots were produced from these somatic embryos. Further experiments are underway to accomplish complete plant production from somatic embryos.

Shoot tip culture was recommenced to understand and overcome the problems of rhizogenesis of clonal plants.

Further experiments on the development of an **in vitro** technique of screening for drought tolerant coconut palms using coconut embryo culture were continued. Laboratory manipulation of drought was attempted using chemicals such as NaCl, polyethylene glycol (PEG) and mannitol. When subjected to stress, embryos from putative drought tolerant parents showed a higher survival rate than embryos from drought-susceptible cultivars. This technique will be useful in that a large population can be handled speedily to screen under stress conditions. The first seedlings resulting from the drought screening experiment were planted in the germplasm conservation block at Poththukulama Research Station.

4.6 Plant Physiology Division

The research programme in plant physiology progressed well. New experiments to study the assimilation of carbon dioxide and assimilate partitioning in young coconut seedlings and in adult coconut palms using labelled carbon were initiated with the assistance of the International Atomic Energy Agency (IAEA).

The glass house experiment on the effects of nitrogen, potassium and chlorine on drought tolerant characteristics of coconut seedlings revealed that nitrogen and potassium could significantly affect the transpiration and stomatal resistance of the seedlings. Dry matter accumulation and root volume were significantly increased with adequate supply of nitrogen and potassium.

Screening of drought tolerant palms in field no. 2 at the Isolated Seed Garden was continued, and 42 new palms selected. Data available on physiological and biochemical parameters from drought tolerant palms revealed that stomatal regulation play a major role in the drought tolerant mechanism and their photosynthetic rate was significantly lower, compared with the drought susceptible palms. Attempts were made to study the heritability of drought tolerant characters in seedlings. These experiments will be continued.

Studies were also initiated with the assistance of the IAEA to screen drought tolerant palms on the basis of water use efficiency using the technique of stable carbon isotope discrimination ratio.

Experiments on optimum canopy area and root volume were continued with good progress. Work on photosynthetic characters of adult coconut palms in relation to light interception at different canopy levels, leaf age and seasonal variation with climatic conditions was continued. Light use efficiency of different cultivars and improved varieties, water loss from coconut palm canopy, monthly variation of transpirational losses, and the water extraction pattern from roots were also studied. These basic studies will yield valuable data on physiological aspects of the coconut palm.

Experiments using labelled carbon to study the carbon budget in adult coconut were initiated. In these pioneering studies, assimilation of carbon, respiratory losses of assimilates, distribution of assimilated carbon into upper and lower leaves in the canopy, developing bunches and stem/roots will be studied.

4.7 Biometry Division

The Division continued to assist the research divisions in designing field experiments, analyses and interpretation of data.

The computer facilities were expanded with the acquisition of the fourth computer and some computer programmes were also developed.

The calibration trial (at Walpita estate) recorded a decrease of 13.0 % for number of bunches and 8.6% increase for nuts per palm. A high yield of 16,735 nuts/ha was recorded in the experimental area. The copra yield showed a marginal increase of 0.3 % over 1990.

The three agri-meteorological stations at Bandirippuwa estate, Ratmalagara estate and the isolated Seed Garden were maintained satisfactorily.

4.8 Multi-disciplinary Projects

Premature Decline of Palms: Experiments on Leaf Scorch Decline (LSD) continued satisfactorily. New experiments on the assimilation of carbon dioxide and on secondary metabolite synthesis were commenced. Formation of polyphenol compounds in roots and leaves of affected palms was investigated. Results obtained from experiments indicate that root density and root activity were low in LSD-affected palms, resulting perhaps in inadequate synthesis of growth hormones.

Immature Nut fall: Experiments were initiated to study the total photosynthetic productivity of the palm canopy and dry matter accumulation during the development of the nut. Interesting results were obtained in studies using labelled carbon, on the distribution pattern of assimilates. Studies were also initiated on biochemical changes during the development of the nut and their effect on immature nutfall.

Studies on the insects visiting the coconut inflorescence were continued, and insect collections for three seasons, and their determinations to order level in respect of the collections for two seasons were completed. These results show that a significant majority of insects visiting the coconut inflorescence are from the order Diptera.

Earthworm Survey: The survey for earthworms and their distribution within the coconut triangle was completed. The data collected show that earthworm counts and casts were significantly higher in the centre of the coconut square than in the manure circle. Significant differences were also observed between agroclimatic zones and between seasons, the highest being in the wet zone following heavy rainfall.

4.9 Estates Management Division

The Division managed three seed gardens, two research and demonstration farms and four estates. The general agricultural conditions in most of the properties were maintained in good order, and particular attention was paid to soil and moisture conservation measures. The agricultural conditions at Bandirippuwa Estate continued to improve, and the profitability of the properties was sustained. The use of cost-effective agricultural practices continued to become popular.

Differential Fertilizer Recommendations (DFR) based on foliar analysis were implemented for all stations, and positive signs on efficient management of palm nutrition and fertilizer costs were already evident.

As at the end of the year, 305 ha (or 51%) of all the properties (total of 600 ha) were under immature coconut. In the developed properties (Bandirippuwa, Ratmalagara, Pothukulama, Walpita and Isolated Seed Garden), 36% of the area were under immature coconut. During the year, 7.3 ha were replanted at Ratmalagara Estate (for a fertilizer trial), and 18.6 ha were newly planted at Maduru Oya Seed Garden.

In spite of sustained efforts, most estates recorded a crop much less than that recorded for 1990, due to sub-normal rainfall experienced in 1989 and 1990. The overall reduction in crop was 31%. However, **Walpita Estate** recorded a 14 % increase in crop, whereas **Ratmalagara, Pothukulama** and **Bandirippuwa** recorded reductions of crop by 56%, 45% and 24%, respectively. The **Isolated Seed Garden** (ISG) too recorded a crop reduction of 13%. The crops recorded at Ratmalagara, Pothukulama and at ISG were the lowest recorded during the last 10 years.

Makandura Seed Garden performed very well, and over 90,000 nuts were harvested thus augmenting the supply of improved seed material to the national planting programme. Although a part of **Maduru Oya Seed Garden** was in good order, poor management of new clearings continued to cause concern. For the first time, seednuts were harvested from this seed garden.

The agricultural conditions at the **Minneriya Research & Demonstration Farm** were considerably improved. Elephants and wild boar continued to damage

the young plantation here, and at the Maduru Oya Seed Garden. 'Elephant trench' was effective in keeping away the beasts, and attempts were made to establish such trenches in vulnerable areas.

Passekudah Research & Demonstration Farm at Kalkudah continued to be out of control due to escalating disturbances in the area, and much damage to buildings and property had been inflicted. As at the end of the year, the general situation in the area had not improved to recommence any activity at this station. The roofs and fittings of all buildings have been removed by unknown persons. The staff were re-deployed at the head office.

The poly-bagged seedling nursery at Ratmalagara continued to be a popular source for high-quality seedlings. Although nearly 7,000 seedlings were sold, the demand was much higher.

At ISG, repairs were carried out in the reservoir, which paid dividents in retaining much-needed water during dry periods. A tube well yielding over 10,000 liters per day was also sunk at the ISG, which provided potable water of good quality to the staff.

Planting of fuel-wood trees and timber trees in the Board's properties was intensified. Over 60,000 seedlings of various types of trees were planted.

Rainfall distribution during the year showed a marked improvement, compared to 1990, and a much better crop is expected in 1992.

4.10 Information Services Division, Library and the Coconut Information Centre.

The Information Services Division continued to provide advisory assistance to the estate sector. A large number of estates and holdings were visited.

The publications programme had to be curtailed as the staff were busy with a new publication, *Coconut Cultivation*, which was published in August. The first print was sold out by November and a reprint was in progress at the end of year. This publication was also translated into sinhala, which was being printed at the end of the year. The other publications during the year included *COCOS* (Vol. 8) and the *Annual Report* (1989). The *Annual Report* for 1990 was with the printer at the end of the year.

Four Advisory circulars in the new series on soil moisture conservation (A7, A8, A9) and on Mammalian pests of coconut (B8) were issued during the year.

The Library services had to be severely curtailed during the year due to a major renovation and refurbishing programme. However, acquisitioning and processing of material to the library and the Coconut Information Centre (CIC) were continued uninterrupted. The library stock recorded 4720 books at the end of the year and 231 new references were added to the data base on coconut literature. Information dissemination services of the CIC continued satisfactorily.

The CRI Library was selected as the Coordinating Centre for the Agricultural Information Network (AGRINET) and the activities of this Centre will be funded by the Council for Agricultural Research Policy.

The CIC actively participated in the IDRC/APCC integrated coconut Information Network, and was the resource centre for compilation of annual and retrospective bibliographies. An annotated bibliography for 1987-88 was compiled for this network, and work on retrospective bibliography on Farming Systems for the period 1965-1990 was undertaken. Further, 3,000 records of coconut literature on microfiche were supplied to the Asian & Pacific Coconut Community.

4.11 Administration Division

The internal promotions due in 1991 were effected, and the Administrative Report for 1990, without the report of the Auditor General was submitted to the

Parliament. As at the end of the year, Auditor General's report on the Accounts for 1990 had not been received.

The normal welfare activities were continued. The employer-employee relationship was cordially maintained, in spite of the inability of the authorities to resolve some outstanding salary anomalies.

The budgeted expenditure during the year was Rs. 56 million, made up of Rs. 44 million as Recurrent Expenditure and Rs. 12 million as Capital Expenditure. The total revenue (excluding transport) for the year was Rs. 6.875 million (up to November). The Government grant was Rs. 38.5 million.

5. OUTSIDE-FUNDED PROJECTS

5.1 Agricultural Research Project (ARP)

The Agricultural Research Project (ARP), funded by the World Bank and administered by the Ministry of Agricultural Development & Research continued its activities on the development of infrastructural facilities at the CRI. The renovations to the Library were completed, and a new water supply scheme together with a well

was also completed. An amenities building which will house a general store and a refectory was also provided. Several other major civil works (housing, auditorium and guest house) were progressing, albeit behind schedule, at the end of the year. The manpower development programme continued satisfactorily. Two officers completed their postgraduate programmes overseas while one officer was awarded a scholarship to read for M Phil locally.

The Project continued to provide assistance for the conduct of extension activities. It also provided equipment, spare parts for equipment and library books during the year.

5.2 Other Projects

The International Atomic Energy Agency (IAEA) provided two research grants, and the work on them commenced during the year. 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.

The Inter-Institutional Research Project on Coconut Intercropping, with participation of the CRI, Dept. of Agriculture (Makandura Research Centre), Veterinary Research Institute, Export Agriculture Department and the University of Ruhuna (Faculty of Agriculture) progressed satisfactorily with regular project monitoring reviews.

6. EXTENSION ACTIVITIES

The CRI participated in several Mobile Secretariats conducted by the Ministries of Plantation Industries and Coconut Industries & Crop Diversification. The Institute participated in an exhibition organised by the Institute of Engineers in October in Colombo. The CRI also participated in the 'Gam Udawa' exhibition held at Kamburupitiya, and an exhibition organised by the Sri Lanka Association for the Advancement of Science and held at the University of Colombo to coincide with the Ministerial meeting of the South Asian Association for Regional Cooperation (SAARC) in November.

During the year, several training programmes, including the CRI component of the Diploma in Plantation Management (organised by the National Institute of Plantation Management) were conducted. Two residential two-week training programmes on coconut cultivation techniques for middle-level management staff of coconut estates was conducted.

A number of Field Days were organised for the benefit of planters from the State-sector organizations.

7. VISITORS

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

Dr T Abeysekera	-	The World Bank
Mr G AniiCEMA	-	Solomon Islands
Ms Jennet Blake	-	Wye College, UK
Mr R Bourdeix	-	IRHO, Port Bouet, IvoryCoast
Dr Glen Bowen	-	Int. Atomic Energy Agency
Mr Michael Chite	-	CEMA, Soloman Islands
Mr Eric Craswell	-	ISNAR/FAO
Mr Bruce R Crouch	-	The World Bank
Dr Andreas Ebert	-	Philippine CoconutAuthority/GTZ
Dr M M Guha	-	Asian Development Bank
Prof. E Hamaya	-	Japan
Dr John W Hardman	-	University of Portsmouth, UK
Mr Issac M Kibuthu	-	Agri. Research Inst.,Kenya
Dr D Kirtisinghe	-	Agricultural Research Project
Mr Savino Kokopu	-	CEMA, Solomon Islands
Dr Stefan Kuiatkouski	-	UNESCO
Mr Nikolo Kuriti	-	CEMA, Solomon Islands
Mr L St Lawrence	-	UK
Mr Jae Min Lee	-	Rep. of Korea
Mr A Maheswaran	-	Asian Development Bank
Mr Noel Mamau	-	CEMA, Solomon Islands
Mr David J Meadows	-	The World Bank
Mr Alfonso M Mendoa	-	Asian Development Bank
Prof. Luo Mingquan	-	Hebai Academy of Sciences, China
Mr R G Morton	-	Asian Development Bank
Mr Pius M N Ndegwa	-	Agr. Research Inst., Kenya
Mr John Parkinson	-	Asian Development Bank
Mr Frank Peacock	-	Asian Development Bank
Mr Hans Raadschilders	-	IRDP, Ratnapura
Mr S B Rajakaruna	-	Ceylon Tobacco Co., Colombo
Dr R V Ramakrishna	-	The World Bank
Ms. Erlinda P Rillo	-	Philippine Coconut Authority
Mr T Caesar Riungi	-	Agr. Research Inst., Kenya
Dr Justin Samarasekera	-	Academy of Sciences, Sri Lanka
Dr A Sangare	-	Director, IRHO, Ivory Coast
Mr G Santos	-	The World Bank

Dr C Srinivasa Sastry	-	ISNAR, The Netherlands
Dr B Scutt	-	The World Bank
Dr I Serejski	-	The World Bank
Dr Dong Keuw Shin	-	Republic of Korea
Mr Mwamzali Shiribwa	-	Agr. Research Inst., Kenya
Dr Amal A Sidarto	-	Asian Development Bank
Dr B C Sison	-	Asian Development Bank
Ms Janet Stewart	-	Oxford Forestry Inst., UK
Mr Jackson Sunaone	-	Solomon Islands
Mr M S Takkar	-	American Embassy, Colombo
Mr Yeong Choi	-	Rep. of Korea
Prof. Pen Yulin	-	Hebai Academy of Sciences, China

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
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
The Asian & Pacific Coconut Community

REPORT OF THE AGRONOMY DIVISION

Head - M de S Liyanage, Ph.D.

1. GENERAL

Studies on cover cropping with creeping and tree legumes as a source of green manure and improving soil organic matter, continued to be an important area of work in the research programme. During the year, a greater attention was given to research on intercropping/mixed cropping in the dry zone and crop/farm models in different agro-ecological zones. Few more collaborative studies were undertaken during the year. The International Atomic Energy Agency and Council for Agricultural Research Policy continued to provide support for several research projects.

Dr H A J Gunatilaka was awarded the PhD degree in Crop Ecology by the University of Wales, United Kingdom. Dr F Abeyratne was appointed 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 1.10 **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)**

Of the three cover crop species, *Pueraria phaseoloides* continued to perform well and maintained a satisfactory cover, whereas both *Calopogonium* and *Centrosema* performed poorly. For this reason, the treatments had to be modified to include only *Pueraria* with two to three management practices.

Records on coconut yield were maintained during the year.

The experiment is in progress.

D N S Fernando, K C P Perera

Experiment 1.10.2 Pothukulama Research Station, Pallama (Dry Intermediate Zone, Sandy loam soil) (1988)

The vegetative growth of all three cover crop species was severely affected by the dry weather conditions and as a result plots were invaded by heavy weed growth. The treatments in the trial will be modified during the early part of 1992 to include only promising species and few management practices.

Records on nut yields were maintained during the year.

The experiment is in progress.

D N S Fernando, H A Abeysoma

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

During the year, one cycle of cutting regimes was completed to estimate biomass production of *Gliricidia sepium*. Leaf biomass yield from seedlings and cuttings did not show a marked difference between cutting intervals, at two years after planting. Irrespective of the frequency of cuttings, trees raised for seedlings performed better than those from cuttings and produced a fresh leaf biomass yield of 2.25 kg/tree/year.

Records on nut yield were maintained during the year. So far, no adverse effects on the palm have been shown due to intercropping with Gliricidia.

The experiment is in progress.

M de S Liyanage, R Marasinghe

PROJECT 2: REHABILITATION OF LOW YIELDING PLANTATIONS

Experiment 2.2 Effect of cultural operations designed to induce root formation on rehabilitation of low yielding plantations

2.2.1 Lataritic gravel soil, Heemmeliyagara Estate, Dummalasuriya (1984)

2.2.2 Lateritic gravel soil, Puwakwatta Estate, Kotadeniyawa (1984)

Results of these experiments have shown that treatments induced new roots and caused a significant improvement in the production of low yielding palms in lateritic soils. In both locations, treatment with quarter circle trenches around the

palm and filling up with either 30 kg Gliricidia loppings (T_1), goat manure (T_2) or sand (T_3) significantly increased the number of nuts/palm and copra weight.

Based on these results, application of 30 kg Gliricidia lopping or goat dung in quarter circle trenches could be recommended for rehabilitating low yielding palms in lateritic soils.

Table 1. *Effect of cultural practices on coconut at Puwakwatta Estate (Expt. 2.2.2)*

Treatment	Nut yield Nuts/ha/yr	Copra content Mt/ha/yr
T1	1211	1.57
T2	1148	1.43
T3	1127	1.39
T4	900	1.18
T5	956	1.36
T6	984	1.39
T7	778	1.00
T8	944	1.18
T9	900	1.00
T10	936	1.20
T11 (control)	965	1.25
Significance	NS	*
LSD (P=0.05)	-	0.336
CV%	14.0	15.6

The experiment was terminated.

D N S Fernando, K B Dassanayake, 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. Pothukulama Research Station, Pallama - 1990

Coconut seedlings in alleys between Gliricidia hedgerows showed better

growth performance in terms of height, stem girth and leaf production compared with those in Leucaena plots, although the differences were not statistically significant.

The annual crop of Pigeonpea established in the alley was harvested during the 'Yala' season and gave an estimated seed yield of 615 kg/ha. Planting of cowpea and grass/legume mixture in alleys was completed during the 'Maha' season.

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, Pothukulama Research Station, Pallama, 1990.**

There was an improvement in the growth of coconut seedlings in treatment plots than those in control plots. Among treatments, growth performance of seedlings was found to be much better in plots planted with Pueraria and Gliricidia than others.

Gliricidia trees were pruned three times to maintain partial shade and supply green matter to coconut seedlings at the rate of 43 kg/palm/year.

Pueraria cover was lopped once during the year and the loppings were applied to palms within the plot. Palms in plots treated with pitcher irrigation were supplied with 54 l of water/palm/year during the dry season.

The experiment is in progress.

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

Experiment 3.5 **Study the feasibility of coconut/cashew mixed cropping in the dry zone, Kamandaluwa Estate, Andigama - 1991.**

In recent years, much interest has been focussed in the diversification of coconut lands in the dry zone. Among the intercrops, cashew (*Anacardium occidentale*) is one of the perennial crops well adapted to the dry zone. However, information on the feasibility of intercropping cashew with coconut in the dry zone is scarce.

A collaborative study with the Sri Lanka Cashew Corporation was initiated and the following five crop models (0.4 ha each) were established during the 'Maha' season.

	Coconut	Cashew
Model 1	12 m x 6 m (138 palms/ha)	-
Model 2	12 m x 6 m (138 palms/ha)	12 m x 12 m (70 trees/ha)
Model 3	10 m x 5 m (200 palms/ha)	10 m x 10 m (100 trees/ha)
Model 4	12 m x 6 m between (180 palms/ha double rows and 6 m within row)	12 m x 6 m (138 trees/ha)
Model 5	8.5 x 8.5 m (154 palms/ha)	8.5m x 8.5m (150 trees/ha)

The experiment is in progress.

H A J Gunathillake, M de S Liyanage, M J I Costa

PROJECT 4: STUDIES ON FIELD MANAGEMENT SYSTEMS

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

During the year, grass/legume mixture produced 2 kg/m^2 fresh fodder and tree legume species produced 4 kg/tree in the wet season. However, Leucaena lost a considerable amount of fodder during the dry season due to psyllid damage. Cattle in the integrated system continued to perform well recording a mean live weight of 267 kg/animal and producing 5.2 l milk/head/day during the latter part of second lactation period. Records and nut yields were maintained during the year, which indicated that nut yield of palms in the integrated plots was 25% higher than those in the control block. The experiment is in progress

Table 2. *Effect of integrating cattle & pasture on coconut yield at Ratmalagara Estate (Expt. 4.1.2)*

Farming system	Female flowers/palm	Nuts/ha/y	Copra wt.(MT./ha/yr)
Integrated system (mean of five paddocks)	1356	928	249
Monoculture system/control (one paddock)	1264	696	202
% oncrease over control	25%	33%	23%

D N S Fernando, R Marasinghe

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

Among intercrops, pineapple, banana and ginger continued to perform well and give a substantial income within a short period, despite the fact that initial investment on these crops was relatively high. In all sites, there was no adverse effect on coconut production due to mixed cropping and in fact an increase in yield was recorded in four sites. During the year, work of four crop models had to be abandoned due to management problems. Collection of agronomic and economic data was continued as per schedule.

The experiment is in progress.

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)

Establishment of perennial and semi-perennial crops was completed in all sites during the year. In crop models, performance of banana, pepper, cashew and mango was satisfactory. Among annuals, cowpea, groundnut and chilies produced satisfactory yield. Of the eight crop models, one in the Intermediate - Wet zone had to be abandoned due to management problems. Instead a new site was selected at Thulawala. Instead a new site was selected at Thulawala where coconut, pineapple and banana have been established.

In the farm-models, pasture and fodder have been established and cross-bred cattle have been introduced and they will be managed under zero-grazed system.

The coconut yields in all crop/farm models (CRI, VRI, DOA), and socio-economic data were maintained during the year.

The experiment is in progress.

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

Experiment 4.2.5 Integration of coconut with cattle grazing natural pasture and fed straw-based ration in the Wet zone. Elgiriya Estate, Hakmana (1990) (Inter-Institutional Research Project)

During the year, yield of coconut palms was monitored and a blanket

Table 3. Costs and returns per acre (Rs.) of the crop model at Pothuwatawana (Expt. 4.2.3)

Crop	1987*		1988		1989		1990		1991		Total	
	Cost	Return	Cost	Return	Cost	Return	Cost	Return	Cost	Return	Cost	Return
Coconut	7247	-	840	-	478	-	1075	0000	1310	-	10945	-
Banana	2012	-	2299	9496	1187	25527	3186	22679	1312	17835	9996	75537
Pineapple	7150	-	5871	205	4028	16374	7293	34082	2784	8564	27126	59225
Ginger**	-	-	5217	8138	-	-	-	-	-	-	5217	8138
Total	16404	-	14227	17839	5693	41901	11554	56761	5406	26399	53284	142900
Net return (undiscounted total net returns)	**-16404**			**3612**		**36208**		**45207**		**20993**		**89616**

* - Cost and returns for October - December period only.
** - Crop failure due to fungal rot.

application of inorganic fertilizer at 3 kg/palm was given. An improvement in the nut yield of palms in plots with grazing cattle was observed.

The experiment is in progress.

M de S Liyanage, D N S Fernando, B Silvan

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

The second harvest of Ipil-Ipil was taken during the year and the estimated wood biomass yield under different systems is given in Table 3. Results showed that the highest wood yield (7.9t/ha) was obtained from the double row system whereas those in the single row system were less productive. Further, irrespective of the planting system, dry wood yield of Ipil-Ipil was higher in the first harvest (3 YAP) than in the second harvest (6 YAP).

Results in Table 4 showed that there was no adverse effect on the yield of palms due to intercropping with Ipil-Ipil.

Based on overall results, it may be concluded that planting Ipil-Ipil in double rows was the best system under coconut in order to obtain the highest fuelwood yield.

The experiment was terminated.

K B Dassanayake and 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.

Among the leguminous crop species, Gliricidia trees and Pueraria cover maintained a satisfactory growth at Walpita Estate while Pueraria cover was affected by dry weather conditions at Ratmalagara Estate. Treatments, as per schedule, were imposed during the year. Records on nut and copra yields were maintained.

The experiment is in progress

D N S Fernando, M N Dias, K C P Perera

Table 4. *Dry wood yield of Ipil-Ipil under coconut (Ratmalagara Estate)*

Treatments	Wood yield (t/ha)	
	First harvest (1989)	Second harvest (1991)
T_1 - Double row System (2240 plants/ha)	15.3	7.9
T_2 - Single row system (1120 plants/ha)	8.3	4.3
T_3 - Alternate double rows (1120 plots/ha)	6.6	3.2
T_4 - Alternate single rows (560 plots/ha)	3.1	2.5

Table 5. *Effect of Ipil-Ipil on nut and copra yield (Ratmalagara Estate)*

Treatments	Nut yield nuts/palm/year 1990	Copra content (g/nut) 1990
T_1 - Double row system	97	184
T_2 - Single row system	100	209
T_3 - Alternate double row system	100	197
T_4 - Alternate single row system	93	189
T_5 - Control	89	197
LSD (P = 0.05)	NS	NS

Table 6. *Coconut yield and wood yield of Ipil under different planting systems in 1991 at Ratmalagara Estate (Expt. 4.3)*

Treatment	Nut yield (palm/yr)	Copra content (g/nut)	Wood yield (MT/ha) (2nd harvest)
T1-Double row system (2240 trees/ha)	97	184	7.9
T2-Single row system (1120 trees/ha)	100	209	4.3
T3-Alternative double rows (1120 trees/ha)	100	197	3.2
T4-Alternative single rows (560 trees/ha)	93	189	2.5
T5-Control (Control only)	89	197	-

Dried under the sun 3-4 days.

Experiment 7.12.2 Substitution of inorganic nitrogen for coconut palms with two different sources of organic matter. Ratmalagara Estate, Madampe - 1991

The objective of the experiment was to study the possibility of replacing inorganic nitrogen with gliricidia (in-situ) and cover loppings.

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

T_1 Control (no fertilizer coconut)
T_2 Adult palm mixture 3 kg/palm/year

T_3 Gliricidia loppings 30 kg + 500 g super phosphate + 1400 g muriate of potash/palm/year

T_4 Cow dung 35 kg/palm/year + 500 g super phosphate + 1200 g muriate of potash/palm/year.

The experiment is in progress

D N S Fernando, M N Dias, R Marasinghe

PROJECT 20: INTERCROPPING

Experiment 20.6 Effect of mixed cropping on the yield and productivity of coconut in the dry and dry intermediate zone. Margaret Estate, Pallama - 1990

Establishment of perennial intercrops and banana was completed during the year. Among perennials, cashew and mango showed satisfactory growth. Records on nut yield were maintained 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.

Mulberry bushes were pruned twice during the year which produced an estimated fresh leaf yield of 15.6t/ha, with a mean leaf water content of 77%. The nutrients content of leaf was satisfactory with 3.58% nitrogen and 2.0% of potassium.

The coconut yields were maintained during the year but showed no adverse effects due to intercropping with mulberry.

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.

Among the multipurpose species, tree growth in height and girth was found

to be superior in Gliricidia and Leucaena. In contrast, Calliandra was shown to be less tolerant to water stress, causing a set-back in growth during the dry period. Coconut yield records were maintained during the year.

The experiment is in progress.

M de S Liyanage, A M U Wijeratne

FOREIGN - AIDED PROJECTS

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.**

In the first experiment (short-term) to determine BNF potential in Gliricidia provenances, ^{15}N enriched urea fertilizer was applied to seedlings as a solution spray three months after planting and, the trees were harvested at eight months after planting. Of the Gliricidia provenances, OFI No. 14/84 and the local cultivar performed well in terms of dry matter yield and nodule number/tree.

The experiment was terminated.

In the second experiment (long-term) to determine the effect of tree management on BNF following treatments were laid down under a mature coconut stand in a randomized block design with three replicates.

T_1 Gliricidia cut at 4 monthly intervals
T_2 Gliricidia cut at 6 monthly intervals
T_3 Leucaena cut at 4 monthly intervals
T_4 Leucaena cut at 6 monthly intervals
T_5 Cassia cut at 4 monthly intervals
T_6 Cassia cut at 6 monthly intervals

The experiment is in progress.

M de S Liyanage, D N S Fernando, H A Abeysoma

3. LECTURES AND SYMPOSIA

Dr M de S Liyanage delivered several lectures on intercrop in coconut lands

and green manuring, to coconut growers in the Gampaha District, Managers, Superintendents and Field Officers of Sri Lanka State Plantation Corporation (SLSPC), Janatha Estate Development Board (JEDB) and private estates.

Dr D N S Fernando delivered lectures on green manuring and cover crops at the training course for management of coconut estates, organized by the Coconut Research Institute.

Messrs K B Dassanayake and M T N Fernando delivered lectures on agronomic and socio-economic aspects of intercropping and soil and moisture conservation in coconut lands to officers of the SLSPC, JEDB, NLDB and CCB.

4. EXTENSION ACTIVITIES

Dr M de S Liyanage and Mr K B Dassanayake visited several on-farm crop models in the Ratnapura District and advised the farmers and CCB field officers in the systematic management of intercrops and collection of agronomic and socio-economic data.

5. ACKNOWLEDGEMENTS

The co-operation and assistance given by the staff of Agronomy Division in implementation of the research programme and in the preparation of this report are gratefully acknowledged. Thanks are also due to Head and staff of the Biometry Division, for assistance in providing nut yield records of experiment and for statistical analysis.

REPORT OF THE GENETICS AND PLANT BREEDING DIVISION

Head - R R A Peries, Ph.D

1. GENERAL

Several new research projects were commenced during the year. Nut number and nut size of the Isolated Seed Garden (ISG) at Ambakelle were severely affected as a result of adverse weather during 1990, and the performance was the worst recorded in the last 10 years. This information was used to commence on a breeding programme using palms which did not respond adversely to changing weather.

1.1 Developments:

A low cost, less cumbersome, light weight tool was introduced to the nurseries for manual weeding to replace mammoty weeding. The tool "Chip hoe" was tried out at the CCB nurseries at Weeraketiya and Attavillu and at the B/E research nursery. Labourers preferred the use of this chip hoe to the traditional mammoty used to weed the conventional seed beds as it was less exhausting and easy on their backs. The damage to growing seedlings is also prevented as the blade is narrower (10 cm) than the blade of the mammoty. This is being developed further.

2. RESEARCH PROJECTS

PROJECT 5: PRODUCTION OF IMPROVED COCONUT VARIETIES

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

The experiment was maintained satisfactorily in its seventh year. Fertilizer application was undertaken only in November due to the non-availability of fertilizer earlier and each palm received at the rate of 3 Kg of urea based APM.

Four ***DG x T*** palms (120, 313, 332, 344) suffered red weevil damage and had to be uprooted in February/March. These palms were replaced with ***T x T*** seedlings in July.

The pattern of flowering from 5 years (60 months) onwards is shown in Table 1 along with the number of palms harvested and the nuts collected from each cultivar, during the year. The hybrids. ***(DG x T; DY x T)*** showed clear and consistent superiority in the rate of flowering compared to the other cultivars.

Table 1. *The progress in flowering from five years (60 months) onwards, the number of palms harvested during the year and the number of nuts collected from each cultivar in the Evaluation of Cultivars trial at Bandirippuwa Estate.*

	Time after field planting (yrs)						
Cultivar	5 89 Dec	5.5 90 June	6 90 Dec	6.5 91 June	7 91 Dec	number of palms harvested	number of nuts harvested
DG x T	67	69	70	74*	74*	67	1175
DY x T	61	66	75	78	78	66	1295
T x T	28	45	52	67	69	40	304
M.T	26	41	49	65	68	39	541
P.P.T	21	36	43	65	66	35	331

* Four palms uprooted during the year due to red weevil damage.

The number of leaves produced up to 5 years (60 months) and the rate of leaf production in the fifth year (Table 2) also showed the superiority of the hybrid under the wet-intermediate zone climatic of Bandirippuwa.

The fruit component analysis (Table 3) showed high variability in parameters, as the yields had yet not stabilized. The *T x T, MT* and ***PPT*** cultivars showed a trend higher nut weight, but this was compensated for by larger nut numbers in the hybrids (***DG x T*** and ***DY x T***).

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

Table 2. *Total leaf production to 60 months from planting and the rate of leaf production between 48 and 60 months in the evaluation of cultivars trial at Bandirippuwa (1984).*

	Mean	SD	LSD 5%
Total leaf number to 60 months			
DG x T	53.35	5.47	1.42
DY x T	49.69	5.93	
T x T	44.23	5.17	
MT	43.71	5.15	
PPT	41.95	5.63	
Rate of leaf production (48 - 60 months)			
DG x T	13.16	1.81	
DY x T	13.26	1.50	0.52
T x T	12.60	1.80	
MT	12.26	2.00	
PPT	11.49	2.04	

DG, dwarf green: DY, dwarf yellow: T, tall: MT, Moorock tall, PPT, plus palm tall. LSD, Least significant difference (LSD 5% = LSD ($P<0.05$)), SD, Standard deviation.

Table 3. *Results of fruit component analysis of the evaluation of cultivars trial at Bandirippuwa. (Data is the mean of six picks).*

Fruit component	Cultivar									
	DG x T		DY x T		T x T		MT		PPT	
	A	B	A	B	A	B	A	B	A	B
Fresh nut weight (g)	1052	0.31	1066	0.29	1389	0.28	1267	0.27	1282	0.24
Dehusked weight (g)	554	0.32	552	0.31	657	0.26	629	0.25	623	0.24
Split nut weight (g)	419	0.26	415	0.25	490	0.24	484	0.19	438	0.20
Kernel weight (g)	269	0.27	265	0.27	306	0.24	304	0.22	312	0.22
Est. copra weight/(g/nut)	168	na	166	na	196	na	194	na	175	na

na = not analysed. A = weight in grammes; B = CV

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

There was generally better growth and yield in this experiment compared to Bandirippuwa Estate. Fertilizer was applied at the rate of 3 Kg per palm of the urea based APM in October.

The palms 25 (DG x T) and 102 (*DY x T*), were affected by red weevil and had to be uprooted during the year. Flowering was recorded once a month and collection of nut samples for fruit component analysis was continued once every two months.

Table 4. *The progress in flowering from five years (60 months) onwards, the number of palms harvested during the year and the number of nuts collected from each cultivar in the Evaluation of Cultivars trial at Thammenna Estate.*

	Time after field planting (yrs)						
Cultivar	5 89 Dec	5.5 90 June	6 90 Dec	6.6 91 June	7 91 Dec	Number of palms harvested	Number of nuts harvested
DG x T	62	74	76	78	78	73	2346
DY x T	48	63	64	71	72	56	1671
T x T	18	44	49	64	65	34	640
M.T	20	43	45	60	61	36	551
P.P.T	34	56	57	68	71	53	905

The patterns of flowering from 5 years onwards and the nut yields during the year are shown in Table 4. The hybrids were again showing much higher yield than the other cultivars. The overall performance was apparently much better than at Bandirippuwa. A combined analysis of the results will be attempted next year.

The leaf number and the rate of leaf production (Table 5) from data collected up to 60 months, was clearly higher in the hybrids (*DG x T; DY x T*) compared to other cultivars.

The fruit component analysis (Table 6) showed again that large nut numbers in hybrids was associated with small nut size. As yields have not yet stabilized, it is too premature to make conclusions on this observations. Studies on water deficit patterns in this experiment have been planned for next year in collaboration with the Soils and Plant Nutrition Division. The research committee visited this experiment on 25 October to review its progress.

Table 5. *Total leaf production to 60 months from planting and the rate of leaf production between 48 and 60 months in the evaluation of cultivars trial at Thammenna (1984).*

	Mean	SD	LSD 5%
Leaf number at 60 months			
DG x T	48.79	5.17	2.00
DY x T	48.13	5.53	
T x T	42.22	5.71	
MT	42.23	6.49	
PPT	44.26	5.16	
Increase in leaf number (48 - 60 months)			
DG x T	13.32	1.65	0.65
DY x T	12.90	1.95	
T x T	12.42	2.09	
MT	12.00	2.54	
PPT	12.71	2.31	

DG, dwarf green: DY, dwarf yellow: T, tall: MT, Moorock tall, PPT, plus palm tall. LSD, Least significant difference (LSD 5% = LSD ($P<0.05$)), SD, Standard deviation

Table 6. *Results of fruit component analysis of the evaluation of cultivars trial at Thammenna. (Data is the mean of six picks).*

Fruit component	Cultivar									
	DG x T		DY x T		T x T		MT		PPT	
	A	B	A	B	A	B	A	B	A	B
Fresh nut weight (g)	960	0.32	966	0.32	1158	0.26	1148	0.28	1194	0.26
Dehusked weight (g)	497	0.38	511	0.35	608	0.29	564	0.31	600	0.29
Split nut weight (g)	379	0.32	387	0.31	474	0.25	441	0.26	465	0.25
Kernel weight (g)	241	0.35	248	0.33	302	0.27	282	0.29	300	0.27
Est. copra weight (g/nut)	152	na	155	na	190	na	176	na	186	na

na = not analysed. A = weight in grammes; B = CV

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

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

After some delay, it was possible to negotiate with the Sri Lanka Army to carry out field operations in this trial. Red Weevil caused the death of 2 guard row palms (05G; 55G). In August, fertilizer was applied at the rate of 3 kg per palm APM on all palms. The progress in flowering (Table 7) was very much lower compared to Bandirippuwa and Thammenna. No nuts were harvested during the year. Leaf production data (Table 8) shows that the number and the rate of leaf production at 60 months was lower than at Bandirippuwa and Thammenna Estate trials, but the pattern between hybrids and other cultivars was very similar.

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

Table 7. *Temporal change in flowering in the evaluation of cultivars trial at Dambakande estate, Kurunegala.*

Cultivar	Time after planting (yrs) 5.5	6	6.5	7	Percentage of palms in flower as at 31 December
DG x T	46	57	66	67	84
DY x T	16	24	42	46	58
T x T	-	01	03	04	05
M.T	01	02	15	17	21
P.P.T	-	-	10	12	15

Experiment 5.1.4 Evaluation of five improved cultivars at Palugaswewa Estate, Rajakadaluwa (1985)

No measurements were made in view the decision to review and discontinue this experiment. The research committee however, wished to continue the experiment to observe the performance of cultivars, in the dry-intermediate zone without moisture conservation practices. The JEDB however, did not wish to continue the experiment without moisture conservation. In November the CRI agreed to go ahead with husk pits and made a contribution of Rs. 15,000 to JEDB towards this operation. No routine observations will be made on this experiment until nuts are ready for harvest, when fruit components will be analysed.

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

Table 8. *Total leaf production to 60 months from planting and the rate of leaf production between 48 and 60 months in the evaluation of cultivars trial at Dambakanda (1984).*

	Mean	SD	LSD 5%
Leaf number at 60 months			
DG x T	43.43	6.11	2.10
DY x T	39.10	6.64	
T x T	28.60	6.29	
MT	31.19	5.99	
PPT	28.53	4.69	
Increase in leaf number (48-60) months			
DG x T	11.37	2.08	0.87
DY x T	10.48	1.90	
T x T	8.13	1.91	
MT	8.23	2.16	
PPT	7.73	1.97	

DG, dwarf green: DY, dwarf yellow: T, tall: MT, Moorock tall, PPT, plus palm tall.
LSD, Least significant difference (LSD 5% = LSD ($P<0.05$)), ns, not significant; SD, Standard deviation

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

This experiment was in its sixth year and the management continued to be somewhat sub-optimal, mainly due to change of ownership over time. Fertilizer was applied in two doses in July and November. Two palms (141 and G74) had to be destroyed due to re-weevil damage. The temporal change in flowering from 4 years onwards, the number of palms harvested and the number of nuts collected during the year are shown in Table 9.

The total leaf number and the rate of leaf production was clearly superior in the hybrids (***DG x T; DY x T***) compared to other cultivars at 5 years. (Table10). Being in the wet zone leaf number appeared to be higher compared to Bandirippuwa and Thammenna.

Table 9. *The progress in flowering from five years (60 months) onwards, the number of palms harvested during the year and the number of nuts collected from each cultivar in the Evaluation of Cultivars trial at Suriyapura Estate.*

	Time after field planting (yrs)						
Cultivar	4 89 Dec	4.5 90 June	5 90 Dec	5.5 91 June	6 91 Dec	Number of palms harvested	Number of nuts harvested
DG x T	18	32	41	56	57	36	125
DY x T	11	16	22	43	44	14	62
T x T	-	-	-	05	06	01	03
M.T	-	-	-	07	09	01	07
P.P.T	-	-	01	02	05	02	06

Table 10. *Total leaf production to 60 months from planting and the rate of leaf production between 48 and 60 months in the evaluation of cultivars trial at Suriyapura (1986).*

	Mean	SD	LSD 5%
Leaf number at 60 months			
DG x T	58.39	4.50	2.89
DY x T	57.03	5.07	
T x T	48.26	4.63	
MT	49.79	4.40	
PPT	47.90	5.44	
Increase in leaf number (48-60 months)			
DG x T	12.70	1.10	0.53
DY x T	11.79	1.56	
T x T	9.55	1.58	
MT	10.21	1.61	
PPT	9.72	1.68	

DG, dwarf green: DY, dwarf yellow: T, tall: MT, Moorock tall, PPT, plus palm tall.
LSD, Least significant difference (LSD 5% = LSD ($P < 0.05$)), SD, Std. deviation

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)

With the poor rainfall distribution at ISG in 1990, nut sizes and nut numbers declined and was the worst recorded in the past 10 years. Data on nut size (split nut weight recorded since 1987) and nut numbers were used to identify palms showing less variability to changes in weather.

A total of 57 palms were selected in field no. 4, ISG based on both nut size and nut number. These palms showed the least variation in response to weather. These palms were further screened and palms which produced an estimated copra weight of 200 g and above were selected as pollen parents. A total of 17 such pollen parents are currently being used to make crosses between the selected total of 57 palms. It is expected to test the progeny under soil water deficit conditions. Planting material would be available from end 1992 onwards.

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

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

The full commissioning of the machine was again affected due to faulty rubber teats. These teats have now been ordered, through the kind assistence of the ARP.

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 Rathmalagara Estate, Madampe, (Field no. 2) for the evaluation of progeny (1986)

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

Experiment 5.4.1.4 Trail at JEDB Mangala Eliya Estate, Puttalam for the evaluation of progeny (1987)

These four trials were maintained satisfactorily. The distribution of rainfall improved during the year at all sites and hence no casualties due to water deficit were observed. Three seedlings died as a result of Red Weevil attack, one each at Bandirippuwa, Ratmalagara and Andigama. Fertilizer application was carried out once at Bandirippuwa during the year with 3 Kg of APM per palm and twice during the year at other sites with YPM (urea). The old stand at Mangala Eliya appeared to affect the trial and negotiations have been made to uproot the entire old plantation. Growth parameters, number of new leaves added and total leaf number were counted twice during the year in all the trials and the performance of the varieties were compared using the procedure of analysis of variance (ANOVA). The appearance of the first inflorescence (first flowering) was also recorded at monthly intervals.

The trials at Bandirippuwa and Ratmalagara have now completed five years after planting and the final leaf count revealed the superiority of *T x DG* compared to *T x T and T x SR* at both sites. The difference in leaf number between *T x T* and *T x SR* was not significant at Bandirippuwa but at Ratmalagara the number was significantly higher in *T x SR* than in *T x T*. The increase in leaf number during the 4th and 5th year after planting and total leaf number at 60 months also indicated the better performance of *T x DG* at both locations. However *T x T* and *T x SR* behaved differently in the two locations. The rate of leaf production was significantly higher in *T x T* compared to *T x SR* at Bandirippuwa and the reverse was observed at Ratmalagara (Tables 11 & 12).

The total number of palms in flower at the end of five and half years at Bandirippuwa and Ratmalagara are summarized in Tables 13 and 14 respectively. The number of palms in flower was comparatively higher at Bandirippuwa compared to Ratmalagara. Here again *T x DG* was superior to *T x T* and *T x SR* at both sites. Flowering in the *T x DG* progeny had reached 100% at Bandirippuwa and 64% at

Ratmalagara whereas *T x T* and *T x SR* had reached only 45.5% and 41% respectively at Bandirippuwa and 3% and 11% respectively at Ratmalagara.

There was apparent progeny x site interaction considering the parameters, leaf number and number of palms in flower, where the overall performance of the three progenies were better at Bandirippuwa. A differences in the performance between *T x T* and *T x SR* was not seen at Bandirippuwa but at Ratmalagara *T x SR* appeared to be ahead of *T x T* in leaf production and time taken for first flowering.

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

Table 11. *Total leaf production, leaf number at 60 months and the increase in leaf number of three types of progeny T x DG, T x T, T x SR at Bandirippuwa (1986).*

	Mean	SD	LSD 5%
Total leaf production at 60 months			
TxDG	61.49	5.41	3.97
TxT	53.34	5.56	
TxSR	51.83	5.99	
Increase in leaf number (48 - 60 months)			
T x DG	14.92	1.79	0.53
T x T	13.94	2.07	
T x SR	13.28	2.59	
Leaf number at 60 months			
T x DG	23.09	3.63	1.09
T x T	21.76	3.72	
T x SR	19.33	5.28	

DG, dwarf green: T, tall: SR, San Ramon
LSD, Least significant difference (LSD 5% = LSD ($P<0.05$)),
SD, Standard deviation

Table 12. *Total leaf production, leaf number at 60 months and the increase in leaf number of three types of progeny T x DG, T x T, T x SR at Ratmalagara (1986).*

	Mean	SD	LSD 5%
Total leaf production to 60 months			
T x DG	52.88	4.98	2.37
T x T	42.42	4.41	
T x SR	47.34	4.96	
Increase in leaf number (48 - 60 months)			
T x DG	12.99	1.85	0.51
T x T	10.91	1.90	
T x SR	12.36	1.73	
Leaf number at 60 months			
T x DG	18.33	3.53	1.10
T x T	15.09	3.25	
T x SR	17.21	3.10	

DG, dwarf green: T, tall: SR, San Ramon
LSD, Least significant difference (LSD 5% = LSD ($P<0.05$)),
SD, Standard deviation

Table 13. *Cumulative number of palms in flower in the three types of progeny T x DG, T x T, T x SR at Bandirippuwa (1986).*

Progeny	Years after planting				
	3.5	4	4.5	5	5.5
T x DG	50 (56%)	68 (76%)	69 (77%)	87 (97%)	88 (100%)
T x T	0	02 (02%)	02 (02%)	33 (34%)	41 (46%)
T x SR	0	05 (05%)	05 (06%)	32 (36%)	37 (41%)

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

Table 14. *Cumulative number of palms in flower in the three types of progeny T x T x DG, T x T, T x SR at Ratmalagara (1986).*

Progeny	Years after planting				
	3.5	4	4.5	5	5.5
T x DG	10 (10%)	38 (42%)	38 (48%)	49 (54%)	58 (64%)
T x T	00 (00%)	00 (00%)	02 (02%)	02 (02%)	03 (03%)
T x SR	01 (01%)	01 (01%)	01 (01%)	07 (08%)	10 (11%)

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

The trial at Andigama Farm, Giriulla (Mudalihamy Block) has now completed four years after planting. The leaf number, increase in leaf number during the third and fourth years after planting and total leaf number at 48 months are presented in Table 15.

The ANOVA for leaf number and the rate of leaf production at 48 months from planting clearly revealed varietal differences. As expected *T x DG* was superior to both *T x T* and *T x SR* in all three parameters studied. *T x SR* also performed significantly better than *T x T* in the same parameters. At four and half years after planting, the total number of palms in flower had reached 27%, and were all *T x DG* hybrids (Table 16).

J.M.D.T.Everard, R.R.A.Peries and R. Jayatilleke

The trial at JEDB Mangala Eliya Estate has now completed four years from planting. Leaf number at 48 months, the increase in leaf number in the preceding year (36 - 48 months) and the total leaf number at 48 months in the four types of progeny, *T x DG, T x T, T x SR* and *T (OP)* at this site are shown in Table 17. In this site too, *T x DG* exhibited its superiority over *T x T, T x SR* and *T(OP)* in the three parameters measured. It is worthy to note here that the T (OP) material was slightly older than the other planting material and hence not truly comparable. Flowering had commenced in *T x DG* recording 24% at the completion of four and half years after planting (Table 18). Flowering has not yet occurred in the other cultivars.

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

Table 15. *Total leaf production, leaf number at 48 months and the increase in leaf number of three types of progeny T x DG, T x T, T x SR at Andigama (Mudalihamy block) (1986).*

	Mean	SD	LSD 5%
Total leaf production to 48 months			
T x DG	37.00	4.83	1.58
T x T	29.34	3.37	
T x SR	31.15	3.51	
Increase in leaf number (36 - 48 months)			
T x DG	11.82	2.59	0.59
T x T	8.34	1.71	
T x SR	9.26	1.99	
Total leaf number at 48 months			
T x DG	15.15	3.76	1.03
T x T	10.38	2.39	
T x SR	11.79	2.68	

DG, dwarf green: T, tall: SR, San Ramon
LSD, Least significant difference (LSD 5% = LSD ($P<0.05$)),
SD, Standard deviation

Table 16. *Cumulative number of palms in flower in the three types of progeny T x DG, T x T, T x SR at Anidigama (Mudalihamy Block 1986)*

Progeny	Years after planting			
	3	3.5	4	4.5
T X DG	1 (1%)	1 (1%)	5 (6%)	25 (28%)
T X T	0	0	0	0
T X SR	0	0	0	0

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

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 trails 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. The cultural operations were successful and fertilizer application was carried out twice during the year as scheduled.

The progenies evaluated in these two trials are; *T x DG, T x T, T x SR* and *DG x SR*. The trial at Daisy Valley estate, in addition, has a *DG x T* progeny for evaluation.

Total leaf production to 36 months, increase in leaf number during the year and leaf number at the end of 36 months were recorded during the year and were compared using ANOVA. Number of palms in flower were also recorded monthly (Table 19 & 20). The performance of the four types of progeny at the Puras Block, Andigama at the end of 36 months after planting revealed the superiority of *DG x SR* over *T x DG, T x SR and T x T*. The total leaf production to 36 months and total leaves at 36 months were highest in *DG x SR* followed by *T x DG*, showing early rapid rate of growth in *dwarf x tall* hybrids. The difference between *T x SR* and *T x T* in this respect was also significant although the increase in leaf number from the second to third year did not show this difference (Table 19). Flowering had commenced in *DG x SR* and *T x DG* with the former reaching about 20% and the latter 2% at 4 years from planting. *T x T* and *T x SR* are yet not in flower.

Results at Daisy Valley (Table 21) were somewhat different to what was observed at Andigama (Puras Block). Here, leaf production pattern of *DG x T, T x DG, and DG x SR* were very similar, *T x SR* was significantly better than *T x T*. Flowering had commenced in *tall x dwarf* hybrids with *T x DG, DG x T and DG x SR* recording 29%, 29% and 22% respectively at the end of 42 months (Table 22).

J.M.D.T. Everard, R.R.A. Peries, R. Jayatilaka, R. B. Attanayake

Table 17. *Total leaf production, leaf number at 48 months and the increase in leaf number of four types of progeny* ***T x T, T x SR, T x DG and T (OP)*** *at Mangala Eliya (1987).*

	Mean	SD	LSD 5%
Total leaf production to 48 months			
T x DG	41.71	4.49	1.20
T x T	33.16	4.64	
T x SR	34.92	3.90	
T (OP)	34.43	4.98	
Increase in leaf number (36 - 48 months)			
T x DG	10.84	2.55	1.20
T x T	8.40	2.07	
T x SR	8.00	2.63	
T (OP)	8.87	2.24	
Total leaf number at 48 months			
T x DG	15.00	3.70	0.64
T x T	10.62	3.70	
T x SR	11.24	3.04	
T (OP)	11.71	3.14	

DG, dwarf green: DY, T, tall: SR, San Ramon, T (OP), tall open pollinated
LSD, Least significant difference (LSD 5% = LSD ($P<0.05$)),

Table 18. *Cumulative number of palms in flower in the three types of progeny* ***T x T, T x SR, T x DG and T (OP)*** *at Mangala Eliya (1987).*

Progeny	Years after planting		
	3.5	4	4.5
T x DG	1 (1%)	17 (19%)	22 (24%)
T x T	0	0	0
T x SR	0	0	0
T (OP)	0	0	0

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

Table 19. *Total leaf production, leaf number at 36 months and the increase in leaf number of four types of progeny T x DG, T x T, T x SR and DG x SR at Andigama (Puras block) (1987).*

	Mean	SD	LSD 5%
Total leaf production to 36 months			
T x DG	27.47	2.30	
T x T	27.47	2.30	
T x SR	24.48	2.03	
DG x SR	28.26	1.65	0.74
Increase in leaf number (24 - 36 months)			
T x DG	5.85	0.91	
T x T	5.60	0.80	
T x SR	5.85	0.91	
DG x SR	7.48	1.24	0.56
Total leaf number at 36 months			
T x DG	9.89	1.42	
T x T	9.89	1.42	
T x SR	8.29	1.24	
DG x SR	10.62	1.94	0.53

DG, dwarf green: T, tall: SR, San Ramon; LSD, Least significant difference (LSD 5% = LSD ($P<0.05$)); SD, Standard deviation

Table 20. *Cumulative number of palms in flower in the three types of progeny T xDG, T x T, T x SR, and DG x SR at Andigama (Puras block) (1987).*

Progeny	**Years after planting**		
	3	**3.5**	**4**
T x DG	0	0	2 (2%)
T x T	0	0	0
T x SR	0	0	0
DG x SR	1 (1%)	16 (17%)	19 (21%)

DG, dwarf green: DY, T, tall: SR, San Ramon

Table 21. *Total leaf production, leaf number at 36 months and the increase in leaf number of five types of progeny, T x DG, T x T, T x SR, DG x SR and DG x T at Daisy Valley estate (1987).*

	Mean	SD	LSD 5%
Total leaf production to 36 months			
T x DG	33.02	3.71	
T x T	27.31	2.73	
T x SR	28.61	2.96	
DG x SR	32.38	3.33	
DG x T	34.07	3.58	0.69
Increase in leaf number (24 - 36 months)			
T x DG	10.77	2.18	
T x T	7.99	1.53	
T x SR	8.89	1.67	
DG x SR	10.79	1.93	
DG x T	11.35	2.27	0.57
Total leaf number at 36 months			
T x DG	12.46	3.06	
T x T	8.84	2.16	
T x SR	9.61	2.43	
DG x SR	12.21	2.79	
DG x T	12.89	3.29	1.70

DG, dwarf green: DY, T, tall: SR, San Ramon.
LSD, Least significant difference (LSD 5% = LSD ($P<0.05$)),
SD, Standard deviation

Table 22. *Cumulative number of palms in flower in the three types of progeny, TxDG, TxT, TxSR, DG x SR and DG x T at Daisy Valley estate (1987).*

Progeny	Years after planting		
	3	3.5	4
T x DG	(1%)	16 (17%)	26 (29%)
T x T	0	0	2 (2%)
T x SR	0	0	0
DG x SR	2 (2%)	13 (14%)	20 (22%)
DG x T	2 (2%)	16 (18%)	26 (29%)

DG, dwarf green: DY, dwarf yellow: T, tall: SR, San Ramon.

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 Sirikandura Estate, Dodanduwa, for the evaluation of progeny (1989).

Experiment 5.4.3.2 Observation trial at Open Prison Camp, Dalupota, 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 are *T x DG, T x DY, T x T* and *T x SR*. The trial at Ratmalagara Estate was established only for the evaluation of hybrid progeny *DG x T, DY x T, DG x SR* and *DY x SR*.

The trials at Sirikandura and Dalupota are now in their third year. The cultural practices were satisfactorily carried out at the two sites. Fertilizer

application was done twice during the year. Black beetle continued to cause concern at the Dalupota site where the sanitation was generally poor. The adult coconut stand at Sirikandura shaded much of the young growing seedlings. Several requests made to the Superintendent of the estate to uproot the old stand did not yield positive results.

Growth measurements such as girth, height, rate of leaf production and total leaf number were taken at half yearly intervals and were analyzed using the ANOVA procedure. The data for the three trials are presented in Tables 23, 24 and 25.

As in the previous year the vegetative growth of all four types of progeny was better at Sirikandura than at Dalupota. At Sirikandura *T X SR* had the highest girth and height at 24 months followed by *T x DG and T x DY* with no significant difference between them. *T x T* showed the lowest girth and height.

At Dalupota the girth and height of *T x DY* was significantly higher than all other cultivars. The difference between the three cultivars were not significant.

There were trends to higher leaf number and rate of leaf production in the hybrids (*T x DG, T x DY*) compared to *T x T* and *T x SR* at both sites. Leaf number at 24 months and leaf production during the preceding year revealed that *T x DY* was performing much better than the other varieties at both sites. However, the performance of *T x DG* too was better compared to *T x T* and *T x SR* at both locations.

The summary of growth measurements taken of the four hybrids under evaluation at Ratmalagara are given in Table 25. According to girth at 24 months from planting the hybrids were similar showing no significant difference between them. However, in terms of height and leaf number at 24 months and leaf increase in the preceding year *DG x T* was significantly better than *DY x T, and DY x SR.*

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

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)

No data analysis was undertaken during the year.

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

Table 23. *Girth, height, total leaf production, leaf number at 24 months and the increase in leaf number of four types of progeny, T x DG, T x T, T x SR and T x DY at Sirikandura estate (1989).*

	Mean	SD	LSD 5%
Girth at 24 months (cm)			
T x DG	76.00	18.81	
T x T	64.72	16.00	
T x SR	79.33	16.77	4.23
T x DY	73.44	17.09	
Height at 24 months (cm)			
T x DG	431.39	61.39	
T x T	389.90	68.09	
T x SR	470.24	76.62	25.97
T x DY	443.65	64.13	
Total leaf production to 24 months			
T x DG	23.93	2.77	
T x T	20.63	2.32	
T x SR	22.10	2.40	
T x DY	23.93	2.64	1.23
Increase in leaf number (12 - 24 months)			
T x DG	8.91	1.68	0.47
T x T	7.34	1.19	
T x SR	8.12	1.20	
T x DY	8.40	1.41	
Total leaf number at 24 months			
T x DG	11.27	2.13	0.67
T x T	9.41	1.72	
T x SR	10.33	1.53	
T x DY	11.24	1.90	

DG, dwarf green: DY, dwarf yellow: T, tall: SR, San Ramon,
LSD, Least significant difference (LSD 5% = LSD ($P<0.05$)),
SD, Standard deviation

Table 24. *Girth, height, total leaf production, leaf number at 24 months and the increase in leaf number of four types of progeny, T x DG, T x T, T x SR and T x DY at Dalupotha (1989).*

	Mean	SD	LSD 5%
Girth at 24 months (cm)			
T x DG	47.88	21.16	
T x T	45.46	16.09	
T x SR	46.94	18.30	
T x DY	61.15	18.10	10.23
Height at 24 months (cm)			
T x DG	247.15	96.64	
T x T	239.32	92.51	
T x SR	250.36	96.17	
T x DY	299.32	92.51	29.47
Total leaf production to 24 months			
T x DG	17.16	3.39	
T x T	17.13	2.06	
T x SR	16.50	3.07	
T x DY	20.15	2.63	1.76
Increase in leaf number (12 - 24 months)			
T x DG	7.77	2.32	
T x T	6.99	1.42	
T x SR	7.39	1.51	
T x DY	8.65	1.59	0.63
Total leaf number at 24 months			
T x DG	9.40	2.31	
T x T	6.82	1.98	
T x SR	7.21	2.34	
T x DY	8.54	3.44	0.69

DG, dwarf green: DY, dwarf yellow: T, tall: SR, San Ramon,
LSD, Least significant difference (LSD 5% = LSD ($P<0.05$)), SD, Standard deviation

Table 25. *Girth, height, total leaves, leaf number and the increase in leaf number of four types of progeny, DG x SR, DG x T, DY x SR and DY x T at Ratmalagara estate (1989).*

	Mean	SD	LSD 5%
Girth at 12 months (cm)			
DG x SR	27.38	5.58	
DG x T	31.83	5.92	5.24
DY x SR	31.47	8.01	
DY x T	28.29	8.08	
Height at 12 months (cm)			
DG x SR	220.69	39.60	
DG x T	267.33	27.69	23.97
DY x SR	235.93	36.66	
DY x T	231.88	38.84	
Leaf number at 12 months			
DG x SR	14.25	2.38	
DG x T	16.83	1.95	1.29
DY x SR	13.8	2.40	
DY x T	14.00	2.72	
Increase in leaf number (12 - 24 months)			
DG x SR	7.50	2.03	
DY x SR	7.60	1.80	
DG x T	10.17	1.34	1.33
DY x T	8.12	2.55	

DG, dwarf green: DY, dwarf yellow: T, tall: SR, San Ramon,
LSD, Least significant difference (LSD 5% = LSD ($P<0.05$)),
SD, Standard deviation

Experiment 5.5 Establishment of germplasm collections (1983)

Experiment 5.5.1 New variety block or crop museum, at block no. 5, Bandirippuwa Estate, Lunuwila (1983)

This plantation was maintained satisfactorily and fertilizer was applied in December 1991. All dwarf forms (***7 DG; 7 DY; 7 DR), 3 King coconut***, **3 Rathran**

thembili; 5 San Ramon (Russeet), **2 pora pol** and 1 **DG x T** were in bearing while 1 King coconut, 1 Rathran thembili, 1 San Ramon (Russeet) and 3 gonthembili were in flower as at 31 December.

There was 1 casuality in pora pol. Seven vacancies of Navasi thembili remain to be filled and a pollination programme has been scheduled to commence in 1992 in order to supply these vacancies.

Experiment 5.5.2 Purification of local (indigenous) germplasm, Bandirippuwa Estate, (B/E) Lunuwila (1984)

The young plantations established in 1990 was satisfactorily maintained and growth measurements were recorded twice this year in April and November.

Thirty six vacancies (*16 gon thembili; 18 pora pol; 2 ran thembili*) were filled and futher 17 seedlings (*15 navasi; 2 ranthembili*) were planted during the year. Of this 5 Gon thembili and 8 pora pol seedlings died prior to establishment.

A pollination programme is being carried out at Bandirippuwa on *gonthembili, bodiri, ran thembili, pora pol, navasi* and *kamandala* to raise seedlings for infillings and new planting scheduled for 1993. The current status of the local germplasm collection is shown in Table 26.

Table 26. *Status of local germplasm collection at Bandirippuwa as at 31 December.*

Status of Collection	Type (form) of coconut						
	Bodiri	Gon thembili	Pora Pol	Ran thembili	Navasi	Dikiri	Kamadala
Number established	80	69	57	19	36	3	6
Vacancies	35	6	20	4	5	-	2
Young palms	25	26	21	7	10	2	4
In stem	20	26	6	6	-	-	-
In flower	3	4	-	-	-	-	-
Bearing	13	4	-	-	-	-	-
Seedlings	-	11	10	2	21	1	-

Total number of standing palms = Young palms + In Stem + Seedlings

Experiment 5.5.3 Conservation of San Ramon, (1986)

This plantation was maintained satisfactorily during the year. Fertilizer application was done in December. Growth measurements were recorded twice in April and November.

Twenty eight palms were in bearing as at 31 December and 5 casualties were reported.

A A L Perera, R R A Peries, H S G Kularatne and R Jayatilaka

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

Rats and porcupines caused considerable damage to the ***dwarf green*** and ***dwarf red*** palms during the year resulting in a total of 98 vacancies, comprising 59 ***dwarf green***, 13 ***dwarf red***, and 26 ***dwarf yellow*** seedlings. Seven ***DY x DG*** were also supplied during the year and six vacancies of ***DY x DG*** and 4 vacancies of ***DG x DY*** were recorded.

Growth measurements were recorded twice during the year and fertilizer application was carried out in December. A pollination programme is in progress to supply the vacancies in Maha 1993.

Experiment 5.5.5 Germplasm from other countries (1985)
Experiment 5.5.5.1 Import of exotic material

An expert consultation on the import of exotic coconut germplasm for coconut breeding was convened by the Ministry of Coconut Industries and Crop Diversification on 10 September to obtain a consensus of opinion on this subject. This was organised as a result of the World Bank recommendation to import of coconut germplasm for breeding. It is hoped that the outcome of these deliberations will be beneficial to the coconut Industry.

Experiment 5.5.5.2 Purification and multiplication of exotic material already available

San Ramon **(SR)**: The plantation was satisfactorily maintained during this year and fertilizer application was done in December 1991. Ten seedlings were supplied for infilling. No pollinations were done during the year. Out of 175 seed nuts remaining at the end of 1990, 119 were harvested and laid at the B/E research nursery.

***Cameroon red dwarf* (CRD); *Brazilian green dwarf* (BGD):**

Pollination is being continued on all 6 CRD and 6 BGD palms available. Total of 180 nuts, comprising 165 CRD and 15 BGD were harvested this year and all CRD and 11 BGD were directly polybagged in the B/E research nursery. Four BGD seednuts were given over to the Tissue Culture Division for a preliminary study on embryo culture as the seed had recorded poor nut-set and poor germination under normal conditions.

Few seedlings resulting from pollination (4 CRD; 2 BGD) were planted in the vacant areas of the B/E research nursery in June this year. All seedlings were maintained satisfactorily and fertilizer application was carried out during the Maha season.

R R A Peries, A A L Perera and H S G Kularatne

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*)

Due to restrictions in travel, priority was given only for collection of nuts from already selected estates for infilling purposes. Only one new collection was made (St. Johns estate, Mangala Eliya) during this year. Selections at Horakelle estate, Melsiripura Group and Keenakelle estate were postponed to 1992.

St. Johns estate, Mangala Eliya:

Available information indicated that mother palms had been selected from this estate in the past for their own coconut replanting programme, based on high yield, shape of nut (spherical) and especially the russet colour.

Mother palms selected in this estate by the CRI had been used for pollination with pre-potent pollen in the production of ***T x T*** seed, prior to 1975.

Twenty five palms were selected from each of fields 3 and 4 (St. Johns A) and fields 1 and 5 (St. Johns 'B') making a total of 100 adult palms. Initial nut collection will be done in early January 1992.

A total of 360 nuts (St. Annes 34; Wellawa 33; Moorock 127; Palugaswewa 110; and Pitiyakande 56;) were collected in two visits this year for infilling vacancies.

Assembly and evaluation of collected material

Conservation Block - Poththukulama Research Station (PRS)

This plantation was maintained satisfactorily during the year. Growth measurements were recorded twice (April and October) and fertilizer was applied in two split doses during the Yala and Maha seasons.

The following accessions were introduced during the year.

Date of planting	Accession	Number of seedlings established	Number of mother palms
19 June	Mahahena (Akuressa)	85	10
29 July	Ambakelle special	85	63

In addition, 67 dwarf progenies from selected parents of Kundasale Government farm were introduced but all of them succumbed to water logging during the monsoon. A total of 33 seedlings (30 ***T x T*** ; 3 ***SR***) were supplied on the guard rows. The status of the PRS conservation block as at 31 December is given in Table 27.

Table 27. *Status of the Germplasm collection - Poththukulama Research Station as at 31 December.*

	Accession	Number of seedlings	Vacancies	Weak seedlings
1.	Moorock	82	-	-
2.	Palugaswewa	85	4	-
3.	Pitiyakande	84	6	-
4.	Clovis	85	2	-
5.	Namalwatta	85	4	-
6.	St. Annes	85	2	-
7.	Margaret	85	13	-
8.	Kasagala	24	17	-
9.	Debarayaya	39	21	-
10.	Kundasala	67	64	3
11.	Mahahena	85	2	-
12.	Ambakelle special	85	-	-

Bandirippuwa Estate, Kotakande germplasm conservation block

Growth measurements were taken twice this year and fertilizer application was done in Maha.
Severe rat damage resulting from poor sanitation led to the loss of a large number of seedlings in the conservation.

Status of the Kotakande conservation block as at 31 December is as given in Table 28.

Table 28. *The status of the Germplasm conservation, Kotakande block, Bandirippuwa Estate as at 31 December.*

Accession	Number of seedlings originally established	Vacancies	Weak seedlings	No. of heathy growing seedlings
Wellawa	84	14	-	70
Pitiyakande	86	23	4	59
Ambakelle tall	86	12	03	71
Moorock	84	50	05	29
Namalwatta	84	75	07	02
Debarayaya	63	35	-	28
Clovis	85	47	02	36
Palugaswewa	81	48	06	27
Ambakelle special	146	103	08	35

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

(a) San Ramon: Rat damage caused severe losses to the San Ramon collection made from Uhumiya, taking the total number of vacancies to 47 at the Kotakande conservation block. Two of the affected palms are showing signs of recovery.

The collection at the PRS was maintained satisfactorily and only 7 vacancies were recorded. Five of these vacancies were supplied during the Maha, season. A total of 107 nuts were collected from the original source during two visits this year and laid at the Bandirippuwa research nursery for infilling vacancies.

(b) Dwarf forms:

(i) Kundasale farm: Nut collection from the ***dwarf*** population at the Government Farm, Kundasale was carried out successfully this year. A total of 309 nuts comprising 82 ***DY***, 144 ***DG*** and 83 ***DR*** were collected allowing 3-6 nuts per palm. All germinated nuts in the prenursery were polybagged and will be ready for planting in Yala 1992.

(ii) Johanawatta: The dwarf palm population at Johanawatta estate (the parents of the dwarf palms at ISG) has now been blocked out and all ***dwarf*** palms had succumbed to the recurrent droughts. This estate would therefore not be considered in future conservation.

(iii) Mirishena estate, Bulathsinhala: Although there were enough mature nuts in the dwarf population at Mirishena estate, Mahagama, Bulathsinhala, collection was not possible as a result of an ongoing dispute in the estate. In this population, there are a few palms which appear to be dwarf palms but are comparatively taller, with larger nuts. In these palms cross pollination has also been reported (A. Rathnasiri, Pers. Comm.). These palms are referred to as **Loku kundira** or **Naw kundira** (meaning dwarfs imported by ship) by the people in the area. In order to make collections during 1992, it may be necessary to negotiate with the parties in dispute.

(iv) Brown (Russet) dwarf: Few russet colour forms scattered throughout the coconut triangle were also identified this year at Madampe, Kirimetiyana temple premises, old police station premises at Mawathagama in Kurunegala, Katana and Colombo. Few collections were done from Madampe and Kirimetiyana temple premises. The 2 palms at Kirimetiyana temple are said to have their origin in Matara 30 years ago.

Fruit component analysis of seed nuts from Mirishena estate Bulathsinhala and Vidyajothi Pirivena, Kirimetiyana are summarized in Table 29 and Table 30 respectively. Extensive studies on these palms will be carried out next year.

A A L Perera, R R A Peries and H S G Kularatne

(c) Others:

A few palms (8 talls and 1 dwarf), remaining from an early introduction from Malaysia were identified during the latter part of 1990 and collections were made in 1991.

Nut collection was also made from palms selected at Goluwapokuna estate in 1987.

Table 29. *Fruit characteristics of Loku kundira/Naw kundira population at Mirishene estate, Mahagama, Bulathsinhala.*

Fruit component	Mean	Range
Fruit weight (g)	1710.0	1301.0 - 2022.0
Husk weight (g)	965.0	715.0 -1217.0
Nut weight (g)	734.5	527.0 - 999.0
Split nut weight (g)	523.0	422.0 - 682.0
Volume of nut water (ml)	201.0	66.0 - 300.0
Thickness of shell (mm)	2.3	1.3 - 3.0
Thickness of kernel (mm)	11.0	7.7 - 13.7
Fresh weight of kernel (g)	326.8	256.0 - 415.0
Dry weight of kernel (g)	135.0	71.0 - 232.0
Estimated copra weight (g)	211.0	

(Sample size was one fruit per palm from 10 palms).

Table 30. *Fruit characteristics of the dwarf russet form at Vidyajothi Pirivena, Kirimetiyana temple.*

Fruit component	Mean	Range
Fruit weight (g)	562.0	444.0 - 640.0
Husk weight (g)	258.0	197.0 - 299.0
Nut weight (g)	311.4	245.0 - 390.0
Split nut weight (g)	248.8	204.0 - 310.0
Volume of nut water (ml)	63.5	35.0 - 128.0
Thickness of shell (mm)	2.4	2.0 - 2.7
Thickness of kernel (mm)	8.6	6.3 - 10.1
Fresh weight of kernel (g)	173.0	140.0 - 220.0
Dry weight of kernel (g)	88.7	68.4 - 115.7
Estimated copra weight (g)	99.5	

(Sample size was 5 nuts per palm from 2 palms).

Razeena (Mahahena) estate

This is a private estate in Akuressa currently owned by Mr. Derek Samarasinha. In the 1930's, the then owners had imported coconut seed from Malaysia and planted around the estate bungalow. Ten of these palms were initially selected (biased selection) on visual characters, but subsequently three palms had been uprooted by the estate. Pollen collection was commenced on 22 May from six *tall* palms and one *dwarf* (dwarf appearance but cross pollinating) and was continued throughout the year. Hybridization was undertaken in June to build up a representative population and also develop selfed progenies and ***D x T*** hybrids from the selected parents. The number of inflorescences emasculated and the number of female flowers pollinated are shown in Table 31.

Table 31. *Total number of inflorescences emasculated, female flowers pollinated and the number of buttons remaining after 3 months at Razeena estate, Akuressa.*

Month	Number of palms emasculated	Number of inflorescences pollinated	Number of buttons pollination	Number of buttons after 3 months of
June	05	05	75	28
July	05	05	63	18
August	07	09	108	39
September	07	07	49	18
October	07	08	58	-
November	07	07	83	-
December	06	07	81	-
Total	07	48	517	103

The number of button nuts of different crosses developing after 3 months of pollination are shown in Table 32. The nuts resulting from pollination would be ready for harvest in late 1992. The open pollinated progenies have been collected regularly and 190 of them have been raised at B/E research nursery. In June, 85 open pollinated progenies from the 8 tall parents and 2 dwarfs were planted in the germplasm conservation block at PRS. (This collection was made at the initial stages, before the 3 parent palms were uprooted by the estate). Results of the fruit component analysis of the selected palms at Razeena estate ('Mahahena' accession) is given in Table 33.

Table 32. *Number of button nuts remaining on the inflorescences after 3 months of pollination at the different crosses in Razeena estate, Akuressa.*

	Male parent						
Female	T-2	T-4	T-5	T-6	T-7	T-8	D-2
T-2	13	-	+	+	08	+	-
T-4	-	13	-	+	+	+	-
T-5	+	-	07	+	06	+	-
T-6	-	-	-	03	-	+	-
T-7	+	-	+	-	24	-	-
T-8	-	+	-	-	+	21	-
D-2	-	+	-	+	03	-	05

\+ Female flowers pollinated in November and December.

Table 33. *Fruit component analysis of palms at Razeena estate (Mahahena), Akuressa.*

Fruit component	Tall		Dwarf	
	Mean	Range	Mean	Range
Fruit weight (g)	1613.8	1297.0 - 1968.0	1055.3	950.0 - 1193.0
Husk weight (g)	674.6	337.0 - 0995.0	-	-
Nut weight (g)	939.1	706.0 - 1135.0	493.0	450.0 - 544.0
Split nut weight (g)	693.0	560.0 - 0843.0	426.0	395.0 - 479.0
Weight of kernel				
wet (g)	440.6	352.0 - 0534.0	264.0	238.0 - 310.0
dry (g)	244.2	207.1 - 0292.2	152.9	123.5 - 188.7
Vol. of nut water (ml)	246.7	146.0 - 0300.0	-	-
Thickness of shell (mm)	4.3	3.4 - 0004.8	-	-
Thickness of kernel (mm)	13.0	8.2 - 0016.4	-	-
Est. copra weight (g)	277.0		170.0	

(sample size: one nut/palm from 8 *tall* palms and three nuts/palm from 1 *dwarf* palm)

Goluwapokuna estate:

Although the palms selected in this estate under the germplasm collection programme (Wickramaratne, 1988) were reported to be introductions from the Philippines, a report of Dr. M A P P Manthiriratne, former Botanist/CRI recorded that they were hybrids between *Sri Lanka Tall* and *Ivory Coast dwarfs*, planted in 1975. *Dwarf* palm pollen had been imported and crossed with selected Tall palms at B/E.

A total of 133 open pollinated progenies were collected from 30 selected hybrid palms and laid at B/E research nursery. Progenies will be further studied in the next few years. It is proposed to use these progenies in a study of segregation in F2. Results of the fruit component analysis of Goluwapokuna hybrids are given in Table 34.

R R A Peries, A A L Perera and M H L Padmasiri

Table 34. *Fruit component analysis of hybrid palms at Goluwapokuna estate, Katunayake.*

Fruit component	Mean	Range
Fruit weight (g)	1802.0	1303.0 - 2280.0
Husk weight (g)	900.1	523.0 - 1310.0
Husk nut weight (g)	902.1	780.0 - 0970.0
Split nut weight (g)	653.3	605.0 - 0692.0
Volume of water (ml)	248.9	218.0 - 0310.0
Thickness of shell (mm)	3.1	1.7 - 0003.7
Thickness of kernel (mm)	13.3	12.7 - 0015.3
Kernel weight		
wet (g)	425.3	395.0 - 0446.0
dry (g)	207.9	160.4 - 0240.9
Estimated copra weight (g)	261.0	

(Sample size; 9 nuts from each of 6 palms)

Twenty nuts were also collected from Margaret estate this year. Seedlings raised were used in November to fill 7 out of 20 vacancies existing in the germplasm conservation block at PRS.

Collection of drought tolerant germplasm

A new collection of 196 nuts from 100 selected palms was made in November from Goyambokka estate, Tangalle. These palms were selected for drought tolerance in 1988, but nut collection was not possible due to the disturbances in the area and staff shortages. Collection will be continued next year for fruit component analysis.

Total of 514 seed nuts comprising 92 from Debarayaya, 222 from Kasagala and 202 from Namalwatta were collected in two visits this year and laid at the B/E research nursery. These will be used mainly for infilling in the germplasm collections.

PROJECT 6: PRODUCTION OF HIGH QUALITY SEEDS AND SEEDLINGS

3. MISCELLANEOUS RESEARCH

3.1 *Improvement of nursery techniques*

Interaction of source of seednuts/nursery site: The experiment was successfully completed and results submitted for publication.

R R A Peries and J M D T Everard

An alternative to top soil in raising of coconut seedlings in polybags

The experiment was successfully completed and results submitted for publications.

R R A Peries and J M D T Everard

Water use and water use efficiency in putative drought resistant tall palms in the isolated seed garden at Ambakelle

Seed nuts in adequate quantity could not be collected during the year due to the selected palm being severely affected by drought in 1990. The experiment was therefore postponed to 1992.

R R A Peries and J M D T Everard

Germination of husked seed coconuts under low light intensity in a humid environment

Preliminary observations indicated that under high relative humidity, dehusked seed nuts showed a higher level of germination than when laid in the open. The experiment will be repeated with some modifications in 1992/93.

R R A Peries and J M D T Everard

A new experiment was commenced during the year in order to upgrade nursery techniques and standardize nursery practices.

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

Experiment, (cf. Annual Report 1990) where river sand was used as an alternative to top soil revealed that river sand was a successful alternative to top soil, but the rate of seedling development was lower than in top soil containing potting media probably due to poor nutrition. The current trial was established at B/E research nursery to evaluate the germination and early growth of coconut seedlings raised in pure river sand or in different mixture of river sand, coir dust, and cowdung with or without fertilizer application in order to find the best and most economic potting mixture. Six different potting mixtures (combination of top soil, cowdung, coir dust and river sand) with and without fertilizer were tested in a completely randomized design with 25 replicates.

Fertilizer is applied at the rate of 70 g per seedling from a mixture containing 3 parts of Ammonium sulphate, 1 part of concentrated super phosphate, 2 parts of Muriate of potash and 1 part of Keiserite in four split applications and growth measurements are recorded at monthly intervals. The experiment is making satisfactory progress.

A A L Perera, R R A Peries and R Jayatilaka

3.2 *Variety Evaluation trials*

Evaluation of the performance of *tall x tall, dwarf x tall* and *Moorock tall* in dry zone, Minneriya (1983)

This trial was maintained by the estate. Arrangements were being made to collect yield data and carry out studies on fruit component analysis begining from the first pick of 1992.

Evaluation of performance of *tall x tall, dwarf x tall, San Ramon* and *dwarf x San Ramon* at Dambuwa Mukalana, Demonstration Farm (DIZ) Thabbowa, Naththandiya. (1991).

Collection of data on yield and fruit component analysis were commenced this year from 16 ***tall x tall***, 16 ***dwarf green***, 14 ***San Ramon*** and 14 ***dwarf x San ramon*** palms planted in October 1981 by the Agronomy division. Four nuts per palm were used in fruit component studies from 4 picks. Yield data were collected from all picks during the year. Summary of collected data is as given in Table 35.

Table 35. *A comparison of fruit components of **tall x tall; dwarf x tall, dwarf x San Ramon** and **San Ramon** at Dambuwa Mukalana demonstration farm, Nattandiya 1991.*

Variety	Mean nut yield/ palm	Mean fruit wt. (g)	Mean husked nut wt.(g)	Mean split nut wt. (g)	Mean kernel wt. (g)	Estimated copra g/nut
SR	57.0	2302.8	1248.0	845.7	543.9	338.3
D x SR	70.2	1747.3	830.2	594.6	390.6	237.8
D x T	75.4	1616.7	900.1	617.0	406.5	246.8
T x T	97.7	1417.9	689.7	509.9	334.4	204.0

4. SEED GARDENS

4.1 THE ISOLATED SEED GARDEN AT AMBAKELLE

4.1.1 Rainfall: The amount and distribution of rainfall for 1991 is shown in Table 36 along with the values for the previous year and the 10 year average (1982-1991). The total rainfall for the year (1379 mm) was 199 mm higher than that of the previous year and generally much better distributed, except the month of February which had zero rainfall and the period July to September, when there was little effective rain. The soil storage from the May/June rains were apparently adequate to prevent any water deficit in the palms during the rain-free months. The total rainfall was also very similar to the 10 year mean value (1338 mm).

Table 36. *The amount and distribution of rainfall for 1990 and 1991 and the 10 year average (1982-1991) for comparison at ISG.*

Month	1990			1991			10 year average (1982-1991)		
	A	B	C	A	B	C	A	B	C
January	221.6	5	5	44.0	5	5	52.66	4.1	4.1
February	0.0	0	0	0.0	0	0	54.56	3.3	3.1
March	34.0	5	5	116.0	9	9	88.61	5.5	5.3
April	38.8	5	5	147.9	10	10	178.36	9.1	8.5
May	145.6	9	9	182.5	8	8	149.54	9.2	8.6
June	8.4	1	1	236.5	17	17	91.31	11.1	10.5
July	67.7	10	10	29.2	6	6	46.25	6.2	5.3
August	0	0	0	17.1	2	2	35.85	4.2	4.0
September	9.5	1	1	25.8	4	4	104.68	9.1	8.4
October	288.6	17	17	221.6	21	21	209.3	14.9	14.4
November	306.7	14	14	208.1	11	11	233.53	13.5	13.0
December	59.2	8	8	151.5	8	8	93.76	7.4	7.3
Total	1180.1	75	75	1380.2	101	101	1338.41	97.6	92.5

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

Table 37. *Total nut yields at ISG from the six picks of the year.*

Pick	1990	1991	Ten year average (1982- 1991)
01	92177	61012	109218
02	81224	74737	147754
03	98105	70664	162292
04	49882	65056	148451
05	63324	51474	141813
06	73421	71007	110650
Total	458133	393950	820178
Number of bearing palms	11517	12868	
number of nuts/palm	40	31	

Table 38. *Nut yields from the tall and dwarf palms at ISG during the year.*

A: Tall Crop

Pick	1990	1991	Five year average (1987- 1991)
01	72768	57546	82170
02	66632	69339	95583
03	86346	54274	101684
04	46069	51973	83243
05	60090	40754	88357
06	70620	51771	85813
Total	402525	325657	536850
Number of palms in bearing	8616*	10133	
Number of nuts/palm	47	32	

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

B: Dwarf (D x T) Crop

Pick	1990	1991	Five year average (1987- 1991)
01	19409	3466	20452
02	14592	5398	27753
03	11759	16390	25633
04	3813	13083	18308
05	3234	10720	22872
06	2801	19236	17690
Total	55608	68293	132708
Number of palms in bearing	2901	2735	
Number of nuts/palm	19	25	

Table 39. Classification of palms at ISG

Field no.	TALL							DWARF														
								Dwarf green							Dwarf yellow							
	B	PB	YP	S	D	V	Total planting points	B	PB	YP	S	D	V	Total planting points	B	PB	YP	S	D	V	Total planting points	Total for field
01	244	31	35	17	03	17	347															347
02	243	07	18	125	07	16	416															416
03	254	-	13	38	20	16	341															341
04	1825	20	102	-	46	569	2562															2562
05 Old)								07						07								07
05 New)	307	44	35	75	05	29	495	167	08	03	-	02	74	254								749
06	830			33	20	529	1412															1412
07	620				15	781	1416															1416
08 A	274			10	04	135	373															373
08 B	379				09	194	582															582
08 C	259				02	350	611															611
09	611	03	158	55	18	08	853	240	278	116	50	19	241	944								1797
10A	170		02	182	09	07	370	81	-	03	47	05	18	154	831	02	14	322	09	335	1513	2037
10B	123			184	05	27	339	294	08	12	142	07	287	750	308	13	06		01	165	493	1582
11A Old)	201			37	07		245															245
11A New)	204	127	1111	415		62	1919															1919
11B Old)	212	04		42	11		269															269
11B New)	248	218	1089	250		55	1860															1860
12 Old)	148	02		46	06		202															202
12 New)	720	403	280	79		34	1516															1516
13 Old)	195			113	07		316															315
13 New)	1840	137	350	65	14	75	2481															2481
14	276	06	02		23	155	462	807				06	1833	2646								3108
Total	10133	1002	3195	1766	231	3041	19386	1596	294	134	239	39	2453	4755	1139	15	20	322	10	500	2006	26147

4.1.2 Nut yields: Total crop figures for 1990 and 1991 are shown in Table 37 with the 10 year average (1982-1991). As a result of the poor rainfall distribution experienced in early 1990, the downward trend in the crop continued and was only 85% of the 1990 crop and only 48% of the past 10 year average.

The nut yields of *Talls* and *Dwarfs* are shown separately in Table 38. The average number of nuts per tall palm further decreased from 47 to 32 and was the lowest recorded in the last 10 years. There was an actual increase in the total as well as per palm yield in D x *T* (19 to 25). This was probably the result of an improved rainfall distribution during the latter part of 1990.

In the ***talls*** the total crop at each pick was lower than in 1991 except the 4 th pick which showed a slight (12.8%) improvement. However in the dwarfs the crops showed an increase from the third pick onwards. There was no particular pattern in which crops reached a peak between picks or between years. The classification of palms (census) as at 31 December is shown in Table 39.

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

Details of the emasculation programme are shown in Table 40. A total of 3156 *dwarf* palms comprising 1981 *dwarf green* and 1175 *dwarf yellow* forms were emasculated during the year.

Table 40. *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	173	-	1982	-	42311	-
09	615	-	4914	-	86167	-
10A	86	846	1291	13372	20285	307401
10B	299	329	4526	5091	112083	117349
14	808	-	14066	-	258218	-
Total	1981	1175	26779	18463	519064	424750

4.1.4 Controlled pollination:

Tall: A total of 545 inflorescences in 45 palms in field no. 3 were pollinated (16,515 buttons) with pollen from fields 1 and 2 (selected pollen parents). At the end of September 4103 nuts were developing on the bunches resulting from these pollination done between January and November. Due to lack of pollinators, no pollination could be done in field no. 3 in December.

Dwarfs: Selfing was continued on 5 ***dwarf palms*** (3339, 3569, 3677, 3714 and 3715) that survived the recurrent droughts and those used as parents of the mini seed garden. Selfing was done mainly to raise seedlings to infill the vacancies in the mini seed garden (Field no. 5). A total of 209 nuts were developing at the end of the year from selfing done between February and July.

Table 41. *Crossing schedule for green dwarfs in field no. 5 of ISG with pollen from Mahahena (Akuressa)*

Male	T-2	T-4	T-5	T-6	T-7	T-8
Female						
3339	07	09	-	-	-	-
3569	05	13	x	07	x	x
3677	06	04	05	07	x	x
3714	x	04	x	x	x	-
3715	04	05	x	01	x	-

x Pollinated in December

From July the same dwarf palm were pollinated with pollen from 'Mahahena' (see section 5.5.6.2d) to produce a **D x T** hybrid. The crossing schedule and the number of developing nuts is shown in Table 41. A total of 77 button nuts were developing from these crosses as at end December.

R R A Peries, M H L Padmasiri, W B S Fernando and J D J Abeysekara

4.2 MAKANDURA SEED GARDEN

Beginning in March a programme was undertaken to systematically rogue the poor palms in the Makandura Seed Garden (MSG). Late bearers and weaklings could act as pollen contaminants and this programme was directed at arresting this problem.

Lack of proper records from planting to date, made the operation very difficult. A new system of record keeping was introduced. All the fields and guard rows at MSG were studied. A report on the palms to be uprooted/replaced was submitted to the Estates Management Division.

R R A Peries and J M D T Everard

5. SEED PRODUCTION

The seed production unit which functioned within the division was transferred to the Coconut Cultivation Board in January. The decision to do so was the outcome of a report, submitted by a committee comprising of CCB and CRI officials. As per the recommendations of this committee, plus palm selection/re-selection remain the responsibility of the CRI. Pick supervision and seed nut selection up to delivery of seed to the nurseries becomes the responsibility of the CCB.

During the year no requests were made to CRI to assist in palm selection or re-selection work.

R R A Peries

6. POLLEN AND POLLINATION

6.1 Pollen collection and issue

Details of pollen collection and issues are shown in Table 42. Pollen of the **typica** variety was collected during the year from 23 inflorescences from 15 selected palms in field 1 and 2 and 2 inflorescences from 16 selected palms in field 4 of the ISG. A total of 370 ampoules of unadulterated pollen were sealed. Pollen from palms on field 1 and 2 were mixed together, adulterated with lycopodium and resealed. A total of 150 such ampoules were produced during the year.

Pollen of the *typica* variety was collected from 15 inflorescences from 6 selected palms from Razeena estate, Akuressa ('Mahahena') and 623 of such ampoules of pollen were sealed. Pollen of the form ***pumilla*** from Akuressa ('Mahahena') was collected from 1 inflorescence from 1 selected palm, and 35 ampoules of pollen were sealed. Small quantities of pollen were sealed in ampoules in this instance to avoid the wastage of pollen.

Pollen from the form ***pumilla*** from ISG was collected during the year from 17 inflorescences in 5 selected palms on field 5 (old plantation) and 144 ampoules of pollen were sealed. Pollen from local forms of ***typica*** on the Variety block (field no. 9) at B/E was collected from 6 inflorescences in 2 palms, and 39 ampoules of pollen were sealed.

Table 42. *Pollen collection and Issue during the year.*

	No. of ampoules						
	typica			nana			
	ISG Tall (Mahahena)	Variety palms (B/E)	San Ramon (B/E)	DG (Mahahena)	DG (ISG)	BGD (B/E)	
Carried over from 1990							
Pollen from individual palms	175	-	-	37	-	-	22
Mixed pollen adulterated with lycopodium	33	-	-	-	-	-	-
Sealed in 1991							
Pollen from individual palms	370	623	39	-	35	144	30
Mixed pollen adulterated with lycopodium	150	-	-	-	-	-	-
Issued for pollination programmes							
Pollen from individual palms							
1. At ISG	271	101	-	-	-	88	-
2. At Akuressa	-	79	-	-	10	-	-
3. At BE	-	-	10	-	-	-	21
Issued to estates (at Rs.10/= per ampoule)							
Mixed pollen adulterated with lycopodium	150	-	-	-	-	-	-
Other uses							
(Viability tests, demonstrations, breakages etc.)							
Pollen from individual palms	25	18	-	-	-	14	-
No viability /Low viability							
Pollen from individual palms	-	-	-	37	-	-	-
Balance as at 31 December 1991							
Pollen from individual palms	249	425	29	-	25	42	31
Mixed pollen adulterated with lycopodium	33	-	-	-	-	-	-

DG, Green dwarf; BGD, Brazillian green dwarf;

Pollen of the Brazilian green dwarf was collected from 5 inflorescences in 5 palms. A total of 30 ampoules were sealed.

A total of 150 ampoules of ***typica*** pollen were issued to Palugaswewa and Daisy Valley estates of the JEDB at Rs. 10.00 per ampoule.

W B S Fernando

Table 43. *Seednuts laid in the Bandirippuwa nursery during the year.*

Variety	Source	Number of seednuts In beds	In Polybags	Total
San Ramon x San Ramon	Field no. 16 B/E	43	91	134
Camroon Red Dwarf	Old nursery B/E	-	165	165
Brazeelian Greedn Dwarf	Old nursery B/E	-	11	11
Ambakelle Special	ISG	1289	-	1289
Germplasm Collections				
Kasaga;a	Kasagala	222	-	222
Debarayaya	Debarayaya	92	-	92
Margaret	Pallama	20	-	20
Wellawa	Mudunawatta	33	-	33
Moorock	Moorock	127	-	127
Clovis (Piyadasa)	Uhumiya	32	-	32
(Ilankoon)	"	18	-	18
(Jayasekera)	"	15	-	15
(Sausiri)	"	42	-	42
Palugaswewa	Palugaswewa	110	-	110
Kundasale (DG)	Kundasale	144	-	144
(DY)	"	82	-	82
(DR)	"	83	-	83
Akuressa	Razeena estate	134	-	134
Pitiyakande	Mawathagama	56	-	56
Goluwapokuna	Goluwapokuna	133	-	133
Namalwatta	Dedigama	202	-	202
Goyambokka	Goyambokka estate	193	-	193
Dwarf Russette	Kirimetiyana temple	-	07	07
Dwarf Russette	Madampe	-	05	05
St. Annes	Mampuri	34	-	34
Experimental				
Ambakelle T x T	ISG	1000	-	1000
	Total	4104	279	4383

Table 44. *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	30	17	25	-	10	-	1009	75	1166
D x T	-	-	-	-	-	-	36	-	36
T x T (HP)	-	-	-	-	-	-	564	-	564
T (OP)	-	-	-	-	-	-	45	-	45
T x DY	-	-	18	-	-	-	-	-	18
Mahayaya	-	-	-	-	-	-	198	-	198
SR x SR	14	-	20	-	-	10	201	15	260
DG	26	-	22	-	-	-	-	-	48
DY	40	-	-	-	-	-	-	-	40
DR	08	-	-	-	-	-	-	-	08
DY x DG	07	-	-	-	-	-	-	-	07
Camroon Red Dwarf	-	04	-	-	-	-	-	-	04
Brazilian Green Dwarf	-	02	-	-	-	-	-	-	02
Pora pol	02	16	-	-	-	-	-	-	18
Gon thembili	16	-	10	-	-	-	-	-	26
Ran thembili	04	-	-	-	-	-	-	-	04
Navasi	15	-	-	-	-	-	05	-	20
Akuressa	85	-	-	-	-	-	-	-	85
Moorock tall	05	-	-	-	-	-	239	-	244
Dehigahalande	-	-	-	-	-	-	224	224	
Maragaret	-	07	03	-	-	-	-	-	10
Sausiri	-	05	-	-	-	-	-	-	05
St. Anne's	-	09	-	-	-	-	-	-	09
Variety nuts	-	-	-	-	-	-	291	47	338
Total	252	60	98	-	10	10	2812	137	3379

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

Table 45. *Availability of planting material at Bandirippuwa Research Nursery as at 31 December*

Variety	Seedlings over 5 months in age		
	In seedbeds	In polybags	Total
T x T	-	763	763
Kasagala	-	27	27
Debarayaya	-	65	65
Margaret	-	04	04
Wellawa	-	19	19
Moorock	-	17	17
Piyadasa	-	21	21
Ilankoon	-	02	02
Jayasekera	-	02	02
Sausiri	-	22	22
Palugaswewa	-	09	09
Kundasale DG	-	57	57
DY	-	52	52
DR	-	30	30
Akuressa	-	69	69
Pitiyakande	-	03	03
St. Annes	-	33	33
Ambakelle Special	(408)	201	201
	(465)	*239	*239
San Ramon (B/E)	39	74	113
Camaroon Red Dwarf	-	62	62
Brazelian Green Dwarf	-	03	03
Total	39	1774	1813

7. RESEARCH NURSERY

7.1 Bandirippuwa Research Nursery

Tables 43, 44 and 45 summarizes 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 in the B/E and PRS germplasm fields.

R R A Peries,A A L Perera,H S G Kularatne and R Jayatilaka

12. ACKNOWLEDGEMENTS

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

REPORT OF THE SOILS AND PLANT NUTRITION DIVISION

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

1. GENERAL

Eleven field experiments and nine laboratory/glasshouse studies on nutritional, soil physical, and water use aspects of coconut were conducted satisfactorily. New experiments were commenced on the water balance studies of coconut plantations. Nutrient Mapping studies confirmed that about 60% of the coconut plantations are deficient in potassium (K) and magnesium (Mg) nutrients and the growers have responded to the CRI recommendations by increased use of dolomite in the coconut plantations. Use of Eppawala Rock Phosphate has saved about Rs 7 million of foreign exchange during the year. Sulphur (S) and chlorine (Cl) deficiency was also observed, for the first time, in few plantations and the relevant fertilizer recommendations were given.

1.1 Innovations

The "Coconut Climber" developed by Mr K S Jayasekara and Mr D P Panditharatne with the assistance of Technic Industries, Dehiwala was manufactured and field tests were carried out satisfactorily. Refinements are in progress. Funds for the project was provided by the Agricultural Research Projects-CARP.

Messers K S Jayasekara, D P Panditharatne, and E M T Banda, developed and introduced a new field implement named "Mulch Rake" to efficiently remove and replace the different mulching materials during the application of fertilizers in coconut plantations. Mulch Rake reduces the cost of fertilizer application by about 30% with labour saving of about 50% (Jayasekara, Panditharatne, Banda, 1991).

Messers K S Jayasekara and D P Panditharatne developed a low cost and easy to clean new dripper named "Screw Dripper" which could be adjusted to give different dripping rates to be used in coconut drip irrigation systems (details in Section 24.3).

1.2 Other Activities

Miss M B M N Dias supervised the final year research project of Mr I Wickramananda from Faculty of Agriculture, University of Peradeniya, Peradeniya.

2. LABORATORY AND GLASSHOUSE STUDIES

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

Simulated rainfall of 800 mm resulted in leaching of about 30% of nitrogen and 80% potassium in goat dung and cow dung packed in PVC pipes of 0.5 m long with an internal diameter of 7 cm. Results show that animal dungs should not be exposed to rainfall leaching to obtained the full nutritional benefits.

When cow/goat dung were mixed with top 0-20 cm layer of sandy soil at the rate of 30 kg/10 m2 (ie: recommended rate for a coconut palm), about 40% of K and Mg from the applied chemical fertilizers were found to be leached below the 1.5 m depth after a simulated rainfall of 800 mm.

Results show the benefits of cow/goat dung to reduce the leaching losses of K and Mg, specially in sandy soils, which have practical implications. A series of perforated PVC pipes were buried at different distances away from the coconut palm at 1.5 m depth in a deep sandy soil at Bandirippuwa Estate, Lunuwila. Field studies are in progress to monitor the leaching losses of nutrients during the monsoonal rains.

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

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

Five most common weeds were planted in 5 l plastic pots (30 cm diameter, 30 cm deep) filled with sandy loam soil. Weeds were allowed to establish in pots. Several soil-plant-water parameters were measured.

Studies were delayed due to poor and non-uniform establishment of weeds after they were transplanted in pots. Studies are in progress.

K S Jayasekara, E M A T Banda, and G D George

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).

Infiltration rate, water storage capacity, bulk density, particle size analysis, and the physical status of coir dust were measured to study the changes occured 6-8 years after the application of coir dust to soil. Detailed analysis of data is in progress.

K S Jayasekara and 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. The relevant palms were fertilized with "Adult Coconut" (0-6-32-5) mixture at the rate of 4.5 kg/palm in August and urea (1.0 kg/palm) in November. Due to the breakdown of the neutron probe, soil water levels could not be monitored regularly.

K S Jayasekara and 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).

Monitoring of the rainfall interception by the coconut palms was continued during the year. Chemical analysis showed that canopy drippings and stem flow contain high levels of nitrogen and potassium nutrients. Figure 1 shows the amount of rain water reached to the soil surface at different distances away from a coconut palm in the study during a rainfall of 69 mm in 11 hours. Data show that stem flow in coconut is high and canopy drippings are concentrated at about 2 m distance from the base (ie: edge of the canopy). The study indicates the possible benefits of having a basin at the base or a bund to collect/catch the canopy drippings into the manure circle area. The edge of the basin/bund has to be out side of the canopy edge. Studies are in progress on practical field aspects of the water harvesting/collecting/storage in the coconut root rhizosphere.

Run-off water was collected to monitor the soil erosion and nutrient losses in a sloping land planted with young coconut. The experiments are in progress.

E M A T Banda, U S S Perera, K S Jayasekara and 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 the growth and yield of coconut (CRIC 65). Bandirippuwa Estate, Lunuwila (1984).

The Experiment was terminated on March 1990. Effect of chemical fertilizers and goat manure on the yield parameters at the time of termination are given in Table 1.

Table 1. *Effect of chemical fertilizers (CU1) and goat manure (GM) on yield parameters of coconut*

Parameter	Rate of fertilizer (kg/palm/y) CU 1 (4.5)	CU1 + GM (4.5 + 20)	% LSD increase	5%
No of nut/palm/y	35.6	45.9	28.99.8	
Wt. of Copra/palm/y(kg)	7.1	9.5	33.81.8	
No of nut/bunch	4.3	5.1	18.60.7	
Total F Flowers/palm	137.8	154.5	12.114.3	

M B M N Dias

Experiment 7.6 Levels of organic manure (goat dung) supplemented with inorganic on the yield of coconut.

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

The experiment was terminated in March after collecting the soil and leaf samples. Results are being analyzed.

Miss 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 (DFR) computermodel that was developed and modified during 1988-1990 period was further refined into two computer models depending on the economic levels to cater for (1) small-holders and (2) large coconut estates. The main difference between the two DFR computer models is that the model for small-holders consist of low external input of N and K fertilizers because of the greater recycling of N and K nutrients in the small-holdings and home gardens.

The DFR service was provided to 98 large coconut estates (> 50 ac) covering an area of about 8198 acres. A total of 323 leaf (14th) samples were collected from those coconut estates and analyzed for relevant nutrients. The status of N, P, K, Mg, Ca, Na, Cl, S, B, Fe, and Mn in these estates are given in Fig. 2-12. Data show that nearly 56% of the palms in those estates have adequate or excess levels of leaf nitrogen (N), while about 84% of the palms have adequate or excess levels of leaf phosphorus (P). However, about 60% of the palms were deficient in both potassium (K) and magnesium (Mg). Data on the chlorine (Cl) and sulphur (S) show that about 15% of the palms have low levels, requiring corrective measures. Boron (B) was not found to be deficient in any of the estates.

It is important to note that about 50% of the palms under the study have low levels of leaf Ca. Hence it is necessary to be precautious about the status of S and Ca in coconut and to give the relevant fertilizer recommendations to avoid the possible nutrient imbalances and adverse affects on the yield.

Under the DFR package, several high yielding coconut estates were advised for the first time to apply gypsum, ammonium sulphate, Agricultural salt, etc. as a preventive measure against possible deficiencies of S, Ca, and Cl.

Both DFR programme and the "Adult Coconut" (0-6-32-5)--organic/urea fertilizer package have helped to arrest and overcome the widespread Mg-deficiency that was prevailed in coconut plantations. This was reflected in the high use of dolomite in coconut (ie: 465 mt of dolomite in 1988, 885 mt in 1990, and ~1400 mt in 1991). Kieserite usage in coconut was reduced from 587 mt in 1989 to 240 mt in 1991.

Data from the DFR Programme are being used in the "Nutrient Mapping" Experiment 7.13.

K S Jayasekara

(b) FAO Fertilizer Project

Three tri-partite (FAO-CCB-CRI) meetings were held to review and monitor the progress of the project. Analysis of data showed that leaf K and Mg levels in certain plots were low. Further, in certain plots there was no significant yield response to the applied general fertilizer mixture. Hence based on the leaf/soil nutrient and yield responses at these plots, a modified DFR computer model for the small-holdings was used to determine the relevant fertilizer mixture/requirement which is more efficient and cost effective.

The objective is to provide the Location Specific-General Fertilizer Recommendations (LS-GFR) for the small-holder sector in regional/district/zonal basis which is efficient than the one mixture recommended for the whole country under the present General Fertilizer Recommendation (GFR). Hence following modifications were introduced into the existing programme to verify the LS-GFR.

1. Verification treatment of the LS-GFR was implemented in the T3 plot (ie: Green palms), if organic manure have not been applied previously. If Green palms were applied with organic manure, then another representative ten palms were selected, adjacent to the existing palms in the same land, keeping a single guard row, to introduce the LS-GFR "verification treatment".

2. The relevant fertilizer rate in the LS-GFR was implemented, only to the palms in the verification treatment which was based on the DFR computer model refined for the small-holder sector considering the previous yield and leaf nutrient responses, economics, management simplicity, etc..

3. Two fertilizer application techniques also will be tested for the ten palms in the verification treatment sa follows:

3.1 Five palms: broadcast the fertilizer within 1.75 m radius, turn soil with a mammoty, and mulch.

3.2 Five palms: apply fertilizer into four equally spaced pits cut 1 m away from the base. Pit dimension is 0.3 m x 0.3 m x 0.15 m (ie: 1'x1'x 6" deep). After placing the fertilizer in the pits, cover it with small amount of soil keeping the depression as it is.

4. The ten red coloured (ie: T1) palms will still be the control palms which will not receive any fertilizer.

5. The ten yellow coloured (ie: T2) palms were applied according to the present General Fertilizer Recommendation ie: 3 kg of "Adult Coconut" (0-6-32-5)

with 0.8 kg of Urea per palm per year. On sloping lands where run-off takes place, fertilizer was applied in half circle trenches cut on the upper side of the slope.

Leaf/soil analytical and yield data collected over the years were entered into a computer data base. Results are being analyzed to prepare a detail report on the project. Part of the report is already completed and it is expected to submit the final report to the FAO in March 1992.

K S Jayasekara

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

Soil and leaf sampling and differential application of fertilizer were completed in July.

Bimonthly yield records from April, covering five harvests, were maintained.

M Jeganathan

Experiment 7.12.1 Effect of green manure on the nitrogen status of coconut palms. Ratmalagara Estate, Madampe (1988).

Leaf (14th) and soil samples were collected from 30 randomly selected palms from the Expt 7.12.1 at the end of November 1990. Soils from 3 different distances (0.9, 1.8, 3.6 m) from the base of the selected palms at 4 different depths (0-15, 15-30, 30-45, 45-60 cm) were also collected.

Table 2 show the average nitrogen concentration in soil for different green manure treatments. The nitrogen concentration in treatments with glyricidia (G, P+G) showed significantly very high levels of nitrogen over the urea treatment (control). The Pueraria treatment (P) showed no difference over the control.

Nitrogen concentration in the soil at different depths and distances in each green manure treatment is shown in Table 3. The nitrogen concentration in the soil of all the treatments, gradually declined with the depth as well as with the distance. The control treatment where nitrogen had been applied as urea showed the lowest concentration at the manure circle (ie: distance 0.9 m). Yet there is no difference between the control and the Pueraria treatments in both, the boarder line of the manure circle (ie: distance 1.8 m) and the centre of square (ie: distance 3.9 m). However, the treatments G and G+P gave high nitrogen concentration in the top

soil (0-15 cm) which gradually decreased with depth (Table 3). Like wise, the nitrogen concentration in all the treatments decreased as the distance from the base of the palm increases. It is only in glyricidia treatments (G, P+G) that showed high nitrogen concentration even in the centre of squares (ie: distance 3.6 m) at different depths after 12 months of green manure application.

Table 2. *Average nitrogen concentration (ppm) in soil for different manurial treatments*

Treatment	Nitrogen concentration (kg/ha)
Control	176.4
Glyricidia (G)	339.6
Pueraria (P)	177.9
P+G	336.4
LSD (P = 0.05)	28.29

Leaf nitrogen concentration in the 14th leaf is given in Table 4. There is no significant difference between different green manure treatments on the leaf nitrogen concentration. All treatments showed nitrogen concentrations within the suggested sufficiency levels (1.8 - 2.0% N) for the same lateritic gravelly soils at Ratmalagara Estate, Madampe by Loganathan and Balakrishnamurti (1975).

Table 4. *Average nitrogen concentration in leaf for different manurial treatments*

Treatment	Nitrogen concentration (%)
Control	1.8
Glyricidia (G)	1.8
Pueraria (P)	1.9
P+G	1.9
LSD (P = 0.05)	0.20

Table 3. *Average nitrogen concentration in soil (ppm) at different depths and distances according to treatments*

Treatment	Depths (cm)	Distances (m) 0.9	1.8	3.6
Control	0-15	219	209	193
	15-30	157	192	164
	30-45	142	148	164
Glyricidia (G)	0-15	514	352	296
	15-30	372	324	293
	30-45	347	281	287
Pueraria (P)	0-15	246	188	189
	15-30	203	164	161
	30-45	157	156	137
P+G	0-15	452	373	202
	15-30	350	292	219
	30-45	339	289	211

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

The data collected from the Expt. 7.7 under the DFR programme was partly entered into the computer data base.

Preliminary analysis of data show low levels of leaf P in estates with sandy soils and lateritic soils, eventhough those estates were fertilized regularly with saphosphosphate. Results indicate the necessity to use a more soluble form of P-fertilizers (ie: Triple Super Phosphate as in CU3) for the sandy soils, specially in dry zone, and research is in progress on these aspects.

K S Jayasekara

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

The objective of the experiment is to determine the growth and yield response curves of the coconut seedlings to the application of inorganic NKMg fertilizers for assessing the optimum levels of fertilizer application under the soil and climatic conditions represented at Ratmalagara Estate, Madampe.

The experimental lay out consists of a 3x3x3 factorial design where second order interactions are confounded with those of blocks. There are 3 blocks of 9 plots each, each plot having 6 palms. Treatment levels are 0, 0.75, 1.5 kg/palm/y of n, K2O, and MgO applied at 6 monthly intervals.

The experiment covers an area of about 5 ha of lateritic gravelly soil. The old coconut palms were removed at the ground level in January. In May, TxT coconut seedlings from Ambakelle Seed Garden were planted in 3'x3'x3' holes in the centre of squares of the old coconut stand ie: to minimize the effects of previous fertilizations. The seedlings were given a basal dose of 250 g of YPM (13-12-17) at the time of planting. The first differential manuring will be done in mid 1992.

M B M N Dias

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

The objective of the experiment is to determine the growth and development of coconut seedlings to the application of different sources of inorganic P-fertilizers tested at four different levels. The optimum level and the most suitable source of P-fertilizer will then be assessed under the soil and climatic conditions represented at Ratmalagara Estate, Madampe.

The experimental lay out consists of a CRB design with four levels (0, 0.25, 0.5, 1.0 kg P2O5/palm/y at 6 monthly intervals) and 3 sources of P (Triple Superphosphate, Saphosphosphate and Eppawala Rock Phosphate) replicated 3 times. There are 3 blocks of 10 plots each, with each plot having 6 palms.

The experiment covers an area of about 2 ha of lateritic gravelly soil. The establishment of seedlings was done as in Expt 7.15.2. The first differential P-manuring will be done in 1992, with NKMg (2-0-2-1) fertilizer mixture as the basal dressing with rates similar to that of YPM.

M B M N Dias

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 NLDB Farm, Marandawila (1987).

Yield records were maintained. Dripping tubes were found to be damaged by animals as they were lying on the soil surface. Hence the tubes were buried (ie: 10 cm deep) and the manure circle areas were covered to reduce the surface soil evaporation. However, the irrigation treatments could not be imposed as scheduled due to the lack of sufficient water available in the existing wells.

L P Vidhana Arachchi and 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 imposed and palms were fertilized with YPM (13-12-17) fertilizer mixture at the rate of 1.5 kg/seedling in May and in November, and 1 kg of dolomite per seedling in May. Several growth parameters (ie: leaf number, palm height) and leaf nutrient levels were measured. Soil and leaf water status were monitored using the neutron probe and pressure bomb apparatus, respectively. Photosynthesis rate was also monitored using LI-COR 6200 photosynthesis meter. Growth of palms have shown a marked response to the differential irrigation treatments. The trial is in progress.

K S Jayasekara, C Jayasekara, and D P Panditharatne

PROJECT 26: STUDIES ON WATER RELATIONS OF COCONUT AND INTERCROPS

Experiment 26.1 Water balance studies of coconut. Bandirippuwa Estate, Lunuwila (1990).

The objective of the experiment is to study the water use of coconut under a deep sandy loam soil in the intermediate rainfall zone. Aluminum access tubes (2 m long) were installed at different distances (ie: 0.5 m intervals) away from the coconut palms along the rows and diagonal lines in the square of four coconut palms (40 y; 7.5m x 7.5m square planting). Preliminary results are given in the Table 5. Results show that with the on-set of dry period, root water uptake was initially confined to top 0-50 cm layer of soil. After two weeks, roots extract water mainly from soil layers below 1 m depth in deep sandy loam soils.

Table 5. *Soil water content (mm) at 1 m away from a coconut palm at different days after a monsoonal rain (Adult coconut palm; 40 y, 35 fronds, deep sandy loam soil, Average pan evaporation 4 mm/d)*

Depth (cm)	Soil Water Content (mm) at days after rain					
	0 Day	7 Day	14 Day	21 Day	28 Day	34 Day
20	36	31	26	24	19	19
40	35	30	28	23	19	19
60	35	30	28	23	19	19
80	29	27	26	22	21	19
100	27	26	26	26	24	20
120	28	27	25	26	22	23
140	33	30	30	29	25	25
160	33	32	32	32	28	29
180	39	37	37	36	31	31

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

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

Conductivity of water under different suction for different plant components were measured. Studies are in progress to relate water conductivity of plant segments with their vascular systems. Primary roots have shown a high axial root water conductance than the secondary and tertiary roots due to large xylem vessels. Studies on the resistance to water flow and the vascular system have indicated the possible benefits of the application of fertilizers to the axils of the leaves in the young and adult coconut. Hence a separate trial was initiated on the "Axil Feeding" of fertilizers in coconut as given in Section 4.8.

Table 6 provides the amount of nutrient fixed/removed by mature fronds at different ages of the coconut palm.

Note the high levels of Cl in the basal portion of the stalk (ie: petiole base) of the frond. Data indicate the necessity to study the nutrient translocation and source-sink relationship in coconut palm. These data were used in the DFR computer model to quantify the nutrient recycling rate under different management practices which involves mulching of whole frond, leaflets, lamina portion after removing ekels, etc..

Table 6. *Nutrient levels and biomass in different components of a mature coconut frond.*

Age of palm	Palm component	Dry mass (g)	N %	P %	K %	Mg %	Ca %	S %	B ppm
1 y	Lamina	28	1.2	0.06	1.6	0.26	0.39	0.16	13
	Ekel	8	0.8	0.05	1.4	0.21	0.32	0.13	7
	Stalk (mid+tip, 1.5m)	8	0.4	0.05	2.2	0.20	0.47	0.22	10
	Base stalk (0.6m)	31	0.5	0.05	2.0	0.18	0.81	0.13	15
3 y	Lamina	229	1.8	0.10	1.8	0.35	0.67	0.20	15
	Ekel	66	0.8	0.08	0.8	0.18	0.20	0.12	10
	Stalk (mid+tip, 1.5m)	79	0.6	0.06	1.8	0.19	0.90	0.24	9
	Base stalk (0.6m)	278	0.6	0.05	2.0	0.20	1.35	0.10	12
4 y	Lamina	562	1.9	0.05	1.9	0.32	0.75	0.18	15
	Ekel	168	0.8	0.08	1.0	0.15	0.15	0.16	9
	Stalk (tip, 1.5m)	73	0.5	0.12	1.5	0.19	0.69	0.21	11
	Stalk (mid,1.5m)	229	0.5	0.06	1.5	0.19	0.36	0.23	11
	Base stalk (0.6m)	669	0.6	0.05	1.8	0.16	1.07	0.12	15
40 y	Lamina	861	1.4	0.09	1.2	0.34	0.43	0.15	14
	Ekel	275	0.5	0.06	0.6	0.20	0.10	0.09	7
	Stalk (tip, 1.5m)	140	0.6	0.08	1.6	0.20	0.60	0.14	13
	Stalk (mid, 1.5m)	408	0.4	0.14	2.0	0.18	1.12	0.12	8
	Base stalk (0.6m)	758	0.5	0.07	1.5	0.19	1.02	0.06	10

K S Jayasekara, C Jayasekara, and S Periathamby

Experiment 26.3 Studies on water balance of coconut and intercrops. Ratmalagara Estate, Madampe (1991).

Objectives of the experiment were to study the nutrient and water balance, growth, and yield of coconut and intercrops under rainfed and irrigated conditions.

Citrus, coffee, pepper, and banana were planted during October-November months between the coconut rows at the recommended spacings. Each crop was planted in 8 coconut squares where only half of that will be irrigated while other half will be under
rainfed conditions. Studies on nutrient and water use of coconut and intercrops are in progress under rainfed and irrigated conditions.

K S Jayasekara, H A J Gunathilake (Agronomy), D P Panditharatne, & E M A T Banda

PROJECT 29: STUDIES ON FERTILIZER USE

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

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

Differential fertilizer Recommendation (DFR) packages were given to all seven estates of the CRI.

Fertilizer input during the last decade for the CRI estates showed that dolomite was not applied regularly resulting a deficit of at least 7 kg of dolomite per palm or more for the 1980-90 period. The widespread Mg-deficiency symptoms that were prevailed at
Bandirippuwa Estate, Isolated Seed Garden, and Pothukulama Research Station have now corrected with the adoption of the DFR package which included high levels of dolomite (ie: 5 kg/palm in 1989, 1990, and 1991).

Studies on the CRI estates to improve the nutritional and yield levels have helped to evaluate the constraints in the fertilizer and related management practices for increased efficiency and profits. The introduction of the Mulch Rake for increased labour efficiency and profits is one such practical benefit. Details of the "Mulch Rake" are given by Jayasekara et al. (1991).

K S Jayasekara, A A Fernando, and B C E Perera

Experiment 29.2 Studies on the localized application of fertilizer in coconut. Ratmalagara Estate, Madampe (1991).

Objectives of the experiment are to 1) assess the efficiency of localized application of fertilizer in holes/pits around the palm on the productivity of coconut, 2) find a suitable technique and the optimum number of pits per palm for the localized application
of fertilizer, 3) establish the maximum possible concentration of fertilizer that a coconut root could tolerate without adversely affecting the nutrient uptake, and 4) study the nutrient movement/diffusion/balance and root growth/distribution in the system.

Treatments are:

1. Control
2. Fertilizer broadcast, turn soil, and mulch
3. Fertilizer to 2 pits/palm
4. Fertilizer to 4 pits/palm
5. Fertilizer to 6 pits/palm

Plots were selected and the treatments will be introduced in December.

Experiment is a completely randomized block design (single palm/plot) with 5 replicates. Palms were blocked for uniformity based on several growth parameter such as number of leaves, yield, and collar girth. Pit dimension is 0.3 m x 0.3 m x 0.3 m and cut 0.3 away from the base. Pits were half filled with cow dung and the manure circle areas were mulched. fertilizer will be applied in 1992.

K S Jayasekara, D N S Fernando (Agronomy), and B C E Perera

4. MISCELLANEOUS STUDIES

4.1 Studies on dolomite and NPK fertilizer in coconut

Nitrogen losses through ammonia was found to be negligible even when the dolomite and urea were applied together and turn the soil with a mammoty where the soil was at or close to field capacity. Dolomite is presently being recommended as a prophylactic measure
against Mg-deficiency. Hence an incubation and leaching studies were initiated under both laboratory and field conditions to monitor the solubility of dolomite under different soil types and agro-climates. The study is in progress.

T W Fernando, S Periathamby, and 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) per seedling in May and November during the monsoonal rains and 1 kg dolomite/seedling in May. Plant growth parameters (leaf number and palm height) and leaf nutrient levels were monitored, as scheduled.

Marked differences in growth were observed in response to different sea water treatments. The trial is in progress.

D P Panditharatne and K S Jayasekara

4.3 Nutrient culture (hydroponics) technique in coconut

Seedlings are growing satisfactorily. Leaf samples were collected to monitor the nutrient levels in plants treated with high rates of fertilizer.

D P Panditharatne and K S Jayasekara

4.4 Ground water nutrient study

Monitoring of nutrient levels in ground water at 19 locations (ie: 17 wells, 1 pond and 1 stream) in the Bandirippuwa Estate, Lunuwila was continued. High levels of NH4-N (6 ppm), K (20 ppm), and Mg (40 ppm) were noted in ground water samples from certain locations. The levels of K and Mg in ground water were increased after monsoon rains indicating heavy leaching losses of applied fertilizer. Data show the importance of these studies on slow release fertilizer, retention of nutrients in soil, split-application of fertilizers, etc. to avoid possible irreparable pollution hazards to ground water in coconut plantations that are being regularly fertilized.

Studies are in progress to evaluate the potential leaching of nutrients from different fertilizers under different soils and rainfalls.

U S S Perera and K S Jayasekara

4.5 Coir dust in manure circle of coconut

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

E M A T Banda and 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 evaluate the Anion and Cation Exchange Resin method for soil analysis and its comparison with other methods.

Soil samples collected at monthly intervals and leaf samples at bimonthly intervals upto March 1991 were chemically analyzed. Soil samples were analyzed by three methods viz. 1M NH4OAC extraction, 0.43 M acetic acid extraction and ion-exchange resin extraction. The data were presented in the Ph.D. thesis at the University of Aberdeen, England titled "Ion-exchange resin method for assessment of nutrient availability in temperate and tropical soils". The important observations in this study are:

1. The three extraction methods mutually correlated with each other highly significantly $P<0.001$; $r>0.8$; $n=240$) with respect to K and Mg extraction. Only ion-exchange resin method and 0.43 M acetic acid extraction method correlated significantly ($r=0.89$; $n=240$) with respect to P extraction. However, the conventional Bray and Kurtz extraction did not significantly correlate with above methods with respect to phosphorus.

2. Extractable Mg and K were increased both in the top (0-25 cm) and the sub (25-50 cm) soils two weeks after muriate of potash and kieserite application. The pattern of seasonal variation of K and Mg status in both the top and the sub soil was much similar.

3. In both the top and the sub soil, the extractable quantity of Mg was dropped due to application of high K dosage and in turn, the extractable quantity of K was dropped due to application of high Mg dosage. The mutual antagonistic effect was much similar to the K-Mg interaction observed in leaf. It follows that high dose of Mg fertilizer application should accompany with high dose of K fertilizer also to compensate for the decrease in availability of each element due to mutual interaction.

3. Extractable P was increased only in the top soil two weeks after fertilizer application. An increase in P level in the sub soil was observed two months after fertilizer application. But the ratio of P concentration of top soil to sub soil was very much wider through out the year. It follows that applied P is much concentrated only in the top layer.

5. No significant lateral movement in the applied nutrient was observed through out the year.

L L W Somasiri

4.7 Studies on irrigation systems for coconut plantations

a) Ratmalagara Estate, Madampe (1990).

The prototype irrigation system installed at Ratmalagara Estate was tested with different drippers. A new dripping system known as "Screw Dripper" was developed by K S Jayasekara and D P Panditharatne.

Screw Dripper consists of a 3 cm long tapering screw (6 mm diameter; 1 mm deep groves) made up of plastic which is screwed into a normal polythene tube with an internal diameter of 4 mm. Rate of water flow could be controlled by turning the screw. Screw
Drippers were manufactured locally at a cost of Rs 1.00 per plastic screw.

Several types of drippers were installed together with the newly developed Screw Dripper to demonstrate the efficiency of different types of drippers. Studies show that the new Screw Dripper is cheap, easy to clean/maintain and the rate of water flow is easily controllable.

Fertilizer tanks were also installed to feed the fertilizer (both water soluble and partially soluble) into the main irrigation system.

Citrus, coffee, pepper, and banana were planted during October-November between coconut rows at the recommended spacings to study the nutrient and water use of coconut and intercrops under rainfed and irrigated conditions (details in Expt.26.3).

b) Bandirippuwa Estate, Lunuwila (1991).

Studies on the prototype irrigation system installed at Ratmalagara Estate, Madampe showed the possibility of using conduit pipes which are generally being used for electrical work. Conduit pipes could withstand a waterhead of about 30 m but is not recommended for drinking water pipes because of the contamination with lead (Pb). Conduit pipes (Rs 13/m) are very much cheaper than PVC pipes (Rs 25/m).

The use of conduit pipes in drip irrigation systems for coconut will reduces the capital expenditure. Hence it is necessary to study the life span and performance of conduit pipes under field conditions. Thus both conduit and PVC pipes were

included in the irrigation model installed at Bandirippuwa Estate, Lunuwila in August to study the water of coconut.

The reticulation system was similar to that described by Jayasekara and Mahindapala (1988). The experimental area consist of Pueraria decumbens as a cover crop and glyricidia and ipil ipil planted in between the coconut rows. Aluminium access tubes (2 m
long) were installed to monitor the water use of coconut, glyricidia ipil ipil, and Pueraria decumbens. Studies are in progress.

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

4.8 "Axil Feeding" of fertilizers in coconut Bandirippuwa Estate, Lunuwila (1991).

Studies from the Expt. 26.2 showed the possible benefits of applying fertilizers to the leaf axils of coconut. Preliminary studies showed that the maximum safe rate for urea (ie: without injurious effects to the leaf petiole or the vascular system) is 200 g/axil while that for KCl, dolomite, kieserite, and Adult Coconut (0-6-32-5) was found to be 500 g/axil. Studies also showed that the fertilizer could be easily placed and get dissolved by
rain when applied to the axils of leaves. Fertilizers were placed in the axils of leaf number 6 to 14 in this study.

Examination of the leaf axils revealed that about 15-20 g of dry matter per axil is generally accumulated in the cavity volume of about 300-1000 cm3/axil. Dry matter could retain about 40-100 g of water and found to be a good incubation medium for fertilizers. It consists of flower and leaf parts. Table 1 show the increase in leaf nutrient levels by absorption and translocation during a 16 day period after the application of fertilizer dissolved in water into the axil of the 6th frond. Detail studies are in progress with the use of 15N to evaluate the translocation path and the fertilizer use efficiency of the Axil Feeding technique.

A field trial was also commenced in April with 1 year old young coconut seedlings planted at Bandirippuwa Estate, Lunuwila. Design ia a randomized block with a single replicate consist of 72 young coconuts seedling. Treatments are as follows:

T1 - Control (with no fertilizers)
T2 - YPM (13-12-17) at recommended rate applied to soil, turn soil and mulch

T3 - Urea and KCl applied to axils below the 3rd frond. Broadcast Saphosphosphate and dolomite within the manure circle and mulch. Rates are same as for YPM.

T4 - Same as T3, but the urea and KCl rates are 1/2 of the T3 treatment.

Table 7. *Response of leaf nutrient level after the application of dissolved fertilizer with time*

Fertilizer	Nutrient level at 14th leaf (%) Days after application			
	0	3 d	11 d	16 d
KCl (200 g/axil)	0.8 % K	1.0 % K	1.2 % K	1.4 % K
Kieserite (200 g/axil)	0.18% Mg	0.22% Mg	0.25% Mg	0.35% Mg
Urea (200 g/axil)	1.2 % N	1.4 % N	1.6 % N	1.3 % N

Fertilizer treatments were imposed in May and November. Several growth parameters (number of leaves, height of seedling) and leaf nutrient levels were measured.

Ten 40 y old coconut palms showing severe Mg-deficiency symptoms at Pothukulama Research Station, Pallama were selected and kieserite was applied to the axils of leaves and to the soil to study the rate of recovery. Initial leaf nutrient levels and response of palms with time are being monitored.

K S Jayasekara, C Jayasekara, T W Fernando

4.9 Studies on nutritional deficiencies of coconut. Bandirippuwa Estate, Lunuwila (1991).

Objectives of the experiment are to study the 1) main effects of nutritional deficiencies 2) effect of nutritional deficiencies on growth, yield, water use, and photosynthesis and 3) potential productivity. Plots also will serve as live demonstration of nutritional deficiencies in coconut. Coconut seedlings (TxT) were 3 y old (planted in 1987; 7.4 m triangular planting). Each treatment has at least 10 palms and a single guard row. Treatments are as follows:

T1 (+All)	- NPKMg fertilizers at recommendation levels
T2 (-N)	- PKMg fertilizers
T3 (-P)	- NKMg fertilizers
T4 (-K)	- NPMg fertilizers
T5 (-Mg)	- NPK fertilizers
T6 (-All)	- Control; No fertilizers
T7 (-K,-Mg)	- NP fertilizers
T8 (-N, -P)	- KMg fertilizers
T9 (DFR package)	- DFR package for potential productivity
T10 (glyricidia+ PKMg)	- Glyricidia planted between coconut rows
T11 (Goat dung + PKMg)	- Goat dung and PKMg fertilizers
T12 (Cow dung + PKMg)	- Cow dung and PKMg fertilizers

Differential fertilizer treatments were applied in November. Plots are expected to be maintained for longer duration (ie: > 50 y) to study the performance of coconut under prolonged nutritional deficiencies as done for other crops.

K S Jayasekara and A A Fernando

4.10 Water Balance Studies of Coconut. Thammanna Estate, Puttalam (1991).

The objective of the experiment is to study the water use/balance of coconut cultivars on a deep latosol in the dry zone.

Two coconut cultivars selected for this study were TxT and DxT which are known to be "drought resistant" and "drought sensitive", respectively. Three palms from each cultivar was randomly selected and aluminium access tubes (3 m long) were installed in December at 0.5, 1.0, 1.5, 2.0, 2.5, 3.0 m away from coconut palms.

Aluminum access tubes were also installed to study the water balance under a pasture cover, close to a husk pit, and in bare soil. Rainfall and pan evaporation at the site will be monitored regularly. Data collection will commence in 1992.

K S Jayasekara and K R R A Peries (Genetics and Plant Breeding)

5. CHEMICAL, PHYSICAL AND MICROBIOLOGICAL ANALYSIS

5.1 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. Eighteen 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.

The division was also participated in the Soil Sample Exchange Programme (SSEP) under the International Soil-Analytical Exchange (ISE) organized by the University of Wageningen, The Netherlands. Six soil samples were analyzed for Total (K, Mg, Mn, N, Na, P, Zn, Cu, Fe), pH-H_2O (1:5), pH-$CaCl_2$ (1:10), Extractable with $CaCl_2$ 0.01 M 1:10 w/v (Cu, Fe, K, Mg, Mn, Na, Zn), Extractable with 1 M NH_4OAC (Ca, K, Mg, Na).

5.2 A total of 2046 leaf samples were analyzed for N, P, K, Ca and Mg. About 60% of these samples were analyzed for Cl, S, B, Fe, Mn, Cu, Zn and Mo.

One thousand four hundred and one 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). Twenty two fertilizer (chemical and organic) and coir dust samples were analyzed for N, P, K, Mg and Organic-C.

Fourteen weed samples and 264 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 154 soil samples were analyzed for several soil physical parameters such as bulk density, particle size, particle density, available water (at 1/10, 1/3, 15 bar using pressure plate), and gravimetric moisture.

6. SERVICES AND EXTENSION ACTIVITIES

6.1 Electronic Workshop

Several minor repairs and maintenance work were carried out for 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 participated as a resource person in the committee 1) to improve the JEDB coconut estates and 2) to improve the CCB coconut nurseries.

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, Miss M B M N Dias, and Dr L L W Somasiri functioned as resources person in two training programmes conducted at the Coconut Development Training Center, Lunuwila and the National Institute of Plantation Management, Athurigiriya.

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

6.3 Advisory/Extension Work

Ninety eight coconut estates covering about 8198 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 and labour facilities were provided by the estates.

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

7. REFERENCES

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**

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

8. ACKNOWLEDGEMENTS

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 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 Rezania 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. Co-operation from Janatha Estate 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/public are also acknowledged.

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

REPORT OF THE CROP PROTECTION DIVISION

Head - P.A.C.R.Perera, PhD

1. GENERAL

The research programme of the Division progressed satisfactorily although heavily restricted by a limited research staff. The surveys on (a) earthworm populations and (b) insects visiting the coconut inflorescence, in the different agroclimatic zones of the coconut triangle were completed. The collaborative research project with Peradeniya and Munster Universities was continued. Miscellaneous investigations on the control of some minor pests of coconut were carried out. The Division contributed to the multidisciplinary projects on premature decline of palms, immature nutfall and earthworms in coconut soils and are reported elsewhere. The Division continued to provide valuable assistance to coconut growers in the identification and control of pests and diseases.

2. RESEARCH PROJECTS

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

Experiment 8.2.2 Effect of nutrient status of plant on susceptibility to *Opisina arenosella* attack; field study.

In this experiment differential application of fertilizers were made using two levels each of nitrogen and potassium. Urea was applied at 0 and 1.6 kgs per palm, and potassium chloride at 0 and 3.2 kgs per palm, with a basal dressing of saphos phosphate at 0.6 kg per palm. Analysis of leaf samples for K and N content are being carried out periodically and bioassay studies would be initiated when significant differences in nutrient levels are recorded between treatments. It is expected to complete this study in early 1992.

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

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 coconut pests (collaborative project with the Universities of Peradeniya and Munster, Germany) (1990)

During the year under review thirty nine extracts from Sri Lankan plants

were tested for insecticidal activity using the coconut caterpillar and the red weevil as test insects. The plant extracts were prepared using the procedures reported earlier (1990).

The extracts tested were the dichloromethane extracts of; *Pseudocarpa championii* (stem & bark), *Madhuca longifolia* (seeds), *Chukrasia tabularis* (twigs & leaves), *Aegle marmelos* (root & bark) *Cananga odorata* (stem & bark), *Madhuca longifolia* (root & bark), *Anoora rohituka* (twigs & leaves), *Santalum album* (flowers), and the methanol extracts of *Pseudocarpa championii* (stem & bark), *Madhuca longifolia* (seeds), *Michelia champaca* (stem & bark), *Chukrasia tabularis* (twigs & leaves), *C. tabularis* (root & timber), *Hortonia fluribunda* (twigs & leaves), *Cananga odorata* (stem & bark), *Atalantoia monophylla* (twigs & leaves), *Meesa perrottetians* (stem & bark), *Glycosmis mauritiana* (root & timber), *Cullenia ceylanica* (stem & bark), *Thespesia populnea* (root & bark), *Litsea ovalifolia* (leaves), *Alesodaphne semicarpifolia* (stem & bark), *Eodonia ceylanica* (root & bark), *Santalum album* (flowers), *Vitex pinnata* (stem & bark) *Shorea stipularis* (bark), *Elacocarbus montaneous* (stem & bark), *Euphoria longara* (leaves), *Polygala orillata* (twigs & leaves), *Madhuca longifolia* (stem & bark), *Alesodaphne semicarpifolia* (leaves), *Dialium ovodeum* (hull), *Myristica dactylocoles* (stem & bark), *Terpenia malabarica* (leaves), *Bhesa montana* (leaves), *Cullenia ceylanica* (leaves), *Euphoria longara* (fruit), *Santalum album* (stem & bark), and *Chukrasia tabularis* (root & bark).

No significant insecticidal activity was recorded with any of the above listed plants. Ten fractions of the extract of the fruit/flesh of *Melia dubia,* (a plant identified previously as showing significant insecticidal activity) were further tested as fractions and sub-fractions. The predominantly active components have now been isolated to a sub-fraction and the active chemicals in this sub-fraction need to be identified now.

V Kumar(Peradeniya University),P.A.C.R.Perera & J Ranaweera

PROJECT 11: BIOLOGICAL CONTROL OF BLACK BEETLE

Experiment 11.1.11 Studies on the composition of attractants in the impregnation box/pit; Makandura, Horakelle (1990)

The experiment at Makandura (1990) comprised of 15 treatments being combinations of 25, 50, 75 and 100% mixtures of soil, coir dust and cowdung. The results of these experiments indicated that mixtures of coir dust and cowdung were more attractive to black beetle than the other treatments. The experiment was therefore repeated in 1991 at two sites (Makandura and Horakelle) using mixtures of coir dust and cowdung containing 25, 50, 75 and 100% of either component.

The results (Table 1) indicate that the mixture with 25% coir dust and 75% cowdung was the most attractive. Hence the mixture with this composition has now been selected for use in the impregnation box/pit,in further experimentation.

Table 1. *Black beetle attraction to different breeding media*

Site	Mean larvae/pit at 30 days after commencement Treatment				
	T_1	T_2	T_3	T_4	T_5
Makandura	12.0	23.0	22.5	0.0	0.0
Horakelle	2.0	9.0	0.5	6.0	0.0
S.D ($P<0.05$)	7.07	9.9	15.56	4.24	0.0

T_1 100% cow dung; T_2 25% coir dust and 75% cow dung;
T_3 50% coir dust and 50% cow dung
T_4 25% soil, 25% coir dust and 50% cow dung; T_5 100% soil

P.A.C.R.Perera & M M Keerthi

PROJECT 17: PREMATURE DECLINE OF PALMS

Experiment 17.6 Studies on *Odontomachus similis* (Kadiya), Bandirippuwa Estate (1989)

The objective of this experiment was to study the effect of establishing *Odontomachus* on healthy palms. Sixty healthy, ca 40 - 50 year old palms, with no signs of leaf scorch comprised the experimental palms. Kadiyas were established at the base of 40 palms through repeated introductions. The balance 20 palms were used as control palms and an insecticide (Aldrin) was applied to the base to keep the palms free of kadiyas. On each palm, the number of bunches, nuts per bunch, total leaves and the number of scorched leaves were recorded at bimonthly intervals for two consecutive years. The analysis of the data (Table 2) showed that the occurrence of scorched leaves on the palms where kadiyas were established was significantly ($P<0.001$) greater than on the control palms palms with no kadiyas. The other parameters studied although not showing statistically significant differences also showed similar trends with lower productivity being recorded on the palms with kadiyas when compared with the control palms.

This experiment has now been concluded.

Table 2. *The effect of Kadiya infestations on leaf scorch and yield*

Treatment	Mean yield/leaves per palm over the period 89.10.11 to 91.11.25			
	Bunches	Nuts	Leav-Tot[1]	Leav-Aff[2]
With Kadiyas	7.48	51.53	27.03	0.35
Without Kadiyas	7.57	56.31	27.75	0.11
Significance	NS	NS	NS	S[3]

[1] Total leaves [2] Affected leaves [3] $P \leq 0.001$

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

MISCELLANEOUS INVESTIGATIONS

Experiment No. 1 Studies on the biology of some Sri Lankan earthworms.

Objectives:

The objectives of this experiment were to study the growth and reproduction rates and the longevity of earthworms under different soils and soil moisture conditions, with a view to encouraging the propagation of earthworms in coconut soils.

Treatments:

The treatments comprised of four soil types : clay, loam, sand and gravel, each with 10,20,30, and 40% by weight of humus and 9,16,23 and 28% by weight of moisture, and was set up as a randomised block design with 4 replicates and 10 worms per pot.

Procedure:

The experiments were carried out in 15 cm diameter clay pots each with 1000 g of soil with the relevant composition and moisture content. Ten one day old earthworms were introduced into each pot and observations on weight gain,

reproduction rate and mortality of worms in each pot were recorded at weekly intervals.

Results:

The results (Table 3) indicate that irrespective of soil type the moisture content has a predominating influence on mortality/survival of earthworms. With sand and loam soils, the lowest humus content (10%) and the highest moisture content (28%) studied, were the most favourable for earthworm survival. With clay soil however, 20% humus and 28% moisture was the most favourable. The studies on weight gain and reproductive rate also showed similar trends with increases in mean weight gain and mean reproductive rate for corresponding increases in moisture content. The experiment is in progress.

P.A.C.R.Perera & A S P Siriwardena

Experiment No.2 Studies on termite control in nurseries.

Objectives:

The objectives of this experiment were to identify a suitable replacement for aldrin, for use in coconut nurseries. This was necessitated due to government restrictions on the import and distribution of Aldrin the commonly used termiticide.

Treatments:

The experiment was a randomised block design with six treatments and four replicates. The experimental area consisted of 24 nursery beds (plots) with 20 freshly germinated (crows beak stage) seedlings per plot. The treatments comprised of five insecticide applications with an untreated control, the insecticides used being Carbofuran, Nitromethylene, Isophenphos, Chlorpyrifos and Aldrin. The insecticide concentrations used were those recommended by the manufacturers.

Procedure:

The experimental area was evenly infested with termites before initiation of experiment by repeated introductions of termites collected elsewhere. Only one application of insecticide was made and the mortality of seedlings due to termite attack were also made at monthly intervals.

Results:

Although the experimental results (Table 4) did not show statistically significant differences between treatments, the lowest mortality of seedlings was obtained with the Chlorpyrifos treatment, and could therefore be recommended as an alternative to Aldrin for termite control in coconut nurseries.

P A C R Perera & K F G Perera

Experiment No. 3 Studies on nematodes associated with coconut cultivation.

General:

Nematodes are serious pests of many agricultural crops. Although previous investigations, most of which were location specific, have not identified any serious nematode pest of coconut in Sri Lanka, they could well be pests of other crops grown in association with coconut. Detailed investigations would therefore be relevant especially as cover crops and intercrops under coconut are presently being encouraged and assisted. A preliminary survey to identify nematode presence and their distribution was therefore undertaken and completed during the period July 1990 to June 1991.

Procedure:

The survey was limited to the major agroecological zones of the coconut triangle and comprised of two from the lowcountry intermediate (IL1 and IL3) and four from the lowcountry wet (WL1 to WL4). In each agroecological zone sampling was carried out at 20 random sites selected on the basis of a grid layout. At each site 3 samples of soil were collected from the root zone of coconut palms. The Baermann funnel method was used for the isolation of nematodes.

Results:

The results of the survey (Table 5) indicate a decrease in nematode populations with an increasing pattern of rainfall. The pattern of these population changes is also reflected in the between season analysis, where the lowest populations were recorded in the highest rainfall season of April to June 1991.

P A C R Perera & K F G Perera

Table 3. *The effect of different moisture and humus regimes on mortality of earthworms under laboratory conditions.*

Soil types	Humus (%) (by weight)	Percentage mortality of earthworms Moisture(%)-(by weight) 9	16.5	23	28.5
Clay	10	100.00 (89.96)	83.33 (65.91)	87.48 (69.38)	54.01 (47.30)
	20	98.23 (82.46)	88.06 (69.79)	43.44 (41.23)	7.16 (15.52)
	30	100.00 (89.96)	100.00 (89.96)	100.00 (89.96)	72.17 (58.10)
	40	100.00 (89.96)	100.00 (89.96)	93.66 (75.35)	57.37 (49.24)
Loam	10	100.00 (89.96)	46.81 (43.17)	36.38 (37.10)	30.22 (33.25)
	20	100.00 (89.96)	71.36 (57.65)	59.59 (50.53)	49.96 (44.98)
	30	100.00 (89.96)	100.00 (89.96)	64.62 (53.50)	76.30 (60.87)
	40	100.00 (89.96)	100.00 (89.96)	100.00 (89.96)	100.00 (89.96)
Sand	10	93.60 (75.35)	71.96 (58.03)	22.10 (28.04)	6.69 (14.99)
	20	33.16 (35.16)	91.97 (73.54)	88.49 (70.17)	63.11 (52.60)
	30	100.00 (89.96)	100.00 (89.96)	98.28 (82.46)	99.17 (84.79)
	40	100.00 (89.96)	91.48 (73.03)	99.17 (84.79)	99.17 (84.79)

Arcsin values in parenthesis; LSD for Arcsin values: Humus = 6.139; Moisture = 6.139; S x H = 10.634; S x M = 10.634; H x M = 12.279; S x H x M = 21.268

Table 4. *The effect of different insecticide treatments on termite attack*

Replicate	Mean seedling mortality per plot					
	T_1	T_2	T_3	T_4	T_5	T_6
R_1	2.02	1.02	1.02	1.02	3.02	3.02
R_2	2.02	3.02	2.02	1.02	1.02	1.02
R_3	3.02	2.02	3.02	1.0	0.02	2.02
R_4	4.02	0.02	8.02	0.02	3.02	2.02
Total	11.08	6.08	14.08	4.08	7.08	8.08
Mean	2.77	1.52	3.52	1.02	1.77	2.02

Table 5. *The distribution of nematodes in the different agroecological zones within the coconut triangle*

Agro ecological zone	Mean nematodes x 10^5 per m^3 of soil					
	Season					
	I	II	III	IV	Mean	SD
IL1	26.47	17.47	7.09	7.58	14.65	9.22
IL3	15.65	41.70	4.65	6.00	17.00	17.18
WL_1	17.00	31.30	15.00	2.30	16.40	
WL_2	25.50	30.65	23.20	9.00	22.09	9.26
WL_3	15.10	26.27	6.77	14.44	8.61	
WL_4	32.70	36.35	16.30	33.00	29.59	9.01
Mean	21.15	28.76	15.42	10.78		
S.D	8.50	10.48	8.54	11.12		

IL - Intermediate low country; WL - Wet low country
Seasons: I: Jun 90-Sept 90; II: Oct 90-Dec 90; III:Jan 91-Mar 91; IV: Apr 91-Jun91

3. INCIDENCE OF PESTS AND DISEASES

Sixty three reports of pest and disease incidence (Table 6) received during the year were investigated and appropriate control measures recommended to growers. An important record was the incidence of *Diocalandra* as a serious pest of coconut, with two records from the western province and two from the southern province. In the western province the pest was recorded to cause damage to the rachis resulting in frond-break, whereas in the southern province damage was caused to the bole area of ca 15 year old palms, with heavy feeding on the softer tissues immediately below the bark, resulting in mortality where control measures were not applied. In all four instances the pest was identified as *Diocalandra frumenti*

Eight instances of disease incidence were recorded of which five were of bud rot two of leaf blight, and one of stem bleeding.

Table 6. *Reports of pests and diseases*

Pest/Diseases	No of reports	Province			
		WP	NWP	SP	CP
Black beetle	7	4	3	0	0
Red weevil	11	3	6	1	1
Coconut caterpillar	22	4	9	9	0
Coconut scale	04	0	3	1	0
Nettle grub	3	0	3	0	0
Diocalandra	2	2	0	0	0
Bud rot	5	3	2	0	0
Leaf blight	2	0	2	0	0
Others	5	1	4	0	0
Total	61	17	32	11	1

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). However, in order to prevent possible major outbreaks chemical control was recommended in selected instances. Laboratory cultured consignments of the fungus *Metarhizium anisopliae* and the

virus *Baculovirus oryctes* were issued as polythene packs to 25 estates for the control of black beetle in the north western and western provinces.

Table 7. *Parasitoid releases for Coconut caterpillar control*

Province	P_1	P_2	P_3	P_4	P_5	Total
Western	9,500	20,250	1,900	3,300	2,775	37,725
N.Western	38,150	91,250	14,675	1,27,700	8,900	2,80,675
Southern	17,750	30,000	2,350	69,500	2,350	1,21,950
Total	65,400	141,500	18,925	2,00,500	14,025	4,40,350

P_1 - *Goniozus nephantidis*; P_2 - *Bracon hebetor;* P_3 - *Eriborus trochanteratus;* P_4 - *Trichospilus pupivora*; P_5 - *Brachymeria nephantidis*

Weeds:

The demand for the biological control agent (*Pareuchaetes pseudoinsulata*) used for the control of Podisinghomaran *(Chromolaena odorata)* continued during the year and a total of 11,225 larvae 125 pupae and 220 adults were issued/released in coconut plantations in the north western and western provinces.

4.2 Chemical control

The incidence of coconut caterpillar was very low and only 847 palms required insecticide treatment as compared to 9860 palms in the previous year. In addition to the coconut caterpillar 788 palms infested with nettle grub(*Parasa lepida)* and 150 palms infested with Coconut scale (*Aspidiotus destructor)* were also treated with insecticides.

5. ASSISTANCE TO OUTSIDE AGENCIES

Assistance was provided to the Sri Lanka Cashew Corporation in the control of cashew pets. In this connection collaborative investigations were carried out at the Cashew Corporation's cashew plantation at Kamandaluwa with a view to recommending suitable methods for the control of the cashew borer *Plocaederus ferrugineus*. This work is being continued.

6. EXTENSION ACTIVITIES

The following lectures/demonstrations were given by the CPD staff:

Dr. P A C R Perera on (1) Principles of Crop Protection, (2) Coconut Pests and (3) Diseases of coconut to a group of middle level management staff of coconut estates (in sinhala), on 07 June.

Dr. P A C R Perera on "Developments in Pest Control Research" to the Regional Managers, Assistant Regional Managers and other staff of the Coconut Cultivation Board, on 25 June.

Dr. P A C R Perera on "Some Reflections on the Effect of Potassium Content of Leaf on Coconut Pest Incidence" to the CRI Research Staff on 17 July.

Dr. P A C R Perera on (1) Principles of Crop Protection (2) Coconut Pests and their Control II and (3) Coconut Diseases and Disorders and their Control to the students of the Diploma in Plantation Management Course, on 24 September.

Mr. M M Keerthi on "Coconut Pests and their Control I" to the students of the Diploma in Plantation Management Course, on 24 September.

Messrs. K F G Perera, K A S Chandrasiri, and Ms D C L Pathirana and A S Siriwardena; Laboratory demonstrations to the students of the Diploma in Plantation Management Course on 24 September.

Dr. P A C R Perera on "Coconut Pests" to Managers, Supervisors and Field Officers of privately owned estates, on 12 December.

Mr. M M Keerthi on "Coconut Diseases" to Managers, Supervisors and Field Officers of privately owned estates, on 12 December.

Messrs K F G Perera, D M Jayakody, W E A Fernando and A S M Premalal-Laboratory and field demonstrations on pest and disease control to Managers, Supervisors and Field officers of privately owned estates on 12 December.

7. 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 & Plant Nutrition Divisions for assistance with the earthworm survey ; and the Commonwealth Institutes of Entomology, and Mycology, London, for insect and fungal identifications respectively.

REPORT OF THE BIOMETRY DIVISION

Head - D.T. Mathes FIS

1. GENERAL

Computerization: The computer facilities were further increased with the commissioning of a forth computer with a hard disc capacity of 40 MB.

Staff: Mr. T S G Peiris served as a member 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 Colombo University. He also functioned as an external examiner in Biometry and Crop Experimentation at the Eastern University, of Sri Lanka.

Mr. D T Mathes refereed scientific articles for Journal of Agricultural sciences, of the National Agricultural Society of Sri Lanka and for Annual Congress 1991 of Postgraduate Institute of Agriculture.

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.L Gunesekera and Mr. L L W Somasiri in their Ph.D projects respectively. Two postgraduate students from Colombo University and four undergraduates from Universities Peradeniya, Vidyodaya and Batticaloa too were provided with such assistance.

3. RESEARCH PROJECTS

PROJECT 19: APPLICATION OF BIOMETRY IN COCONUT RESEARCH

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

The bimonthly recording of vegetative and yield characters were carried out without interruption. Variation of yield parameters between the six picks of 1990 and 1991 is given in Tables 1 and 2. The total number of bunches for the year showed a decrease of 13.0% over 1990. The first three picks recorded an increased number of nuts per palm while 4th and 5th picks recorded a decrease compared to that of 1990. An improvement was shown in the 6th pick. The number

of nuts per hectare too showed a similar pattern to nuts per palm. The recorded yield was 16735 nuts/ha compared to 15414 nuts/ ha recorded in 1990. The year showed an increase in yield by 8.6% over 1990. The copra yield per hectare was 3,276.6 Kg/ha which is a marginal increase of 0.3% over 1990.

Table 1. *Average yield components in 1991 (Expt. 19.3)*

Pick number	Number of bunches/palm	Number of nuts/palm	Number of nuts/ha	Number of nuts/bunch
1	2.3 (2.3)	17.5 (7.4)	2765 (1173)	7.5 (3.3)
2	2.0 (2.9)	19.4 (15.3)	3060 (2422)	9.8 (5.3)
3	2.1 (2.5)	24.3 (22.4)	3848 (3548)	11.7 (9.0)
4	2.1 (2.3)	11.6 (16.7)	2878 (3567)	8.5 (9.9)
5	2.1 (2.4)	11.6 (16.7)	1833 (2636)	5.5 (7.1)
6	2.1 (2.2)	14.9 (13.10	2351 (2068)	7.1 (6.0)
Total	12.7 (14.6)	105.9 (97.5)	16735(15414)	

Figures in paranthesis are those recorded in 1990

Table 2. *Average weight of husked nut and copra yield in 1991 (Expt. 19.3)*

Pick	Weight of husked nut (g)		Copra (kg/ha)	
	1991	1990	1991	1990
1	673	734	595.47	275.51
2	580	773	567.94	599.11
3	551	663	678.48	752.74
4	609	608	560.86	694.00
5	669	620	392.41	522.98
6	640	638	481.48	422.20
Total/Ave.	612	662	3276.64	3266.54

Copra yield = husked nut weight x 0.32

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

4. MISCELLANEOUS STUDIES

4.1 Relationship between coconut yield and rainfall at Ratmalagara.

Crop data (nuts per ha) from 1969 to 1989 and the rainfall from 1968 to 1987 were subjected to relationship studies. The correlation coefficients between the annual yield and total bi-monthly rainfall of the previous year to the harvest for seven groups of 15 consecutive years are shown in Table 3.

Table 3. *Correlation coefficients between yield and two monthly rainfall in the year prior to harvest*

Year Group	JF	MA	MJ	JA	SO	ND
1969-1983	0.354	0.331	0.293	0.292	-0.136	-0.710**
1970-1984	0.428	0.363	0.364	0.228	-0.100-	0.666**
1971-1985	0.529*	0.485	0.342	0.204	-0.098	-0.543*
1972-1986	0.457	0.503*	0.148	0.161	-0.282	-0.564*
1973-1987	0.334	0.655**	0.173	0.197	-0.409	-0.382
1974-1988	0.294	0.658**	0.165	0.110	-0.259	-0.358
1975-1989	0.305	0.573*	0.112	0.290	-0.248	-0.374
Mean	0.386	0.510*	0.228	0.212	-0.206	-0.374

* $p < 0.05$ ** $p < 0.01$

Using two monthly total rainfall of the year prior to harvest and number of rainy days regression models with the yield were fitted for the seven groups. The variables used were January/February(J/F), March/April(M/A), May/June(M/J), Square of November/December(ND^2), MA*MJ(MAMJ), number of rainy days in January/February(nJF), and the yield(y). The coefficients of determination and the estimates(forecast) one year ahead are shown in Table 4. The percentage error of forecast ranged from 1.9 to 40.0%.

T S G Peiris

Table 4. *Estimates (forecast) one year ahead, the actual yield and the percentage deviation*

Year Group	R2 (%)	Actual yield (nuts/ha)	Est. yield (nuts/ha)	% Deviation
1969-1983	89.18	7973	7187	9.8
1970-1984	92.73	12476	17484	40.0
1971-1985	83.89	11881	12880	8.4
1972-1986	88.64	8677	10761	24.0
1973-1987	92.74	9440	9252	1.9
1974-1988	92.06	13115	10888	16.9
1975-1989	86.14	11594	9402	18.9

Table 5. *Correlation between yield(y) and monthly rainfall(x) and the 'b' values for the multiple regression (R2 = 87.69%) between yield and monthly rainfall (crop data from 1969 - 1989)*

Variable	Simple correlation (y vs x)	'b' values
Intercept		3154.4
January	0.1324	143.1
February	0.2028	27.8
March	0.5275**	62.6
April	0.4005	46.0
May	0.3381	163.5*
June	0.2164	302.9*
July	0.5747**	-7.9
August	-0.2352	78.5
September	-0.1542	47.4
October	-0.0249	-62.6*
Age parameter	-0.5411**	-31.3

Est. yield for 1989 (nuts/ac) = 4178
Act. yield for 1989 (nuts/ac) = 3849
Deviation = 329; Percentage deviation = 8.5.

4.2 Relationship between coconut yield and rainfall at Palugaswewa.

Crop data from 1969 to 1988 and the rainfall from 1968 to 1987 were subjected to relationship studies. The correlation coefficients between the annual yield and total monthly rainfall of the previous year are shown in Table 5. The table 5 further shows the parameter estimates for the multiple regression between yield(y) and total rainfall of months January to October. An age parameter too was fitted to this equation. The error of estimation (forecast) for the year 1989 was 8.5%.

D T Mathes & W E R C Fernando

4.3 Studies on distribution of rainfall at Isolated Seed Garden

Some attempt was made to study the rainfall distribution at ISG over the last three decades. Fiveyear moving total of the rainfall indicates that there had been a steady decline of total rainfall over the past three decades(Fig 1).

D T Mathes

5. COMPUTER FACILITY

(a) computerization of the data collected from the experiments continued throughout the year.

W E R C Fernando, K Herath and D T Mathes

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

Protus Fernando, H P De Zoysa and D T Mathes

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

D T Mathes and H P De Zoysa

(d) Assistance was provided quite often to all research divisions on the use/application of data base packages and statistical packages.

H P De Zoysa, W E R C Fernando & D T Mathes

(e) A talk on ""An overview of Management Information System for Agricultural Research was given to staff of the Institute.

T S G Peiris

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

T S G Peiris and W E R C Fernando

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

T S G Peiris & H P De Zoysa

(h) Assistance was provided to CARP in preperation of the report on Management Information System and Programme Budgeting System of Agricultural Organisations under CARP.

T S G Peiris

(i) A feasibility study of the present computer environment and future expansion of the computer system of the Coconut Cultivation Board was carried out.

T S G Peiris

6. YIELD RECORDING

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

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

7. EXTENSION ACTIVITIES

Trainees from the National Institute of Plantation Management (NIPM) National Apprentice Board (NAB) and students from Universities and Aquianas College were briefed on the work of the division.

8. AGRI-METEOROLOGY

The three meteorological stations at Bandirippuwa estate, Ratmalagara estate and Isolated Seed Garden wrere maintained satisfactorily. Daily recordingd were taken throughout the year on rainfall,temperature, evaporation, humadity and soil temperature.

8.1 Bandirippuwa Estate

(a) Rainfall (Table 6): Rainfall recorded in all months. Very heavy rainfall was observed for the month of May. This resulted an overall high rainfall of 988.6mm during the first half compared to 687.4mm during the second half. The total rainfall for the year was 1676mm. This was lower than the year 1990.

(b) Temperature (Table 7): The monthly maximum temperature ranged form 29.8 to 32.4 °C as against 29.3 to 32.4 °C in 1990. The monthly minimum temperature ranged from 21.6 to 25.5 °C. On the whole, the temperature during the year was slightly higher compared to 1990.

(c) Sunshine (Table 7): Longer sunshine hours were observed during the early and latter part of the year. The average for the year was 7.0 h.

(d) Soil Temperature (Table 8): The average temperatures recorded at depths 5,10,20,30,60 and 120 cm during the morning were 28.4, 28.8, 29.3, 30.0, 30.1, 30.0 °C while those for the afternoon were 32.0, 31.1, 30.5, 30.2, 30.0, 30.0 °C respectively.

8.2 Ratmalagara Estate (Table 9)

The Rainfall recorded in all months. The total rainfall recorded for the year was 1448.0 mm. This is similar to that recorded in 1989 and 1990. Considerable reduction in rainfall was observed for the months October and November as compared to 1990.

8.3 Isolated Seed Garden (Table 10)

Except for the month of February rest of the months experienced rainfall. The total rainfall for the year was 1380.2 mm as compared to 1180.1 and 850.2 mm observed for year 1990 and 1989 respectively. The months March, April, May and June observed good rain. On the whole there was fairly a good distribution of rainfall during the year.

Table 6. *Rainfall(mm) for the last 10 years and in 1991 (Bandirippuwa Estate)*

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	81-90 Ave	1991
January	50.8	0.0	0.0	197.9	13.0	61.7	31.2	0.0	25.4	201.8	58.2	37.7
February	66.0	0.0	0.0	106.9	189.0	35.0	0.0	111.4	0.0	16.8	52.5	12.2
March	16.5	144.3	0.0	145.5	228.9	62.0	118.3	87.4	65.7	84.3	95.3	97.5
April	100.6	125.2	219.7	425.2	103.9	60.2	237.6	283.0	234.9	74.8	186.5	90.3
May	333.5	232.9	322.1	297.7	275.3	284.7	187.2	109.9	52.3	227.7	232.3	481.5
June	107.4	328.4	138.4	115.1	291.3	44.7	61.6	255.8	153.4	29.0	152.5	269.4
July	38.6	152.1	79.7	111.0	14.5	33.5	6.4	151.8	99.0	156.3	84.3	105.8
August	41.4	188.9	120.6	0.5	139.9	77.2	156.5	105.2	20.4	0.3	85.1	22.6
September	124.2	185.2	242.1	129.3	168.4	94.7	410.7	303.4	222.1	11.9	189.2	59.3
October	298.4	235.7	50.0	121.9	195.6	224.3	579.3	88.8	395.9	395.1	258.5	309.2
November	297.2	244.6	159.0	239.8	306.3	149.4	194.7	370.7	379.4	623.3	296.4	161.4
December	12.9	57.7	141.0	83.0	63.7	63.5	79.9	19.1	50.3	90.2	66.1	29.1
Total	1487.5	1895.0	1472.6	1973.8	1989.8	1190.9	2063.4	1886.5	1698.8	1911.5	1756.9	1676.0

Table 7. *Summary of meteorological observation in 1991 (Bandirippuwa Eatate)*

Month	Temperature (0C)		Evaporation (mm)	Relative Humidity (%)		Sunshine(hrs)
	max	min	per day	a.m.	p.m.	
January	30.6	22.5	4.3	80	65	7.0
February	32.4	21.6	4.9	75	55	9.3
March	32.3	23.8	4.7	79	67	8.8
April	31.8	24.0	4.6	78	71	8.3
May	32.3	25.3	5.1	79	71	7.1
June	30.0	25.3	2.9	83	77	4.9
July	30.1	25.4	3.7	80	75	6.5
August	30.1	25.5	4.1	79	75	6.6
September	30.9	25.0	4.1	78	71	6.9
October	29.8	23.7	2.9	83	78	4.5
November	30.7	23.1	3.9	81	70	7.5
December	30.4	22.3	3.7	79	65	6.9
Average	30.9	23.9	4.1	79	70	7.0

Table 8. *Soil temperature (^0C) at different depths (Bandirippuwa Eatate)*

	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	26.9	27.4	27.9	28.6	28.9	29.0	30.1	29.2	28.9	28.7	28.8	29.0
February	27.6	28.4	29.2	30.0	29.9	29.7	32.6	31.4	30.6	30.3	29.8	29.7
March	29.7	30.2	30.9	31.6	31.4	31.0	33.9	32.9	32.2	31.9	31.4	31.1
April	29.9	30.1	30.4	31.0	31.1	31.0	33.0	32.2	31.5	31.3	31.0	31.0
May	30.2	30.5	31.0	31.7	31.8	31.5	34.0	32.9	32.2	32.0	31.7	31.5
June	27.6	27.8	28.2	28.7	29.0	29.2	30.0	29.4	29.1	28.9	28.9	29.1
July	28.4	28.6	29.2	29.8	29.7	29.6	31.3	30.6	30.1	30.0	29.7	29.6
August	28.7	28.9	29.5	30.1	30.0	30.0	31.8	31.1	30.5	30.3	30.0	30.0
September	30.2	30.4	31.2	32.0	31.8	31.3	35.5	34.1	32.6	32.3	31.7	31.3
October	27.9	28.2	28.6	29.3	29.6	29.9	30.7	30.1	29.5	29.3	29.5	29.9
November	27.6	27.9	28.3	29.0	29.3	29.3	31.2	30.2	29.6	29.3	29.2	29.2
December	26.8	27.0	27.6	28.3	28.7	28.8	30.1	29.5	28.9	28.7	28.7	28.9
Average	28.4	28.8	29.3	30.0	30.1	30.0	32.0	31.1	30.5	30.2	30.0	30.0

Table 9. *Rainfall (mm) for the last 10 years and in 1991 (Ratmalagara Estate)*

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	81-90 Ave.	1991
January	78.7	0.0	0.0	132.9	16.6	64.8	13.6	0.0	77.7	185.5	57.0	36.2
February	11.3	0.0	0.0	166.2	122.1	54.3	0.0	101.3	0.0	8.3	46.4	12.2
March	38.4	118.8	0.0	168.6	158.3	74.7	72.0	53.3	117.4	96.2	89.8	88.8
April	52.5	112.2	109.2	703.6	208.3	143.4	120.4	231.4	204.2	37.7	192.3	104.4
May	290.8	196.8	145.3	282.4	82.3	246.1	141.5	68.0	54.2	114.6	162.2	375.7
June	87.4	190.8	80.9	39.1	126.0	50.9	65.1	221.9	126.5	12.6	100.1	264.2
July	55.1	35.6	55.6	88.6	39.1	22.6	16.9	57.9	124.2	92.7	58.8	38.1
August	80.4	155.2	74.9	2.0	13.3	85.9	139.5	158.1	10.0	0.0	71.9	16.1
September	121.6	36.6	109.9	132.8	84.2	26.4	190.0	259.7	161.4	17.4	114.0	43.0
October	168.9	272.8	79.5	109.3	209.9	153.0	502.8	58.0	238.9	389.2	218.2	211.3
November	304.0	200.8	163.6	472.8	319.0	228.4	195.9	230.1	298.7	434.6	284.8	175.8
December	24.2	118.7	216.3	95.9	104.4	95.9	53.2	88.8	24.4	76.7	89.8	82.2
Total	1313.3	1438.3	1035.2	2394.2	1483.5	1246.4	1510.9	1528.5	1437.6	1465.5	1485.3	1448.0

Table 10. *Rainfall(mm) for the last 10 years and in 1991 (Isolated Seed Garden)*

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	81-90 Ave	1991
January	36.9	0.0	0.0	96.9	38.3	59.1	5.9	3.3	58.4	221.6	52.0	44.0
February	11.5	0.0	2.1	228.9	113.4	65.8	0.0	135.0	0.0	0.0	55.7	0.0
March	93.5	176.3	1.6	279.7	94.6	55.3	21.7	77.4	29.5	34.0	86.4	116.0
April	48.4	61.7	52.8	821.4	100.0	104.9	141.1	233.3	81.7	38.8	168.4	147.9
May	147.8	281.8	248.8	155.5	171.4	121.9	100.2	71.7	16.0	145.6	146.1	182.5
June	148.9	110.7	73.4	29.7	88.8	74.5	49.8	129.7	112.2	8.4	82.6	236.5
July	72.5	32.1	26.4	117.0	17.9	4.2	4.5	91.4	72.1	67.7	50.6	29.2
August	54.3	91.6	78.0	3.8	10.7	47.4	48.1	60.1	1.7	0.0	39.6	17.1
September	68.4	35.6	89.4	164.7	107.4	37.4	270.8	272.2	34.0	9.5	108.9	25.8
October	280.3	199.9	105.7	227.3	108.7	199.9	467.6	61.3	221.9	288.6	216.1	221.6
November	295.9	152.7	199.3	210.6	334.8	236.1	143.2	319.5	214.7	306.7	241.3	208.1
December	54.3	93.4	331.4	53.6	118.6	7.6	49.5	64.8	8.0	59.2	84.0	151.5
Total	1312.7	1235.8	1208.9	2389.1	1304.6	1014.1	1302.4	1519.7	850.2	1180.1	1331.7	1380.2

DISTRIBUTION OF TOTAL RAINFALL AT ISG
From 1960 to 1990

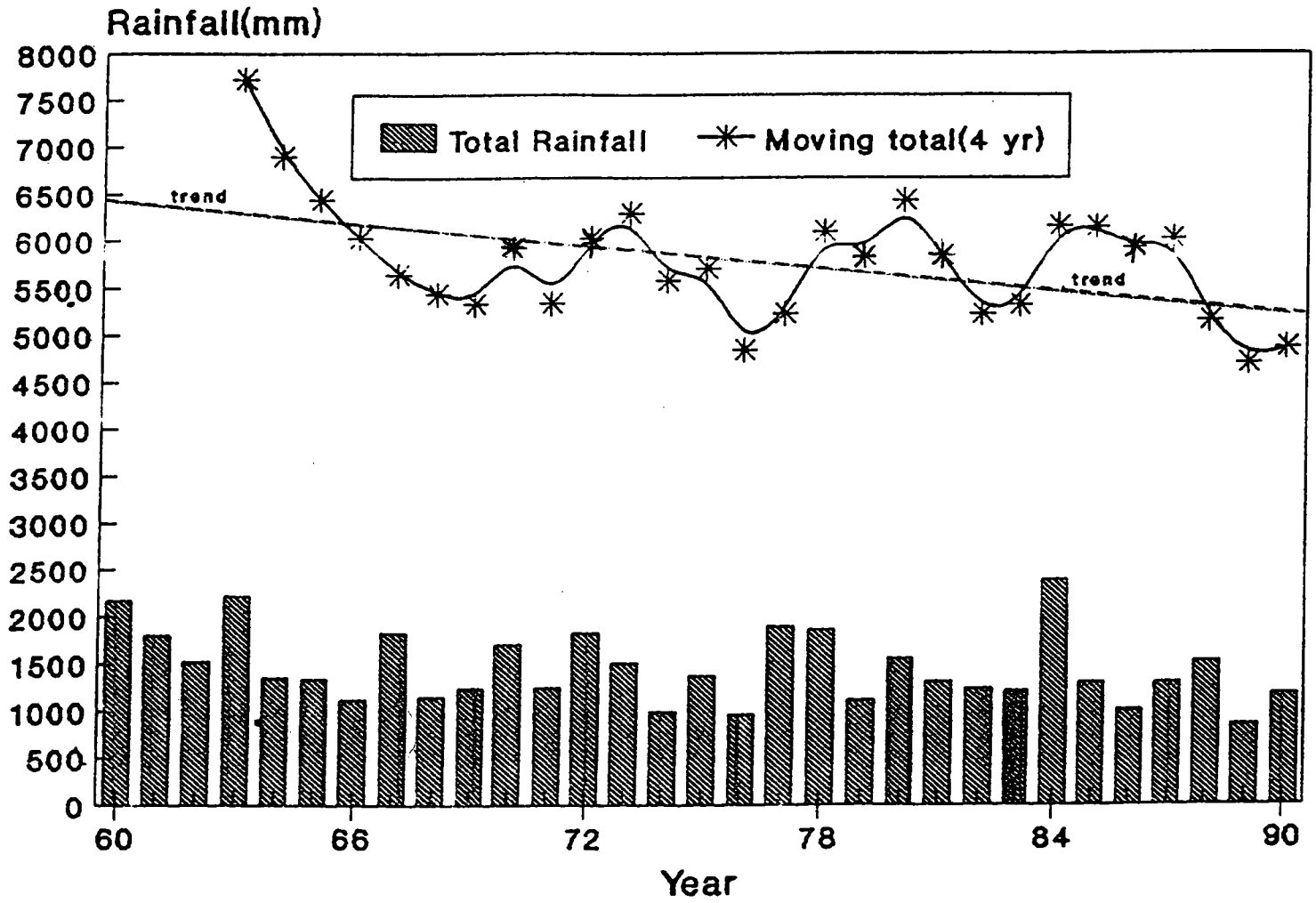

Fig.1

REPORT OF THE TISSUE CULTURE DIVISION

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

1. GENERAL

Seven seedlings screened in embryo culture for tolerance to drought were planted in the germplasm conservation block at the Poththukulama Research Station. Formation of non embryogenic/haustorial type tissue was considered a major problem in the attempt to achieve somatic embryogenesis from immature embryos and efforts to overcome this problem were given high priority.

The use of microwave irradiation to induce mutations in embryo cultures was tried out for the first time.

The Coconut Research Board in October appointed a panel of scientists to review the research work, identify constraints and future directions, and recommend strategies for the improvement of Tissue Culture in coconut.

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 techniques for clonal propagation of improved cultivars, Dwarf x Tall (CRIC 65) and Tall x Tall (CRI 60) were continued using immature embryo explants.

A large number of somatic embryos have been regenerated from the callus tissues derived from immature embryos. In an effort to improve germination and further growth of the somatic embryos, they were subjected to various treatments.

One plantlet about 8 cm tall and a number of shoots have been produced from somatic embryos. Satisfactory root formation in the plantlet was observed. But soil establishment of the resulting plantlet could not be attempted.

Further investigations are in progress to accomplish consistent plant production from somatic embryos.

S M Karunaratne, S C Fernando and C Gamage

Experiment 18.2 Culture of shoot explants of coconut *in-vitro* (1983)

An investigation on optimization of rooting conditions using shoot tip cultures was undertaken. A good root system is essential for enhancing the survival rate of plants during acclimatization and subsequent transplanting.

Shoot tips from over grown seedlings and cultured embryos were grown in the medium developed in this laboratory.

Preliminary attempts were taken to induce rooting, subjecting shoots to several stress treatments such as salt, hormones and irradiation.

M Karunaratne and S C Fernando

Experiment 18.3 Application of embryo culture technology to select drought tolerant coconut germplasm (1986)

Further investigations on the development of an ***in-vitro*** technique have been made to improve the screening procedure. Polyethylene glycol (PEG) and mannitol were used to simulate drought conditions. Instead of embryos as in earlier experiments, seedlings developed from isolated zygotic embryos of the Sri Lanka tall variety were used as the experimental material in order to reduce the duration of the screening procedure and to prevent the inhibitory effect of polyethylene glycol (PEG) and mannitol on the germination of zygotic embryos.

It was found that none of the experimental material died due to stress damage caused by 1% and 2% PEG. Percent survivors gradually dropped with increase in PEG concentration over the 2% level. None survived PEG concentration higher than 6%.

When mannitol was used for inducing 'drought' conditions, no losses were recorded at 0.05 M mannitol. But the survival rate gradually dropped with increase in mannitol concentration and none survived at the 0.8 M concentration.

The same screening technique using germinated embryos derived from Ambakelle special was commenced. NaCl was used to induce drought conditions.

Preliminary investigations have been made to reduce the cost of the screening procedure by substituting Analar grade sucrose and KCl with commercial sucrose and fertilizer grade KCl.

Six seedlings, that survived the stress conditions caused by different

concentrations of NaCl and 1 seedling from the control were planted in the germplasm conservation block of the Poththukulama Research Station for the evaluation of their performance under field conditions.

S M Karunaratne, R R A Peries and Sunil Santha

3. ACKNOWLEDGEMENTS

The assistance and cooperation of the staff of tissue culture division in compiling this report is gratefully acknowledged.

REPORT OF THE PLANT PHYSIOLOGY DIVISION

Head - C Jayasekara, Ph D

1. GENERAL

During the year drought screening studies were carried out with a good progress. Much emphasis was given to study important physiological processes Viz. photosynthesis and water relations of the bearing coconut palms.

Expert Assistance was received from the international Atomic Energy Agency in planning and initiating the programme of research on water use efficiency of coconut and on partitioning of photosynthate, using $^{13}C/^{12}C$ discrimination and ^{14}C as tracers.

The division participated in two multi-disciplinary projects as reported in the previous year Annual Report and collaborated with the Soils and Plant Nutrition Division and the Agronomy Division. During the year appreciable progress in research activities was achieved after inception of this new research division.

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 second experiment commenced in 1990 was completed after imposing two drying cycles. At the field capacity nitrogen and potassium have shown significant influence on transpiration ($P < 0.001$) and leaf water potential ($P < 0.001$) of the coconut seedlings. However, during water deficit nitrogen had significant influence ($P < 0.001$),but neither potassium nor chlorine had significant influence on transpiration and leaf water potential of the seedlings. Adequate supply of nitrogen and potassium significantly increased the root dry matter accumulation ($p < 0.001$) and root volume was also increased (p,0.001). All the collected data on this experiment will be analysed early next year to prepare the final report.

C Jayasekara and G V Athukorala

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 at monthly intervals (Viz. rate of transpiration, leaf water potential, soil water use, rate of photosynthesis) of fourty two palms was commenced this year. Photosynthetic measurements (with the use of LI-COR 6200 portable photosynthesis meter) of drought tolerant and drought susceptible palms selected in the previous studies revealed that in drought tolerant palms rate of photosynthesis ($P<0.01$), stomatal conductance ($p<0.001$), and stomatal resistance ($p<0.01$) were significantly low compared to the drought susceptible palms as given in the Table-1 . There was a slight increase in sugar and proline concentration in drought tolerant palms, but that increase was not statistically significant. From these observations it became evident that drought tolerance in those palms is mainly achieved through stomatal regulation and not by osmotic adjustment. A contributed research paper based on this work was presented at the Platinum Jubilee of the Central Plantation Crop Research Institute in Kasaragod (ISOCRAD-2) Kerala,India.

Table 1. *Photosynthesis characteristics of the drought tolerant and drought sensitive palms*

Palm type	Rate of Photosynthesis $\mu molm^{-2}s^{-1}$	Inter cellular CO_2 Conc(ppm)	Stomatal resistance s cm^{-1}	Stomatal conductance mol m^2 s^{-1}
Drought tolerant palms	3.85	188.23	1.168	0.938
Drought sensitive palms	5.14	200.10	0.728	1.575
Significancy	$p<0.01$	ns	$p<0.01$	$p<0.001$

Preliminary studies on drought screening of coconut genotypes based on water-use efficiency (WUE) with the use of $^{13}C/^{12}C$ discrimination ratio was commenced at the later part of the year with the assistance from the International Atomic Energy Agency (IAEA) Technical co-operation project SRL/05/026. Dr G D Bowen who arrived under the IAEA expert mission helped to set up preliminary experiments.

C Jayasekara, A Nainanayaka, R D N Premasiri, L R S Silva

Experiment 16.4 **Studies on heritability of drought tolerant character into open pollinated seedlings from selected drought tolerant palms. [Glass house study] (1987)**

The first experiment established to compare genotypic /environment interaction and heritability of drought tolerant characters in self-pollinated " putative" drought tolerant palms and drought sensitive palms was completed after imposing two drying cycles. As reported in the previous Annual Report control pollinated seedlings raised from drought tolerant parents behaved same as the parents, withstanding imposed soil water deficit without physical damage to the seedlings. These selected seedlings were planted at the Bandirippuwa Estate but unfortunately some seedlings were lost due to heavy water logging and cattle damage.

A new experiment was commenced with open pollinated *Tall* seedlings raised from the seednuts obtained from a new set of palms identified as drought tolerant genotypes under the drought screening programme described in experiment 16.3. Rate of photosynthesis and water relations parameters were measured at the field capacity conditions. It is regretted to report that this important experiment has to be terminated half-way and future glasshouse studies have to be suspended until the plant house roof is renovated as roofing material has completely perished.

C Jayasekara, C S Ranasinghe and R D N Premasiri

Experiment 16.7 **Studies on physiology and biochemistry of different varieties and forms of coconut (1989)**

Studies on the rate of photosynthesis and respiration of few cultivars and hybrids of coconut were carried out. Differences in the rate of photosynthesis was observed among some cultivars. *Dwarf x Tall* (CRIC 65) hybrid has reported high photosynthetic rate and high light-use efficiency compare with *TallxTall*. This study is being continued.

C S Ranasinghe, C Jayasekara and P S A De Saram

Experiment 16.9 **Studies on vegetative growth and physiology of Ambakelle special seedlings grown under field conditions (1990)**

Vegetative growth measurements viz. number of leaves produced, seedling height, and girth at collar were taken at quarterly intervals. Leaf area of the newly developed leaves was recorded at six-monthly intervals in order to determine maximum photosynthetic leaf area of the canopy at the time of initial flowering. The rate of photosynthesis and water relations measurements of the seedling were commenced this year. Chlorophyll content in last open mature leaves was also measured.

Experiment is in progress.

C S Ranasinghe, P S A De Saram and R D N Premasiri

Experiment 16.10 **Studies on the effect of canopy and root modification on yield of coconut (1990)**

Recording of button nut numbers, fruit numbers and tagging of newly opened inflorescences were continued at bimonthly intervals. Canopy size of individual treatment were maintained by pruning lower leaves depending on the number of leaves produced during a two-month period.

Root volume was maintained by not allowing to regenerate new roots in the pruned area. The study continues.

C Jayasekara, L R S Silva and A Jayathilake

Experiment 16.11 **Evaluation of field performance of embryo-cultured seedling (1987)**

Growth measurement of embryo-cultured seedlings were continued as reported in the previous years Annual Reports. Out of thirteen *tall*, two *dwarf red* and six *dwarf yellow* and one *dwarf green* seedlings one *dwarf red*, five *dwarf yellow* and the *dwarf green* seedling came into flower during this year. The observations made suggest that these seedlings have taken five and half to six years from the time of transferring to soil for initial flowering. The inflorescences and the nuts developed were found to be normal as ordinary palms raised from the seednuts.

All the seedlings received 2 kg of YPM mixture in three split applications and the recommended cultural practices.

C Jayasekara and R D N Premasiri

PROJECT 25: ESTABLISHMENT AND FURTHER GROWTH OF AMPUTATED POLY-BAGGED SEEDLINGS

Experiment 25.4 Field performance of amputated poly-bagged seedling (1989)

New field experiment was commenced with amputated poly-bagged seedlings and same aged nursery bed raised seedlings during this year. Vegetative growth measurements were recorded at the time of planting. Amputated poly-bagged seedlings were very small compare to the same aged ordinary seedlings at the time of planting.

Preliminary data showed that amputated seedlings were able to catch up growth and reached to the size of the nursery bed raised seedlings within first ten-month-period after transplanting in the soil.

C Jayasekara, A Nainanayake & L R S Silva

3. EXPERT MISSION:

Dr G D Bowen, former Head of Soil Fertility, Irrigation and Crop Production Division/ IAEA and Honorary Fellow at the CSIRO/ Soils Division, Adelaid, Australia carried out an expert mission in the Plant Physiology Division from 01.12.91 - 20.12.91 to assist on ^{14}C labelling work.

4. EXTENSION ACTIVITIES:

Trainees from the National Institute of Plantation Management, Private estate owners and conductors were briefed on the activities of the division.

6. ACKNOWLEDGEMENTS:

The assistance of the staff of the Plant Physiology Division in conducting experiments and the preparation of this report is gratefully acknowledged. Thanks are due to Mr K S Jayasekara and Soil Physics staff for routine neutron probe measurements and to Mr D T Mathes and staff for analysis of data.

MULTI- DISCIPLINARY PROJECTS

PROJECT 17: PREMATURE DECLINE OF PALMS

(PROJECT LEADER - C Jayasekara Ph D)

Participating Divisions: *Plant Physiology Division*
Agronomy Division
Soil and Plant Nutrition Division
Crop Protection Division

General Remarks: During the year experiments conducted to determine possible cause(s) for Leaf Scorch Decline (LSD) were continued with satisfactory progress. The studies on CO_2 assimilation and secondary metabolite synthesis in leaves and roots of LSD palms were commenced this year. Formation of polyphenolic compounds in leaves and roots was investigated with some assistance from the Biochemistry Division, Tea Research Institute. From the studies so far carried out it became evident that root density and root activity were low in LSD affected palms. It was hypothesized that poorly developed/decaying root system in LSD palms may not synthesizing sufficient levels growth hormones required for canopy functions. Based on this hypothesis cytokinin was fed into few roots in healthy and LSD affected palms and visual canopy observations were made.

Experiment 17.1 Studies on internal water relations of Leaf Scorch Decline (LSD) palms (1987).

The studies on water relations of LSD palms were continued. As reported in the previous Annual Reports, measured water relations parameters gave consistently low transpiration rates, high stomatal diffusive resistance and low leaf water potentials in LSD affected palms compared to healthy palms.

Water uptake from individual roots of healthy and LSD affected palms was determined by measuring volume of water absorbed through roots during a known period of time. The observations so far made have not given conclusive results. However, it was evident that the volume of water absorbed within a twenty-four-hour period was very low in most instances (5 ml or less) and in LSD palms the number of active roots per palm was found to be very low compare to the healthy palms.

These studies are being continued.

C Jayasekara, N P A D Nainanayake and 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 continued during this year.

The study on anatomy of healthy and LSD affected palms was continued. This study was rather difficult and time consuming as very small portion of macerated tissue could be examined under the microscope at any occasion.

Two studies on accumulation of polyphenolic compounds in roots and root regeneration in relation to the severity of symptoms using soil core samples were initiated at the later part of this year.

Table 1 *Rate of Net photosynthesis of healthy and LSD affected palms depending on the severity of symptoms.*

Palm type	Mean rate of net photosynthesis for 28 fronds in the canopy (μmol CO^2 m^2 s^{-1})	S D
Healthy	4.28	0.807
Incipient LSD	1.81 a b c	0.586
Mild LSD	0.84 b c	0.586
Moderate LSD	2.08 a b	1.336
Severe LSD	2.39 a	1.570

$P < 0.05$, Same letters denote values are non significant

N P A D Nainanayake, C Jayasekara and L R S Silva

Experiment 17.3 **Determination of net rate of photosynthesis, foliar organic and inorganic nutrients in LSD palms (1987)**

The net photosynthesis of LSD and healthy palms was measured using a LI-6200 photosynthesis meter. Results showed that there was a decreasing trend in

photosynthetic activity of LSD affected palms at the incipient stage itself as given in the Table-1 and with increasing the age of the leaves as given in the Table-2. It is difficult to explain the observed decrease in net rate of photosynthesis of incipient and mild LSD palms than in moderate and severe LSD palms. This study is being further continued as it is necessary to collect data from at least ten palms or more from each status of severity to obtain conclusive results.

Table 2 *Variation in rate of net photosynthesis of different leaf classes within LSD affected coconut palm canopy*

Leaf Class	Mean rate of net photosynthesis (μmol CO_2 m^2 s^{-1})	S D
1-16 (upper whorl)	3.216	1.379
17-21 (middle whorl)	2.060 a	1.646
22-28 (lower whorl)	1.757 a	1.090

$P < 0.05$, Same letter denote values are non significant

Polyphenol assay in green and withered leaves showed that the presence of higher levels of total polyphenolic compounds in withered leaves of LSD affected palms than healthy palms. Total Polyphenol content in fresh green coconut leaves was low and flavanol group poly phenols were the most common in fresh leaves. Preliminary studies on this aspect were carried out with some assistance from the Biochemistry Division, Tea Research Institute, Thalawakelle.

These experiments are being continued with satisfactory progress.

C Jayasekara, N P A D Nainanayake, C S Ranasinghe and W P K K Fernando

Experiment 17.4 **Studies on the effect of root pruning and incorporation of organic manure on LSD palms (1989).**

Yield recording of the palms was carried out at bi-monthly intervals. Water relations parameters were measured at half yearly intervals and the data so far

collected do not show any improvement of water status of LSD palms as a result of the treatments.

The experiment is being continued.

K B Dasanayake, C S Ranasinghe and M Bastian

Experiment 17.5 Studies on nutrients, water and physical aspects of Leaf Scorch Decline in coconut (1990).

Analysis of macro and micro nutrients in the leaves of LSD palms was not continued as sufficient data have been already collected. Nutritional studies carried out so far indicated that LSD in coconut may not be directly related to nutrient deficiencies, but nutrient deficiency may appear as a secondary effect.

As reported in Exp.17.1 LSD palms showed high leaf water deficit compared to that of "healthy" coconut palms. This may be a secondary effect as a result of root decay observed in LSD palms or due to a possible blockage in the vascular system. Studies on the vascular system of coconut palm are rather difficult due to their thickenings, large in number and smaller in size of the vascular elements. The study is being continued.

Table 3 *Estimated Canopy Transpiration of a fourteen (14) year old bearing coconut palm (Soil at field capacity, Pan evaporation 4 mm day^{-1})*

Frond No	Total Frond Area (m^2)	Mean Leaf Water Potential (bar)	Total Transpiration (l of H_2O fronds^{-1} d^{-1})
1-5	15.3	10.0	20.8
6-10	14.6	11.5	19.8
11-15	15.7	15.0	18.6
16-20	16.2	15.0	12.7
21-25	19.7	18.0	10.0
26-30	14.2	18.0	8.2
31-37	23.0	18.0	12.3
Total	118.7		101.4

K S Jayasekara, C Jayasekara, N P A D Nainanayake and L R S Silva

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 and Plant Nutrition Division

General remarks: The role of earthworms in improving the agronomic value and fertility of agricultural lands is widely accepted. With the continued application of artificial fertilizers and the indiscriminate use of pesticides especially weedicides it is feared that the earthworm populations in coconut is being systematically decimated. This preliminary survey is designed to identify the present distribution and variations of earthworm populations in the different agroclimatic zones of the coconut triangle.

Experiment 27.1 **Preliminary survey on distribution and seasonal variation of earthworm populations in coconut soils; coconut triangle (1990)**

The survey, covering six agroclimatic zones within the coconut triangle (Ann.Rept. 1990), was completed during the year. Analysis of the data confirmed the observations recorded earlier. Both earthworm casts and populations per m^2 were significantly ($P < 0.05$) different between the major agroclimatic zones of wet lowcountry and intermediate lowcountry. In general populations in the centre of the coconut square were found to be greater than that in the manure circle. The considerable variation observed was probably due to variation in estate management practices. Similar trends were also recorded for counts of earthworms per m^2 between seasons, but the counts for casts showed an opposite trend. The latter effect was probably due to wash off following heavy rain.

P A C R Perera, M M Keerthi & D C L Pathirana

PROJECT 28 - IMMATURE NUTFALL

(Project Leader - C Jayasekara Ph D)

Participating Divisions: *Biometry Division*
Soils and Plant Nutrition Division
Crop Protection Division
Plant Physiology Division

General Remarks: The experiments conducted on several disciplines were continued with satisfactory progress. Routine measurements of total canopy net photosynthesis accomplished with light interception and water relations of the coconut palm canopy provided an understanding on total photosynthetic productivity of the coconut palm canopy and photosynthetic capacity of individual leaves with age. Further, dry matter accumulation during nut development and respiratory losses of assimilates from leaves and developing nuts were also studied.

A study on distribution pattern of assimilated carbon in bearing coconut palms was conducted by labelling a single leaf with 5 m ci of $^{14}CO_2$ and tracing the distribution pattern of assimilate with time. An experiment to study the biochemical changes taking place during the development of nuts and at the time of immature nutfall was commenced at the later part of the year.

The observational trial conducted last year to assess diurnal and seasonal variation of immature nutfall was terminated early this year after collection of sufficient data. Some observations made on this preliminary trial was reported in the previous Annual Report.

Experiment 28.2 Studies on nutrient and water relations in immature nutfall of coconut (1990)

Water extraction pattern of coconut roots was studied using a neutron probe and it was observed that during a rain-free period of three weeks, coconut roots extract soil water mainly from soil layers below 1 m depth. Average root water extraction at 1 m away from a coconut palm in deep sandy soil at Bandirippuwa Estate was found to be 91 mm of water during a 34 days of rain free period.

As reported in the previous Annual Report total canopy transpiration from two fourteen-year-old *Dwarf x Tall* hybrid coconut palms were recorded at monthly intervals. Total canopy transpiration varied with the soil water availability as well as the climatic conditions. Table-3 gives the estimated rate of transpiration for different fronds in the canopy of a fourteen-year old bearing *Dwarf x Tall* hybrid coconut palm under the weather conditions prevailed at Bandirippuwa Estate. Total water loss by canopy transpiration from same aged palms during different months of the year are given in Table 4.

The studies are being continued.

Table 4 *Water loss by canopy transpiration(l of H_2O canopy^{-1} d^{-1}) in fourteen-year old Dwarf X Tall hybrid coconut palms at the Bandirippuwa Estate.*

Palm	February	May	July	Aug	Nov	Dec
A	62	110	75	106	-	-
B	82	133	-	76	100	65

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)**

The collection of insects visiting the coconut inflorescences were completed for three seasons during the year and the insect collections in respect of two seasons have now been placed in their respective orders (Table 5).

These results indicate that, of the insects visiting the coconut inflorescences, the numbers in the order *Diptera* are significantly greater ($P < 0.05$) than those for other orders studied.

These studies are being continued.

P A C R Perera, M M Keerthi and D C L Pathirana

Experiment 28.4 **Dry matter production in leaves and specific mass transfer into developing bunches (1990).**

In situ measurement of net photosynthesis of individual leaves in the canopy was carried out using the LI- 6200 photosynthesis meter. Estimated total net canopy photosynthesis of a fourteen-year-old *Dwarf x Tall* hybrid coconut palm is given in the Table 6. For this estimation total light exposure period was considered as eight hours as stomata in coconut palm leaves completely close by 3 o'clock in the

Table 5. *The insects visiting the coconut inflorescence; classed under major representative orders*

Order	Mean insects caught/trap/24hr															
	IL_1		IL_3		WL_1		WL_2		WL_3		WL_4		DL_1		DL3	
	S_1	S_2	S_1	S_2	S_1	S_2	S_1	S_2	S_1	S_2	S_1	S_2	S_1	S_2	S_1	S_2
1.	5.6	4.7	3.9	2.6	4.9	4.9	3.3	6.1	3.6	4.9	14.3	11.4	3.6	6.1	1.9	9.6
2.	23.0	12.8	22.4	14.1	16.4	16.7	11.5	22.5	15.7	19.0	34.6	35.9	8.4	30.1	9.8	42.1
3.	1.1	0.6	0.9	4.8	0.5	0.4	0.6	0.6	0.8	1.0	0.6	0.7	0.5	1.9	0.8	1.3
4.	12.9	16.7	6.9	7.8	8.3	9.0	9.8	7.5	5.7	9.3	16.2	10.1	10.4	7.6	3.6	10.4

Significance: Between seasons - NS; Between zones - NS; Between orders - S ($P<0.001$)
Orders: 1. Coleoptera; 2. Diptera; 3. Homoptera; 4. Hymenoptera
IL - Intermediate lowcountry; WL - Wet lowcountry

evening. The observations revealed that during the rainy months of May, June and July in the South - West monsoon and in December net rate of photosynthesis was considerably decreased compare to the other months of the year. Even though, soil was saturated with water during this period, photosynthesis was reduced due to limitation of availability sunlight due to heavy cloud covers and over casting.

Table 6 *Estimated total net canopy photosynthesis (g of C canopy^{-1} d^{-1} of a fourteen-year old Dwarf x Tall hybrid coconut palm*

No of fronds	Net photosynthesis(g of C fronds/day) for different leaf classes				
	May	July	Aug	Nov	Dec
1-5	44	60	145	150	127
6-12	84	65	194	215	164
13-15	28	28	56	60	49
16-25	64	57	149	155	82
26-32	22	29	42	58	25
33-39	01	03	23	17	12
Total	243	242	609	655	459

Considering 8 hr exposure period to light

Dry matter accumulation into developing bunches within a thirty-day- period was studied at three occasions by using harvested nuts at different stages of maturity. Assuming equal distribution of assimilates within a thirty-day-period the estimated accumulation of total dry matter into developing bunches within a day in July, August and October were found to be 608, 482 and 294 g respectively. Thus, except in July less than one third of the daily assimilated carbon in the canopy was sufficient to supply required assimilate for developing nuts (regardless of the assimilate synthesized by nuts themselves).

Labelling of a single active frond in the canopy with 5 m ci of $^{14}CO_2$ and tracing the labelled assimilate in various active sinks, respiratory losses of labelled assimilate from leaves with time revealed that partitioning of current assimilate into developing bunches greatly depend on the sink activity. Three hours after labelling, highest activity in nut water was observed in third and fourth bunches. Those nuts were at active filling stage of kernel and nut water. Hence, it is possible to assume

that partitioning of current photosynthate depends on the demand for assimilates in developing bunches. Within a week gradual build up of activity in all bunches was observed. The soil core samples were taken up to a depth of 1 m and at different distances from the coconut bole. The root samples were collected from soil cores and observations revealed that more fine roots were confined to 1.5 m away from the bole and within twenty four hours more ^{14}C activity was confined to those fine roots due to the translocation of labelled assimilate.

C Jayasekara, C S Ranasinghe, K S Jayasekara & W P K K Fernando

Experiment 28.5 Development of nuts in relation to climatic factors.

The aim of this study is to determine the biochemical changes occurring within the nuts in relation to various stress conditions. This experiment was commenced at the later part of the year. Six palms were selected from the same experimental site at Bandirippuwa Estate and no of female flowers in developing inflorescences were recorded.

In order to study biochemical changes occurring in developing nuts amino acids were first analysed by the method of High Performance Liquid Chromatography (HPLC). Glycine, alanine, proline, valanine and lysine were the amino acids found in four months old tender nuts. With increasing the maturity, number of amino acids in nut water was increased up to fourteen amino acids and their concentrations were also increased with the age of the nuts. Similarly sugars in nut water was studied by HPLC method. Similar analysis will be carried out for fallen immature nuts to determine the changes occurring prior to nut fall. Attempts were made to analyse the growth hormones in tender nut water by using available facilities. However it was failed due to difficulties in concentrating the hormone exist in minute concentrations.

C Jayasekara, C S Ranasinghe, & W P K K Fernando

REPORT OF THE INFORMATION SERVICES DIVISION

Assistant Information Officer - J L J G Pinto

1. GENERAL

The work of the division continued satisfactorily. Assistance was provided to the coconut estates sector. Many coconut estates were inspected and advice on improvements was given. Training programmes and other informative activities were sucessfully conducted.

2. PUBLICATIONS

2.1 Technical Publication

Volume 8 of COCOS was published. Annual Report for 1989 was printed and made available

2.2 Extension publication

Pol pawath	-	Volume 13 No 1 (in preparation)
Coconut	-	Pulletin Volume 7 No 1 (in preparation)

2.3 Advisory Circulars

The following were published:

A 7, A 8 and B8 in Sinhala
A 6, A 7, A 8, A 9 and B 8 in English
A 6, A 7, A 8, A 9 and B 8 in Tamil

Reprinting of 10 advisory circulars in sinhala were with the printer at the end of the year.

Book on Coconut Cultivation was published in English.,

The sinhala version of this book was in print during the latter part of the year.

3. ADVISORY ACTIVITIES

The division continued to provide free technical advisory assistance to coconut estates 50 ac and above. Many of such estates were visited and necessary

advice was given. This also included estates belonging to JEDB, NLDB and SPC. The total number of estates registered at the end of the year stood at 300.

Advisory assistance was also provided to many owners and home gardners who also requested such advice.

Requests for CRI Advisory Circulars increased during the year. Most of these requests were from agriculture students.

4. TRAINING PROGRAMMES AND STUDY TOURS

4.1 Following training programmes were conducted during the year:

(a) Attachement training for 03 batches of students from the National Apprenticeship Board.

(b) One student from NAB Stenography Training Centre Katunayake in 'on the job' training in stenography (English).

(c) Attachement training for two students from Joseph Vaz College, Wennappuwa, under practical orientation programme, who have gained admitance to universities.

(d) Attachment training for one officer from Sri Lanka Cashew Corporation from 15 January to 15 May.

(e) Assistance was also given to 03 final year economics students from university of Kelaniya, and to 05 agriculture students from Aquinas College Colombo and to one student from Postgraduate Institute of Agriculture Peradeniya to collect data on various aspects of coconut for edition of their independent reports.

(f) Training programme for a batch of 22 middle level management staff of coconut estates from 3 June to 11 June was successfully conducted and certificates of participation were awarded.

(g) CRI component of the NIPM for a batch of 24 Assistant Superintendents/Managers of the JEDB and SLSPC from 16 September to 27 September.

(h) CRI component of the NIPM for a batch of Managers/Supervisors and field officers of privately owned coconut plantations from 9 December to 14 December.

(i) A programme for Regional and Assistant Regional Managers of the CCB held at CDTC - CRI provided the resource personnel - 25 June.

4.2 Following study tours were arranged for persons indicated:

(a) Group of ADB Consultants on Agricultural Extension study - 19 February.

(b) Mr Vivencio C Gallego of the Philippine Coconut Authority from 16 to 25 May.

(c) Group of project officers from the National Institute of Education March 25 and 26.

(d) Dr Rolf Handten Agronomist Buntehof Research Station West Germany - 26 April.

(e) Group of 15 Agriculture Diploma students from Poly Technic Gampaha,

(f) Batch of 39 second year students from the school of agriculture Pelwehera, Dambulla, 13 September.

(g) For a German Botanic group on 15 August.

(h) Dr Etsugi Hamaya of Japan on 14 October.

(i) A batch of 10 Chemistry students from the University of Sri Jayewardenapura 17 October.

(j) Dr Ebert and Rillo of the Philippine Coconut Authority 3- 16 December.

(k) CRI staff officers to Minneriya and Maduru Oya Farms on 1 and 2 May.

(l) Dr Wadasinghe and students from the University of Peradeniya on 14 October.

5. SEMINARS, LECTURES, FIELD DAYS/EXHIBITIONS

A seminar on Importation of Coconut Germplasm to Sri Lanka was held at

BMICH Colombo on 10 September, 1991. This was attended by reputed Sri Lankan Scientists. Papers were presented by the Director, Coconut Research Institute,and the Head, Genetics & Plant Breeding.

5.1 For the first time, executive officers of the CRI and their families where taken to Research and Demonstration Farms at Minneriya and Maduru oya.

5.2 A series of lectures was delivered on the activities and t he new recommendations of the CRI to Assistant and Regional Managers of the Coconut Cultivation Board, and Project Officers of the National Institute of Education at the Coconut Development Training Centre on March 26 and on June 25 respectively.

5.3 A series of informal discussions amongst Research Divisions on new recommendations and research highlights were organised.

5.4 Presentations by CRI officers on foreign study tours were organized.

5.5 The following field days were conducted:

For the Directorate and and 25 Superintendents of the JEDB at Makandura Seed Garden, Gonawila - 01 February

For members of the Board of Directors and 25 Superintendents of the NLDB at Andigama Farm. Giriulla and at Goluwapokuna Estate, Udubaddawa - 09 March.

For 25 Assistant Managers and Managers of the NLDB at CRI Lunuwila an at Makandura Seed Garden, Gonawila - 15 May.

For 45 Middle Level Management Staff of NLDB at CRI Lunuwila and at Makandura Seed Garden, Gonawila on 21 May

Field Day at Minneriya Research & Demonstration Farm at Maduru Oya - 22 -23 June.

A Field for Regional Managers of the CCB at Ratmalagara - 06 September.

5.6 Exhibitions

The Institute participated in the following exhibitions during the year:

At Sevavanitha Organisation, Town Hall, Nattandiya - 23 January.

At Gam Udawa Exhibition at Kamburupitiya - 23 June to 03 July.

At the Techno 91 Exhibition at BMICH, Colombo 11 - 13 October.

At the SLAAS, SAARC Science exhibition at Univeristy of Colobmo 7 - 10 November

At Joseph Vaz College, Wennappuwa on 4 - 5 December.

6. PHOTOGRAPHY

Transperancies and photographs required for research divisions were prepared and supplied.

7. MUSEUM

The museum ws maintained satisfactorily with more additions.

REPORT OF THE LIBRARY AND COCONUT INFORMATION CENTRE

Librarian/Project Leader - M J C Perera, A L A

1. GENERAL

The Library had to limit its services during the year due to a major renovation progrmme started in November, 1990. Financial assistance for this programme was provided by the World Bank funded Agricultural Research Project. However, services rendered by the Coconut Information Centre (CIC) continued uninterrupted.

Mrs P D U C Dharmapala, Library Assistant left for employment abroad with effect from 25.03.91. Mrs P A S F Perera, Librarian and Miss S N Gunathileka acted for her during her absence. Mrs Dharmapala reported back for duty on 12.11.91.

2. ACQUISITIONS

The Library stock recorded 4720 books as at 31.12.91. New additions to collection during the year was 26. Orders have been placed with Agents for 27 more books.

100 periodical titles including 13 annual reports have been received and of which 27 titles were on subscription and the rest received were on exchange and on complimentary basis.

231 records relevant to coconut information were identified from various sources of which 105 items including 5 postgraduate thesis were included into the literature collection of the centre. Requests have been made for the missing items from authors and various organizations and only 26 have been responded.

3. SERVICES

3.1 Routine Service

Lending and inter library loan services had to be completely cut off due to non accessibility of materials. Acquisitioning of new materials and their processing continued as usual. Research staff were regularly alerted for information relevant to their work. Information services to the staff carried out by providing literature searches and material. Current Awareness Service to coconut literature for the Asian and Pacific Coconut Community (APCC) Newsletter was provided regularly.

3.2 External Services

IRDC/APCC Integrated Coconut Information Network: CIC services have been requested by the APCC for compilation of annual and retrospective bibliographies and for provision of coconut literature on microfiche for the above information project. Compilation of the annual bibliography for the period 1987/88 has been completed and maththe compilation of the retrospective bibliography for the period 1965-90 on 'Farming Systems' are being processed. 3000 microfiche items for literature on coconut have been supplied to the APCC.

Under the above information project a training programme on the use of micro CDS/ISIS software package on processing of coconut information was organized by the APCC for the South Asian Information Specialists of the APCC member countries and was held at the Hotel Taj Samudra, Colombo from 23-29 August. Mr M J C Perera served as a resource person at this workshop and mae a full day presentation on the role of CIC on development of an International Coconut Information Centre followed by a demonstration of the CIC databases using micro CDS/ISIS software package. Mrs P A S Perera organised the demonstration.

Agricultural Information Network (AGRINET): Coordination activities of the above network system was entrusted to the CRI Library with the Council of Agricultural Research Policy (CARP) serving as the sponsoring agency. This network systems was earlier coordinated by the Natural Resources Energy and Science Authority (NARESA).

Since taking over the coordinating activities by the CRI library several meetings of the member libraries were convened to reorganise the activities. Surveys conducted to were ascertain periodical title holdings of the member libraries and user needs and a database created using micro CDS/ISIS software package for holdings of periodical titles in member libraries, periodical title allocation for Selective Dissemination of Content Page (SPCP) services and user needs. This network system has 24 member libraries with more than 520 unique periodical title holdings and more than 500 users.

A successful User Seminar was also conducted for Kandy region users at the Postgraduate Institute of Agriculture on 28 November which was attended by nearly 100 users. Objective of the seminar was to create user awareness on the activities of the AGRINET and information resources and developed information technologies available in the country.

4. TRAINING

Mrs P A S F Perera, Miss T I I Peiris and Mr D B Jayasinghe followed a

3 day training programme in May on 23, 24 and 30 conducted by the Keels Business Systems on Disk Operating Systems (DOS) of IBM-PC Computers. Miss T I I Peiris and Miss S N Gunathillake attended a five day training on the use of 'Ventura' software package conducted by the Institute for Computer Technology (ICT), University of Colombo from 22 - 26 July.

5. FURNITURE AND EQUIPMENT

Following equipment and furniture were procured during the year:

(a) IBC-PC Microcomputer with 1 MB memory (APCC donation).

(b) Laser Printer-Hewlett Packard Laser jet III and Scanner Hewlett Packard Scanjet plus.

(c) 10 units of metal shelves.

6. PRINTING AND BINDING

Binding of 450 copies of the Report of the Coconut Research Board for the year 1990 was partially completed and 2000 copies of medical aid forms printed. Further, 950 copies of the Report of the Coconut Research Board for 1988 - 89 were bound for the institute.

REPORT OF THE ESTATES MANAGEMENT DIVISION

Manager (Estates) - P S Liyanagama, B Sc (Agric)

1. General

The following nine units were administered by the Division:

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

Passekudah Research & Demonstration Farm is not functioning since June 17, 1990 due to the escalation of terrorists' violence in the region. Staff of the Farm are redeployed at the Head Office. Possibilities of reviving the Farm were explored with no success towards the end of the year. Rest of the units were maintained in good order. The recommended cultural practices were carried out. Ground conditions were well maintained and adequate soil and moisture conservation measures were taken.

Nut yields recorded an overall drop of 31 percent over the previous year's crop which could be attributed to the sub-normal rainfall received during the previous two consecutive years. However, there is a marked improvement this year especially in regard to the distribution of rainfall with prospects for a better crop in the ensuing year.

All stations have now changed over to the Differential Fertilizer Recommendations (DFR) provided by the Soils and Plant Nutrition Division already indicating signs of efficient management of palm nutrition and fertilizer costs. General performance of the estates etc. are given in Table 1.

2. BANDIRIPPUWA ESTATE, LUNUWILA

(Superintendent: Mr M R L A Perera)

District : Puttalma
Electorate : Wennappuwa
Agro-climatice Zone : Semi-Wet Intermediate

Table 1 *General Performance of the Estates, Seed Gardens etc.*

		BE	RE	PRS	WE	ISG	MK	MO	MIN	PRS	TOTAL
1.	**Extent (ha)**										
Coconut	Mature	72.0	48.0	55.5	16.2	91.3	-	-	4.1	8.1	295.2
	Immature	51.9	50.4	10.9	-	48.2	53.9	57.5	8.1	24.2	305.1
TOTAL		123.9	98.4	66.4	16.2	139.5	53.9	57.5	12.2	32.3	600.3
Nursery		1.6	-	-	-	-	-	-	-	-	1.6
Other crops		-	4.1	1.8	-	-	-	-	-	2.0	7.9
Jungle		-	3.2	-	-	309.8	-	20.0	-	-	333.0
Reservoir			-	-	-	-	2.0	2.4	-	-	4.4
Roads & Buildings		22.3	2.0	2.5	1.6	3.0	2.0	4.0	0.4	3.6	41.4
TOTAL		**148.1**	**110.5**	**85.8**	**17.8**	**456.3**	**58.3**	**85.0**	**50.6**	**47.4**	**1059.8**
2.	**Cencus of Palms**										
Bearing palms		8222	6350	6756	2214	14179	7342	164	443	1200	46870
Young Palms		6521	8014	8553	134	3349	2702	3980	78	1889	30220
Seedlings		868	-	401	-	2327	-	1370	1219	-	6185
Dud palms		108	49	160	53	280	-	-	-	-	650
Vacancies		1209	32	763	125	6012	123	3117	678	2100	14159
TOTAL		**16928**	**14445**	**11633**	**2526**	**26147**	**10167**	**8631**	**2418**	**5189**	**98084**
3.	**Crop Data**										
1991 - pick 1		47696	31745	40681	18155	61012	11550	-	1910	-	212749
pick 2		47696	31745	40681	18155	61012	11550	-	1910	-	212749
pick 3		108544	50803	47228	51320	70664	18885	169	4203	-	351816
pick 4		74417	44156	29611	38474	65056	17653	196	2840	-	272403
pick 5		62226	43419	34497	34476	51474	9052	214	5525	-	240883
pick 6		45937	26234	36771	21808	71007	14216	422	2417	-	218813

Table 1 (Contd.)

		BE	RE	PRS	WE	ISG	MK	MO	MIN	PRS	TOTAL
1991 Total		**408894**	**242772**	**239248**	**190230**	**393950**	**94322**	**1075**	**18580**	-	**1589071**
1990 Total		535644	550359	435712	166671	458133	17468	12	9053	-	2173052
Difference + %		-24	-56	+14	-14	-	-	-	-	-	26.8
1991 *Estimate*		400000	500000	400000	180000	400000	70000	-	10000	-	1960000
Previous 5 years average		407435	631282	546501	162303	818928	-	-	-	-	2566449
Nuts/palm	1990	62.9	72.7	65.0	80.3	42.2	-	-	-	-	49.2
	1991	49.7	38.2	35.4	85.9	85.9	27.8	-	-	-	33.9
Yield/ha	1990	10106	10142	8220	10288	5018	-	-	-	-	7129
	1991	7685	5005	4313	11743	4315	-	-	-	-	5383
4. Crop disposal											
Sold		282102	169036	204693	153204	33299	3809	-	10314	-	856457
Converted to copra		19394	6738	16603	7404	84889	4210	-	5265	-	144503
Research		487	14316	-	-	3722	-	-	-	-	18525
Seednuts		822	1510	85		- 209311	78164	1075	-	-	290967
Staff issues		49126	11778	5523	2175	18043	3419	-	1260	-	91324
Rejections		18506	17156	122344	5639	25939	-	-	582	-	101832
Awaiting Sale		38457	22238	-	21808	18747	-	-	582	-	101832
Total		408894	242772	239248	190230	393950	94322	1075	18580	-	1589071
5. C O P (Rs/1000 nuts)		**2305**	**1246**	**2925**	**2170**						
6. N S A (Rs/1000 nuts)		**3655**	**3540**	**3321**	**3681**						

Table 2 *Rainfall (mm) with Number of Wet Days in Parenthesis*

	Bandirippuwa Estate				Rathmalagara Estate				Pothukulama Estate			
	1990		1991		1990		1991		1990		1991	
January	201.8	(5)	37.7	(6)	185.5	(6)	36.2	(3)	203.4	(5)	124.5	(5)
February	16.8	(1)	12.2	(2)	8.3	(1)	12.2	(1)	0.0	(0)	0.0	(0)
March	84.3	(8)	97.7	(9)	96.2	(5)	88.8	(7)	30.4	(3)	98.5	(9)
April	73.8	(8)	90.3	(10)	37.7	(6)	104.4	(10)	28.9	(2)	111.4	(8)
May	227.7	(16)	481.5	(14)	114.6	(13)	375.7	(9)	160.5	(10)	124.1	(6)
June	29.0	(5)	269.4	(22)	12.6	(4)	274.7	(23)	9.1	(1)	246.9	(11)
July	156.3	(13)	105.8	(9)	92.7	(10)	38.1	(5)	79.5	(4)	38.7	(2)
August	0.3	(1)	22.6	(8)	0.0	(0)	16.1	(3)	0.0	(0)	16.2	(2)
September	11.9	(8)	59.3	(8)	17.4	(2)	43.0	(5)	2.0	(1)	21.4	(4)
October	395.1	(23)	309.2	(21)	389.2	(17)	213.4	(21)	358.3	(16)	281.1	(18)
November	623.3	(17)	161.4	(13)	434.6	(14)	175.8	(10)	284.4	(10)	178.1	(11)
December	90.2	(10)	29.1	(7)	76.7	(8)	82.2	(5)	56.9	(4)	96.4	(5)
Total	**1911.5**	**(115)**	**1676.2**	**(129)**	**1465.5**	**(86)**	**1460.6**	**(102)**	**1213.4**	**(56)**	**1337.3**	**(81)**

Table 2 (Contd.) *Rainfall (mm) with Number of Wet Days in Parenthesis*

	Walpita Estate				ISG Ambakelle				Makandura Seed Garden			
	1990		1991		1990		1991		1990		1991	
January	201.8	(5)	37.7	(6)	185.5	(6)	36.2	(3)	203.4	(5)	124.5	(5)
February	16.8	(1)	12.2	(2)	8.3	(1)	12.2	(1)	0.0	(0)	0.0	(0)
March	84.3	(8)	97.7	(9)	96.2	(5)	88.8	(7)	30.4	(3)	98.5	(9)
March	136.3	(8)	173.9	(9)	34.0	(5)	116.0	(9)	138.9	(8)	188.4	(9)
April	89.1	(3)	137.6	(7)	38.8	(5)	147.9	(10)	91.0	(4)	112.9	(12)
May	199.3	(14)	443.7	(10)	145.	(9)	182.5	(8)	175.1	(15)	616.9	(12)
June	87.2	(10)	428.5	(20)	8.4	(1)	236.5	(17)	48.8	(9)	438.9	(23)
July	190.3	(12)	164.3	(9)	67.7	(10)	29.2	(6)	224.9	(15)	137.8	(9)
August	0.0	(0)	54.9	(6)	0.0	(0)	17.1	(8)	0.0	(0)	41.6	(7)
September	21.0	(2)	91.0	(2)	9.5	(1)	25.8	(4)	10.2	(2)	110.0	(7)
October	331.0	(19)	401.1	(12)	288.6	(17)	221.6	(21)	416.3	(21)	313.0	(14)
November	592.2	(5)	144.5	(12)	306.7	(14)	208.1	(110	694.1	(13)	116.5	(12)
December	157.0	(5)	65.2	(4)	59.2	(8)	151.5	(8)	103.3	(6)	26.3	(4)
Total	**1896.2**	**(95)**	**2235.3**	**(99)**	**1180.1**	**(75)**	**1380.2**	**(107)**	**2100.89**	**(98)**	**2160.8**	**(114)**

Table 2 (Contd.) *Rainfall (mm) with Number of Wet Days in Parenthesis*

	Maduru Oya Seed Garden				Minneriya Farm			
	1990		1991		1990		1991	
January	276.8	(7)	290.5	(9)	236.9	(6)	138.9	(9)
February	34.0	(3)	30.3	(3)	73.3	(3)	2.9	(1)
March	66.0	(1)	200.0	(5)	148.2	(6)	96.5	(6)
April	54.5	(3)	27.8	(3)	152.1	(5)	26.9	(2)
May	80.8	(6)	21.0	(4)	168.6	(4)	24.8	(3)
June	0.0	(0)	10.5	(5)	0.0	(0)	5.4	(1)
July	31.3	(2)	1.5	(1)	20.8	(1)	4.9	(1)
August	101.8	(4)	80.0	(2)	105.1	(6)	25.0	(2)
September	174.5	(7)	114.8	(4)	162.9	(3)	72.1	(3)
October	313.8	(12)	173.8	(10)	222.2	(10)	290.8	(7)
November	108.8	(8)	358.0	(16)	104.9	(3)	237.0	(12)
December	581.3	(15)	581.3	(14)	337	(17)	325	(9)
Total	**1823.6**	**(68)**	**1889.5**	**(76)**	**1732.6**	**(68)**	**1250.8**	**(56)**

Only 58% of the planted area is in production whilst the balance (51.9 ha) is young plantations (Table 1).

Rainfall: The total rainfall (1676.2 mm) indicates a decrease of 235.3 mm (12.3%) over that of 1990. However, the number of wet-days had been increased from 115 to 129 with a better distribution throughout the year (Table 2).

Nut Yields: The total nut yield for the year (408 894) is 24% on par with the average yields of the past (Table 1).

Disposal of crops: The coconut produce of the estate was disposed mainly through brokers as husked nuts for processing.

Field Operations:

.1 **Manuring:** Bearing palms were manured during Maha season with the DFR at Urea 1/5 Kg, ERP - 0.5 Kg; SP-0.2 Kg; MP-1.8 Kg and Dolomite-5.0 Kg.

Seedlings were manured with YPM at various rates from 1.5 Kg to 2.5 Kg depending on the age and at 1.0 Kg Dolomite per each seedling. Experimental plantations were manured as per their requirements.

.2 **Weed Control:** Ground conditions were maintained in good order. Weeding was done mainly by employing Rotaslasher in four rounds for the year. Manure circles were kept free of weeds using herbicides.

.3 **Soil and Moisture Conservation:** Palm bases were kept well covered with an effective mulch of coir dust, coconut husks, weed trash, coconut fronds etc. Husk burying was restricted to 103 semi-circular trenches of 90 x 60 x 60 cm in field No. 9. Existing cover crops were well maintained. No new contours were opened but reconditioned them where necessary.

.4 **Fences:** Perimeter fence approx. 20 km was well maintained. About 1700 m of the fence in field Nos. 1, 7 and 8 were reconditioned using new posts and barbed wire. Routine maintenance of the fence was carried out as required and the fence was kept free of creeping weeds using herbicides. Incidents of wilful damages to the fence were negligible.

.5 **Roads and Paths:** Estate roads were maintained in food order. Field roads were kept free of weeds using herbicides. A new field road was opened up on the northern boundary of field No. 9.

.6 **Replanting:** No new plantings were done during the year. All new clearings

were well maintained. 290 palms of the old stand remained in field No. 3 young plantation were uprooted and removed by tender.

.7 Buildings, Machinery etc: Vehicles and equipment were satisfactorily maintained. Estate received two new motor-cycles (YAMAHA 125 RX) under the ARP. Altogether there are four motor-cycles, one double-cab pick-up, five tractors and a hand tractor at the estate. Estate workers repaired three tractor trailers (44 Sri 1272, 46 Sri 2257, 46 Sri 1427) that were out of commission of one third the estimated cost of repairs by the work-shops saving about Rs. 25,000/- for which those workers received a commendation.

.8 Tree planting: Estate planted 5149 trees other than coconut consisting timber trees, NFTS and horticultural plants.

.9 Dairy: Herd strength by end of the year was

Cows	26
Heifers	29
Bulls	02
Bull calves	12
Total	**69**

Disposal of milk was mainly to the institute staff not concessionery rates and the surplus was sold to the milk collecting centre. Disposal figures are given below.

Sold to the staff	
(a) at concessionary rate Rs. 2.50	12 580 1/4 l
(b) at concessionary rate Rs. 5.00	831 1/2 l
Sold to collecting centre	5 732 1/2 l
Total production	**19 144 1/4 l**

.10 Costs and returns: Cost of Production (COP) for the year was Rs. 2,305/- per 1000 nuts produced and the Net Sales Average (NSA) was Rs. 3655/-.

.11 General: The general performance of the estate continued to improve for the second consecutive year realising substantial profits after a long non-profit making period. Security status of the estate greatly improved. Maintenance of books and records and general office work satisfactory.

3. RATHMALAGARA ESTATE, MADAMPE
(Superintendent: Mr G Vithanage)

District	:	Puttalam
Electorate	:	Chilaw
Agro-climatic zone	:	Semi-dry Intermediate Zone

Excepting for 2.3 ha of reserved jungle the entire plantable land of the estate is under coconut. Of this a highly disproportionate share (51%) is under immature coconut.

Rainfall: The total rainfall for the year is more or less the same as that of previous year but the number of wed days is increased by 17% with a better distribution.

Nut yields: The total nut yield for the year (242 772) is 56% less than that of the previous year and 62% less than the past average.

Disposal of crops: Crop was disposed mainly through brokers as husked nuts for processing.

Field Operations:

.1 **Manuring:** Bearing palms (6350) and young palms (8014) both were manured as per the DFR at various NPK plus 3 kg of dolomite.

.2 **Weed Control:** Weeds were kept well under control. Slashing with tractor and cheddy weeding were done in four rounds for the year. Herbicides were used to control noxious weeds and to maintain manure circles free of weeds.

.3 **Soil and Moisture Conservation:** Husk burying programme hand to be curtailed due to restricted funds. However, 417 nos. of semicircular husk trenches (90 x 60 x 60 cm) were completed in fields No. 1, 2 and 3 young plantations. One section of field No. 8 mature stand where the soil is hard type surface mulching was done with coir dust and in wet weather incorporated it into the soil. An effective mulch was maintained in palm bases covering a greater circle.

.4 **Fences:** Renovated 500 of the perimeter fence and another 4000 m were cleared and kept in good order, using herbicides to keep them free of creeping weeds. Perimeter fence infield No. 5 needs early attention.

.5 **Roads and Paths:** All field roads were maintained in good order. Herbicides were used to keep them free of weeds. 700 m of new roads were made during the year.

.6 **Replanting:** 7.3 ha in field No. 5 were replanted in May using polybagged CRIC-60 seedlings to establish a nutritional trial conducted by the SPN Division.

.7 **Buildings, Machinery etc:** The roof of Watcher's quarters No. LC-1 in field No. 3 blown off by a gale was replaced. Repairs to quarters No. IAS-1 is in progress. Rest of the houses were maintained in good order. An engine overhaul was done on estate vehicle 28 Sri 3039 Land Rover. Two tractors are awaiting repair and rest of the vehicles are in good order.

.8 **Nursery:** The following were laid in polybags during the year:

CRCI 60	:	5782 seednuts
CRIC 65	:	300 seednuts
Dwarf Red	:	337 seednuts
King coconut	:	485 seednuts

Sales during the year:

CRCI 60	:	6936 seedlings
CRIC 65	:	53 seedlings
Dwarf Red	:	05 seedlings

(@ Rs. 25/ - realising a revenue of Rs. 174 850/-)

.9 **Costs and Returns:** The Cost of Production and Net Sales Average were Rs. 1246/- and Rs. 3440/- respectively.

.10 **General:** Estate was maintained in good order the visitors made remarks.

4. POTUTHUKULAMA RESEARCH STATION, PALLAMA

(*Superintendent: Mr D M Pathirage*)

District	:	Puttalam
Electorate	:	Anamaduwa
Agro-climatic zone	:	Semi-dry Intermediate Zone

66.4 ha out of the total extent of 85.8 ha are planted to coconut of which 16% (10.9 ha) is immature. 4.1 ha left unplanted owing to a land dispute and another 11.0 ha are kept reserved for future planting by research. No further land is available for planting.

Rainfall: Total rainfall for the year indicates a 10% increase with more no. of wet days (81) compared to the previous year (56), resulting in a slightly improve distribution.

Nut yields: Total crop for the year (239248) is 45% less than that of the previous year (435 712) and 56% less than the past average, which can be attributed to the unfavourable weather conditions prevailed for the past two consecutive years. However, a significant improvement in yields can be expected in the ensuring year.

Crop wad disposed mainly as fresh nut through brokers.

Field Operations:

.1 Manuring: The mature stand 6636 palms were manured as per the DFR. PK and Mg were applied in dry weather followed by urea in rainy season. Young Plantations were manured with YPM plus dolomite in two split doses as per the recommendations. Mg-deficient palms were identified and treated with extra dose of dolomite and kieserite as recommended by the SPND Division.

.2 Weed Control: Ground conditions were satisfactorily maintained by performing four rounds of weeding mainly be mechanical slashing by tractor. Noxious weeds such as Imperata cylindica, Penicitum polystachion, Panicum repense were controlled using herbicide glyphosate. Palm bases were kept free of weeds using grammoxone. Selective cheddy weeding was done manually at intervals where necessary.

.3 Soil and Moisture Conservation: Husk burying was done in 534 pits of 150 x 90 x 90 x 90 cm in fields No. 1, 2, 3, 4 and 10. The entirety of the balance husks were used for mulching seedling bases in fields No. 14 and 15. In respect f the fields palm bases were mulched with fallen fronds, weed trash etc.augmented with coir dust mulch in greater circle 2 ft beyond the standard manure circle, in field No. 6. Existing cover crops were well maintained.

.4 Fences: Boundary fence was maintained in good order. Wilful damages were minimal. Mayosa seedlings were planted along the southern boundary of field No. 15. Vacancies of the live-fence were infilled with gliricidia stakes.

.5 Roads and Paths: All field roads were well maintained. Field road along the southern boundary of fields No. 14 and 15 was improved and made motorable. The new main road in the sam two fields was further improved using 42 cubes of gravel.

.6 Young Plantations: No new plantings were done by the estate. G & P B trial in field No. 14 was expanded by planting another 239 seedlings during May-June season. All young plantations were well looked after and no serious incidents of pests and diseases were reported. 350 m of 1.2 x .0 x .9 m drains and 190 m of .9 x .6 x .6 m drains were opened in filed No. 14 young plantation to drain out excess water.

.7 Intercropping: The banana intercrop in field No.6, double row avenue plantation was further expanded by planting another 150 of kolikuttu and 229 ambul suckers. Manuring was done in three split doses with the recommended mixture. A fungal disease was treated with Dithane and Beulate. Base of the clumps were kept thoroughly mulched with coir dust. 64 Kilikuttu and 194 ambul plants flowered during the year.

.8 Buildings and Machinery: Tractor No. 36 Sri 5434 (MF 135) was fully overhauled. Ford tractor No. 37 Sri 6168 was sent for repairs. Estate vehicle No. 31 Sri 6208 (Land Rover) needs clutch mechanism attended. Minimal maintenance was afforded to the buildings.

.9 Costs and returns: The Cost of Production for the year was Rs. 2925/- per 1000 nuts produced and the Net Sales Average was 3321/- per 1000 nuts.

5. WALPITA ESTATE, WALPITA

(Officer-in-charge: Mr I A N Hemasiri)

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 Progeny Trial with a planted extent of 16.2 ha of coconut. About 50% of the land is intercropped as trials or demonstrations by the Agronomy Division.

Area under intercrops is given in Table 3.

Table 3 *Area Intercropped (ha)*

Intercrop	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
Banana/Pepper	-	0.81	0.81
Mixed	0.20	-	0.20
Total	4.23	1.74	5.97

Rainfall: Annual rainfall recorded on 18% increase over the previous year's rainfall with more or less the same no. of wet days but with a better distribution over the year.

Nut yields: Walpita is the only station that recorded a comparative increase in yield (14%) with 85.9 nuts per palm producing the highest yield per hectare. This is 17.2 % more than the average production of the past.

Disposal of Crops: Coconuts were disposed mainly as husked nuts for processing through brokers. Intercrop produce were sold through brokers as well as locally as applicable.

Field Operations:

.1 Manuring: Palms were removed as per the DFR provided by the SPND. Plantation does not display any deficiency symptoms.

.2 Weed Control: Weeding in Walpita Estate did not pose a problem as half the estate is intercropped and a good part of the balance half is under creeping covers - Pueraria. It was mainly uprooting cheddies manually as and when required and the ground conditions were maintained very satisfactory. Herbicides were used to contain weeds in palm bases.

.3 Soil and Moisture Conservation: An effective mulch was maintained in palm bases throughout the year and the cover crop was well maintained. Husk burying was done in 250 pits of 150 x 90 x 90 cm in dimension in hand gravel areas of the 'A' block.

.4 Fences: The boundry fence was maintained in good order. Gliricidia stakes were planted along the fence where necessary to complete the live-fence.

.5 Roads and Paths: Roads were maintained free of weeds using herbicides. No major work on roads was done during the year.

.6 Intercropping: Areas intercropped are given in Table 3. 0.81 ha of Banana/Pepper intercrop was established during the year. Projected revenue could not be realised on pepper and coffee due to poor market prices prevailed.

.7 Costs and returns: Cost of production of coconuts was Rs. 2170/- per 1000 nuts and the Net Sales Average was Rs. 3681/- per 1000 nuts. Returns on intercropping is given in Table 4.

Table 4 *Returns on intercropping*

Produce	Quantity	Revenue (Rs.)
Cocoa (dry bears)	470 kg	27197.28
Cinnamon (peelings)	17 kg	3423.04
Coffee (dry bears)	74 kg	2960.00
Pepper (dry seeds)	312 kg	19647.75
Pepper (seedlings)	2150 nos.	10750.00
Banana		3936.00
Total revenue		67914.07

Total expenditure on intercropping was Rs. 43,350/- realising a profit of Rs. 24,567.07

.8 Buildings, vehicles etc: Buildings were maintained satisfactorily. Electricity supply from the CEB was obtained during the year. Hand tractor (KUBOTA) and the motor bicycle (HONDA CG 125) were kept in good order.

6. ISOLATED SEED GARDEN, AMBAKELLE

(*Superintendent: Mr S M Wijeratne Banda*)

District : Puttlam
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 (1380.2 mm) was 17% more than that of the previous year and is slightly above (3.8%) the previous 10 - year average. With 107 wet-days much better distributed than the previous year there could be better crops in the following year.

Nut yields: Total nut production for the year indicates a 14% decrease over that of the previous year but it is about half the average yield over the last 10 years (Table 1). Breakdown of the production by the two varieties is given in Table 3.

Disposal of Crops: Crop was disposed mainly as seednuts and the breakdown is given in Table 1.

Field Operations:

.1 Manuring: The entire seed garden was manured as per the DFR provided by the SPND, the common mixture being Urea 1.6 kg; ERP 0.7 kg; SP 0.7; MP 2.8 kg and Dolomite 3.8 kg per palm. Fields no. 1,2,3 and 4 were manured in the early part of the year and the rest were manured from September to November. All ingredients, N, P, K and Mg were applied together since the weather conditions were favourable for doing so.

Extra 1 Kg of Kieserite was applied to 484 palms in fields No. 4, 6, 8, 9, 10A and 10 B. Newly planted seedlings were manured using YPM as per the recommendations with 1.5 kg Dolomite.

Young palms in fields No. 11 A and 11 B were supplied with at 30 Kg of cow dung per palm forked in along with the inorganic manure. 165 declining palms in field No. 4 suspected for LSD were treated with cowdung 40 Kg; Kieserite 1 Kg and Muriate of Potash 1 kg per each palm.

.2 Weed Control: Ground conditions were maintained in good order. Mechanical methods coordinated with chemical control measures proved to be very effective in ground maintenance. On the average four rounds of weeding were done for the year.

.3 Soil and Moisture Conservation: All young palms were mulched with husks at the base. Rest of the palms were provided with a mulch consisting fallen fronds, weed trash etc. A coir dust mulch was applied in extended manure circle upto about 50 cm at 5 cm thickness. Cover crop Pueraria was established in 25 ha in fields No. 10A, 10B 11B, 12 and 13 increasing the total area under covers upto about 55 ha. out of 140 ha planted extent. All these covers were well maintained semicircular husk trenches (90 x 60 x 60 cm) were supplied to 525 young palms in field No. 11 B. Coir dust was used to supplement husk in burying.

.4 Irrigation: Fields no. 10 A, 10 B,11 A and 12 and the infills were watered during the early part of the year, using water from the newly installed tube-well in field no. 12.

.5 Pests & Diseases: A nettle grub attacks was reported but was controlled chemically using monocrotophos as a foliar application in the nursery and young palms and as a trunk injection in adult palms.

.6 Roads and Paths: All field roads were well maintained and were kept free of weeds using herbicides.

.7 Tree planting: 8000 plants of Acasia auriculiformes were planted along the road-sides and fences during the year.

.8 Fences: The entire perimeter fence was maintained in good order in spite of several incidents of wilful damage to the fence.

.9 Costs and Returns: Cost of production was Rs. 4881/- per 1000 nuts and the Net Sales Average was Rs. 5615/- per 1000 nuts.

7. MAKANDURA SEED GARDEN, GONAWILA

(Superintendent: L J C Perera)

District	:	Kurunegala
Electrorate	:	Katugampola
Agro-climatic Zone	:	Semiwet Intermediate zone

This seed garden was established in 1984 with the financial assistance of the Asian Development Bank. The entire plantable area of the seed garden in put under coconut to produce CRIC - 60 and Ambakelle special varieties. (Report for 1988 gives planting details.)

Rainfall: Total rainfall for the year (2160.8 mm) is slightly more than that of the previous year (2100.8 mm), but had a better distribution throughout the year with 114 wet-days compared to 98 days last year.

Nut yields: Seed garden is gradually approaching full bearing status with 7342 out of 10167 palms in flower producing a harvest of 94,322 nuts in the year compared to 17,468 nuts in previous year 83% of the harvest (78,164) was selected as seednuts. A clarified flowering and harvesting details are given in Table 5.

Disposal of Crops: Crop was disposed mainly as seednuts (83%), to the CCB nurseries.

Table 5 *Flowering and Harvesting Details*

	Flowering and Harvesting						Harvest (nuts)			
	1987	1988	1989	1990	1991	**Total**	1989	1990	1991	**Total**
IS	1	169	470	305	203	1153	78	7203	28212	35493
1B	-	1	137	290	313	741	-	554	6228	6782
2S	-	52	422	673	273	1420	65	2201	15601	17867
2B	-	-	65	320	385	770	-	119	5601	5721
3S	2	102	290	385	214	993	51	2882	11905	14838
3B-1	-	2	37	72	50	161	-	58	11905	14838
3B-11	-	-	31	84	104	219	-	-	2012	2012
4S	-	65	358	308	352	1083	31	2510	12560	15101
4B-1	-	68	310	204	186	768	-	1941	10400	12341
4B-11	-	-	7	21	6	34	-	-	297	297
Total	**3**	**459**	**2127**	**2662**	**2091**	**7342**	**225**	**17468**	**94322**	**112015**

Field Operations:

.1 **Manuring:** The entire plantation was manured as per the DFR is one application (per year) during October to December at the following rates per palm.

Urea	1.1 to 1.4 kg
Saphos	0.5 kg
ERP	0.2 kg
MOP	1.5 to 2.0 kg
Dolomite	3.0 kg
Kieserite	1.0 to 1.5 kg

.2 **Weeding:** Ground conditioned maintained satisfactorily. There were no definite weeding rounds but the cheddies were manually uprooted and removed when required. Slashing was done in limited areas as major part of the seed garden is covered with creeping legumes mainly Pueraria reducing the cost of weeding to a minimal amount. Manure circles were maintained free of weeds using herbicides.

.3 **Soil and moisture conservation:** Palm bases were mulched with coir dust and weed trash in fields no. 1 and 4, 275 husk pits (150 x 90 x 90 cm) and 105 husk trenches (90 x 60 x 60 cm) well establshed cover crop effectively contributed in conserving soil and moisture.

.4 **Fences:** A new perimeter fence measuring 816 m in length western barrier in field no. 1 using concrete fence posts. The entire boundary fence (3096 m) was maintained in good order.

.5 **Roads:** New by-roads were introduced in all fields. The entire road network 4186

.6 **Pests and Diseases:** No incidents of pests and diseases were reported during the year.

.7 **Removal of Sub-standard Palms:** Uprooted and removed 170 sub-standard palms as per evaluation and recommendation made by the G & P B Division.

.8 **Drains:** 532 m of drainage canals in fields No. 1 and 2 were cleared desilted and reconditioned twice during the year to facilitate draining out surplus water.

.9 **Tree planting:** Around 1000 timber plants were established along the perimeter and roadsides during the year.

.10 **Buildings, machinery etc:** David Brown tractor No. 37 Sri 1853 sent for repairs to agents in 1990 was not returned till end of the year. Other vehicles and equipment were well maintained. The four buildings in dispute are still not taken over from the contractor for over two years now.

.11 **General:** Seed garden continues to show progressive improvement every year in succession and there is no doubt that it will compte up to the expectations.

8. MADURU OYA SEED GARDEN, BOGASWEWA

(Superintendent: Mr A N Ekneligoda)

District:	:	Polonnaruwa
Electorate	:	Polonnaruwa
Agro-climatic Zone	:	Dry Zone

This seed garden was established under the East Coast Rehabilitation Project of the Coconut Development Authority, financed by the Eurpoean Economic Community. Work on the seed garden commenced in the latter part of the year 1985. A total extent of 57.5 ha were planted with CRIC-60 seedlings by end of the year.

Rainfall: Total rainfall and the distribution are slightly better than those of the previous year.

Harvest: First regular harvest of the seed garden was made in March yielding 74 nuts increasing upto 422 nuts in the final harvest resulting total yield of 1075 nuts all of which were laid in nursery to raise seedlings. Prior to this 12 nuts were harvested last year from a tree that flower in 1989 in field No. 1. There were 639 palm in flower by end of the year, inclusive of 475 that came into flower during the year.

Field Operation:

.1 **Manuring:** Grown up seedlings were manured as per the DFR provided by the SPND. Young seedlings below three years of age were manured with YPM plus Dolomite at 1 kg per seedling.

.2 **Weed Control:** Ground conditions were satisfactory in cover cropped areas, whilst the rest were getting into weed frequently.

.3 **Soil and Moisture Conservation:** Palm bases were mulched with the available material such as weed trash. Husk burying could not be practiced for want of material.

.4 **Fence and boundaries:** Perimeter fence was in a poor status mainly due to frequent damages by wild elephants.

.5 **Roads:** Main internal roads were satisfactory but the by roads were more or less neglected.

.6 **Pests and Diseases:** A heavy infestation of red weevil was reported but controlled using chemicals (monocrotophos) under the guidance of the CPD.

.7 **Damage by wield animals:** Damage by wild elephants continued. Wild boar damage reached alarming proportion causing many casualties. Non-availability of ammunition for fire-arms is making the situation worse.

Opening of a trench of 1.2 x 1.2 m along the perimeter proved to be very

effective in containing visitations by wild elephants as well as wild boar and the work on this project programmed to be continued in the following year.

.8 New planting: Another 18.6 ha were planted during the year increasing the planted extent upto 57.5 ha.

.9 Irrigation: Water is now available in plenty in the irrigation canal provided for the seed garden by Mahaweli authorities. This would prevent any further casualties due to moisture stress.

.10 Drainage: It was observed that certain sections of the land are getting water-logged and necessary drains were provided to remove surplus water. Elevated platforms were prepared where necessary and seedlings from the irrigation canal too was pausing drainage problems which were rectified.

.11 Buildings etc: Progress of work in the fresh contract awarded to construct an office building and quarters for Superintendent is very slow. Absence of these buildings hampers the activities of the seed garden.

9. RESEARCH AND DEMONSTRATION FARM, MINNERIYA

(Officer in Charge: Mr Newton Gamage)

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. Out of the 12.2 ha of planted extent 4.1 ha are in bearing now.
Rainfall: Total rainfall for the year (1250.8 mm) is 28% less than that of the previous year (1732.6 mm).

Nut yield: Nut yield is on the increase as the plantation is reaching bull bearing status. A total crop of 18580 nuts which is more than double that of the previous year was procured.

Field Operations:

.1 Manuring: Bearing palms were manured as per the DFR and the seedlings with YPP plus Dolomite. In addition the inorganic fertilizers each palm was applied with 30 kg of cow dung.

.2 **Weed Control:** Weeds were kept under control mainly by the use of rotary slasher and the palm bases were kept free of weeds using herbicides.

.3 **Others:** Cover crops was retarded due to dry weather and regeneration was very slow. Palm bases were mulched with paddy straw and weed trash. Palms were irrigated during dry weather using tractor bowser drawing water from a nearby water hole.

200 m of perimeter fence was redone on the western boundary. Elephant damages to the fence were repaired regularly. Here too the work on 1.2 x 1.2 m elephant trench was commenced towards the end of the year. Once completed it will effectively control visitation wild elephants. All roads were maintained in good order.

10. RESEARCH AND DEMONSTRATION FARM, PASSEKUDAH, KALKUDAH

(Officer in Charge: Mr A Thavaratnarajah)

District	:	Batticaloa
Electorate	:	Kalkudah
Agro-climatic Zone	:	Dry Zone

Activities: The OIC and the staff are shifted to the head office and the farm could not be revived as the security status did not improve sufficiently.

REPORT OF THE AGRICULTURAL RESEARCH PROJECT

Project Coordinator - M Jeganatha, M Phil

1. ACTIVITIES

1.1 Manpower Development Programme

Long Term Training: The following officers completed their postgraduate studies:

Mr H A J Gunathilake, Assistant Agronomist, returned to the island on 18 September, after successfully completing the Ph D degree at the University of North Wales, UK. His thesis was titled 'The role of roots in plant competition'.

Mr L L W Somasiri, Assistant Soil Scientist, returned to the Island on 13 November, after completing the Ph D degree at the University of Aberdeen, UK. The subject of his thesis 'A mixed ion-exchange resin procedure for assessing nutrient availability in temperate and tropical soils'.

The following officers continued with their postgraduate studies:

Mr R A J R Perera, Agricultural Economics, North Carolina, USA, Ms W M U Fernando, Population Genetics, Birmingham, UK, Ph D; Ms L K Weerakoon, Tissue Culture, Illinois State, USA, Ph D; Mr T G L G Gunasekera, Crop Management, North Wales, UK, Ph D; Mr N A Tennakoon, Soil Microbiology, Aberdeen, UK, Ph D; Mr H P S Jayasundera, Biological Nitrogen Fixation, Reading, UK, Ph D.

Ms L K Weerakoon's fellowship was upgraded for a Ph D degree, by the award of a Graduate Teaching Assistantship by the Illinois State University, USA.

Mr T G L Gunasekera's and Mr H P S Jayasundera's fellowships were upgraded for Ph D degrees, on the split programme arrangement, and they returned to the Island on 06 October and 18 December respectively to undertake their field studies for periods of 18 months.

Long Term Training (Local): Ms D M D I Wijebandara, Technical Assistant, Soils and Plant Nutrition Division has been admitted to the Post Graduate Institute of Agriculture, Peradeniya for a M Phil degree in Soil Science with effect from 24 September.

Short Term Training (Foreign): Mr M J C Costa, Technical Assistant, Agronomy Division participated in the eight week 'Farming System Training Programme' held at the Asian Institute of Technology, Bangkok, Thailand (11 May - 30 June).

1.2 Council for Agricultural Research Policy (CARP) - Special Programme

Mr T S G Peiris, Senior Biometrician, participated as a resource person in the workshop on Management Information System/Programme Budgeting System (MIS/PBS), conducted by the CARP for agencies under the CARP/ARP support. The workshop was held in Colombo from 19 - 21 February and 06 - 07 June,

Mr H P de Zoysa, Technical Assistant, Biometry Division attended the workshop as a trainee from the Institute.

1.3 Strengthening of Research Station Facilities

Laboratory/Field Equipment and Spares: A psychrometer was received.

Vehicles: Four motorcycles were received.

1.4 Field Days Workshops and Seminars

(i) Field Day (at the CRI Seed Garden, Makandura), 01 February - Directorate of the JEDB, Board V and 25 Superintendents from JEDB Estates.

(ii) Field Day (at Andigama Farm, Giriulla and a Seminar at Galpikuna, Udubaddawa), 09 March.

(iii) Field Day (at the CRI Research and Demonstration Farm, Minneriya Farm, Minneriya and the Maduru Oya Seed Garden). 01-02 May. Research Staff of the CRI.

(iv) Field Day (at the CRI Seed Garden, Makandura, 15 May, National Livestock Development Board(NLDB), managerial staff.

(v) Field Day (at the CRI Seed Garden, Makandura), 21 May. NLDB middle level management staff.

(vi) Training Programme (at the CRI), 02-11 June, Assistant Superintendents of the JEDB and SLSPC.

(vii) Training Programme (at the Coconut Development Training Centre, Lunuwila), 25 June. Regional and Assistant Regional Mangers of the Coconut Cultivation Board.

(viii) The field days and training programmes were funded by the Project.

1.5 Mr R V Ramakrishna, World Bank visited the Institute on 19 March, to review the progress of the Agricultural Research Project, under the seventh Supervision Mission.

A Mid-term Mission of the World Bank reviewed the Progress of the Agricultural Research Project on 11 October. The Mission comprised Mr Iver Serejaki, Mr R V Ramakrishna, Prof. Rolf A E Mueller, Mr Charles H. Anthold (World Bank) and Dr L H Fernando and Dr R L de Silva(Sri Lanka)

1.6 Civil Works

The Facilities Building was completed and handed over to the Institute on 09 December.

Auditorium: Work is complete except for the construction of a mineral fibre acoustic ceiling

Library: Refurbishing of the Library was completed and handed to the Institute on 10 September.

Work on the refurbishing of the Guest House and construction of quarters and the screen house is in progress.

The work on the water distribution system, including a new well and over-head tank was completed in October and handed over to the Institute.

2. INTER INSTITUTIONAL RESEARCH PROGRAMME (IIRP) - COCONUT INTERCROPPING

The seventh, eighth and ninth meetings of the progress of the IIRP-Coconut Intercropping were held on 20 March, 12 July and 21 October respectively.

The Progress Review of the above programme from commencement upto December 1990 was forwarded to the Executive Secretary, CARP on 22 March.

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, 1991 was as follows:

Grade	Unclassified	Sp. Cl.	Cl. I	Cl. II	Cl. III	IV	Total
Executive	02	-	06	09	22	08	47
Technical	-	10	23	26	-	-	59
Intermediate	-	01	02	04	-	-	07
Clerical	-	17	11	18	-	-	46
Operative	-	18	12	16	-	-	46
Minor	-	57	36	42	-	-	135
Ungrade							
Drivers	-	09	11	16	-	-	36
Watchers (12 hr)	-	-	-	-	-	-	15
Total	02	112	101	131	22	08	391

Appointments, retirements, resignations, deaths of officers, and internal promotions, etc. are reported separately.

Administration: The general administrative functions were continued. Internal promotions due for the year 1991 was finalized.

The total expenditure during the year was Rs. 51,316,996/= comparing Rs. 13,219,996/= as capital expenditure and Rs. 38,097,000 as recurrent expenditure. The revenue during the year was Rs. 9,395,993/=

2. WELFARE

(a) Finance Aid

2.1 Provident Fund: The loans from the Provident Fund to employees amounted to Rs. 2,498,503.00.

2.2 Distress Loans: Distress loans to employees amounted to Rs. 1,105,200.00

2.3 Transport Loans: Transport loans to employees amounted to Rs. 1,733,000.00.

2.4 Loans to Relieve Indebtedness: Loans to relieve indebtedness to employees amounted to Rs. 75,000.00.

2.5 Education loans: Education loans to employees amounted to Rs. 20,000.00.

2.6 Medical Aid: A sum of Rs. 702,382.00 was reimbursed by the Medical Aid Scheme to its members.

(b) Other facilities to employees

1. Financial assistance were granted to the Multi Purpose Co-operative Society, Recreation Club and the Art Circle to promote their activities during the year.

2. The Medical Aid Scheme organized an dental clinic for the benefit of the staff and their families.

3. The two donations have been made from the reserve fund to two members of the Medical Aid Scheme.

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	Busses	03	Jeeps/Double Cabs	17
Vans	04	Lorries	03	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 and National Apprenticeship Board.

The salary payments were fully computerised at the in house computer. Four members of the staff was trained in the basic concept of computerised ledger keeping.

3.3 Engineering Unit

The Engineering Unit continued to provide maintenance services for Electricity, Water supply, Refrigerators, Air Conditioners, Telecommunication System, Machineries, Vehicles, Official Quarters and Office buildings in the Institutes' Head Office and Estates. It was achieved to get the power supply to the Walpita Estate, complete the entire replacement of roof and ceiling of a bungalow at Ratmalagara Estate and ceiling of the Agronomy Division building at Head Office. There was a considerable saving incurred on vehicle servicing at the Engineering Unit Service Centre. It was also achieved to attend some major repairs to the Institutes' vehicles at the Engineering Unit workshop.

STAFF MATTERS

1. Appointments

Ms W N I S C Fernando as Assistant Botanist on 15 January.
Mr A A F L K Perera as Assistant Geneticist on 17 January.
Mr N P A D Nainanayaka as Assistant Plant Physiologist on 21 January.
Mr P M Gilbert as Supplies Officer on 22 April.
Ms K P S Jayathilaka as Clerk/Typist on 22 April.
Ms R M M Dilhani as Accounts Clerk on 29 May.
Mr T Gunadasa as Administrative Assistant on 10 July.
Ms H M A Herath as Stenographer (English) on 15 July.
Ms A A N P Kanthi as Clerk/Typist on 25 July.
Mr K N A S Perera Resident Engineer on 15 November.
Mr D G Manamudali as Deputy Director (Adm. & Fin.) on 23 December.

2. Retirements

Mr P Tikiribanda, Watcher on 04 January.
Mr S A F Appuhamy, Driver on 30 January.
Mr H Bandappuhamy, Lab/Field Assistant on 11 February.
Mr K P C Fernando, Supervisor on 11 February.
Mr J Gnanaratne, Office Attendant on 19 July.
Mr R Jayasinghe, Watcher on 12 December.

3. Resignations

Ms M J Ariyadasa, Stenographer (English) on 01 January.
Ms H J M G D Jayasundara, Technical Assistant on 01 January.
Mr L U Jayawardena, Resident Engineer on 01 March.
Mr H M D T N Mudalige, Technical Assistant 25 February.
Mr P J C Fernando, Lab/Field Assistant on 12 April.
Mr J I Jayalath, Supervisor on 01 June.
Mr T M S Pieris, Book Keeper on 01 July.
Ms S M Karunaratne, Senior Research Officer on 07 July.
Ms P H C M G Rodrigo, Clerk on 12 July.
Mr W A S Surendra, Carpenter on 12 August.
Mr D N B Perera, Deputy Director (Adm. & Fin.) on 15 December.
Dr P Kanagaratnam, Head, Crop Protection Division on 01 August [decided in 1991]

4. Vacation of Post

Ms W E M Coonghe, Clerk/Typist on 27 March, 1990 [decided in 1991)
Ms D M T Marasinghe, Clerk/Typist on 12 March
Mr P M Gilbert, Supplies Officer on 30 April.
Mr D P Ranasinghe, Driver on 23 August.

5. Retrenchment

Mr G M R Karunasekara, Experimental Officer on 31 July.

6. Affiliations

Mr P Kariyawasam, Seed Production Officer on 01 January.
Ms W A A A M V M J K Dondeenu, Clerk/Typist on 01 January.
Mr M J P Perera, Lab/Field Attendant on 01 January.
Mr A P Justin, Lab/Field Attendant on 01 January.
Mr J A Hubert, Lab/Field Attendant on 01 January.
Mr R M Tennakoon, Lab/Field Attendant on 01 January.

6.1 Trnsfers

Mr R P Victor (Estate clerk) from Isolated Seed Garden to Ratmalagara Estate on 01 January.

Mr B M Senagosa (Estate clerk) from Ratmalagara Estate to Poththukulama Research Station on 01 January.

Mr J A R Reginole (Estate clerk) from Poththukulama Research Station to Isolated Seed Garden on 01 January.

Mr H M Weerasinghe (Watcher) from Isolated Seed Garden to Minneriya on 01 January.

Mr B G Jayapala (Watcher) from Minneriya to Ratmalagara Estate on 01 January.

Mr W Wipulasena (Watcher) from Isolated Seed Garden to Ratmalagara Estate on 01 January.

Mr A A Aranolis (Watcher) from Isolated Seed Garden to Poththukulama Research Station on 01 January.

Mr P A C Chandrasekara (Watcher) from Ratmalagara Estate to Isolated Seed Garden on 01 January.

Mr D M Thilakratna (Watcher) from Poththukulam Research Station to Isolated Seed Garden on 01 January.

Mr S M Gunarathhamy (Watcher) from Poththukulam Research Station to Isolated Seed Garden on 01 January.

Mr K G Danapala (L/F Att.) from Maduruoya to Ratmalagara Estate on 01 January.

Mr B Somapala (Guest House Keeper) from Administration to Isolated Seed Garden on 06 February.

Mr M Nadarajah (L/F Att.) from Mylambaweli to Crop Protection Division on 06 February.

Mr R M Dharamasena (Guest House Keeper) from Bandirippuwa Estate to Ratmalagara Estate on 22 April.

Mr I A N Hemasiri (Supervisor) from Makandura Seed Garden to Walpita Estate on 01 August.

Mr M Sisira Perera (Supervisor) from Minneriya to Makandura Seed Garden on 01 August.

Mr N Gamage (F/Officer) from Walpita to Minneriya on 01 August.

Mr S L Fernando (Watcher) from Makandura Seed Garden to Walpita on 17 September.

Mr H M Anura Kumara (Watcher) from Bandirippuwa Estate to Makandura Seed Garden on 17 September.

Mr N Gamage (F/Officer) from Minneriya to Walpita on 15 November.

7. Promotions

Executive Grade

Mr T S G Peiris, Biometrician to Class I on 14 December, 1990 [decided in 1991]

Technical Grade Class I to Special Class

Mr M R L A Perera, Superintendent on 01 January.
Ms K C P Perera, Senior Technical Assistant on 01 January.
Mr U S S Perera, Senior Technical Assistant on 01 January.

Clerical & Allied Grade Class I to Special Class

Ms J K F Perera, Clerk/Typist on 01 January.
Ms P C A Fernando, Clerk/Typist on 01 January.
Ms M M M R Fernando, Clerk/Typist on 01 January.
Mr H B Thalgahagoda, Assistant Shroff on 01 January.
Mr R A L C Fernando, Clerk/Typist on 01 January.

Operative Grade Class I to Special Class

Mr P D Bennet Silvan, Lab/Field Assistant on 01 January.
Mr W L B Silva, Lab/Field Assistant on 01 January.
Mr E W E G Gunasinghe, Lab/Field Assistant on 01 January.
Mr M D V Saparamadu, Lab/Field Assistant on 01 January.
Mr E M Gunarathbanda, Lab/Field Assistant on 01 January.

Drivers Grade Class I to Special Class

Mr B K M B Rodrigo, Driver on 01 January.
Mr P M E Andrew, Driver on 01 January.

Minor Grade

Mr M A S Fernando, Lab/Field Attendant on 01 January.
Mr L Vanculamberg, Cattle Keeper on 01 January.
Mr K K P Mendis, Labourer on 01 January.
Mr H P Karanis, Pollination Labourer on 01 January.
Mr D W Jayasena, Office Attendant on 01 January.
Mr S Samaratunga, Cattle Keeper on 01 January.

Mr K H R L Appuhamy, Office Attendant on 01 January.
Mr K Venayagam, Cattle Keeper on 01 January.
Mr J M Uparatne, Pollination Labourer on 01 January.
Mr R K Munasinghe, Labourer on 01 January.

Technical Grade Class II to Class I

Mr M J I Costa, Technical Assistant on 01 January.
Mr B M Jayatilaka, Book Keeper on 01 January.
Ms S D Hemamala Bandara, Technical Assistant on 01 January.

Clerical & Allied Grade Class II to Class I

Ms N R Marasinghe, Clerk/Typist on 01 January.
Ms M M J R Fernando, Audit Clerk on 01 January.
Ms R D I Somasiri, Audit Clerk on 01 January.

Operative Grade Class II to Class I

Mr U V M Fernando, Lab/Field Assistant on 01 January.
Mr W T H C Fernando, Lab/Field Assistant on 01 January.
Mr M Victor, Lab/Field Assistant on 01 January.

Drivers Grade Class II to Class I

Mr H M Kirihamy, Driver on 01 January.

Minor Grade Class II to Class I

Mr I J A Fernando, Lorry Cleaner on 01 January.
Mr S A L Antony, Lorry Cleaner on 01 January.
Mr W W F N Fernando, Labourer on 01 January.
Mr S Somasiri, Office Attendant on 01 January.

8. Full pay leave for study in Sri Lanka

Ms D M D I Wijebandara, Technical Assistant for postgraduate studies at the University of Peradeniya, two years from 01 October.

9. No-pay leave for study in Sri Lanka

Mr S Malavipathirana, Technical Assistant, from 01 January.
Mr J D S Kularatne, Technical Assistant, from 01 February.

Mr Nalaka Susantha, Technical Assistant, from 01 October.

10. Overseas leave on no-pay

Ms P D U C Dharmapala, Library Assistant (Scotland)
Mr A A D N Athauda, Clerk/Typist (Maldives)
Mr Ivan Appuhamy, Technical Assistant (Australia)
Ms R D I Somasiri, Audit Clerk (UK)

11. Training & Visits

11.1 Overseas Training

Mr M J I Costa, Technical Assistant participated in a training course on Intergrated Farming Systems Management held in Thailand from 11 May to 05 July.

Mr T W Fernando, Technical Assistant participated in a familirization tour on the use of fertilizers, in India from 12 November to 05 December.

Dr D N S Fernando, Agronomist underwent a three-month training course on use of ^{15} N at International Atomic Energy Agency, Vienna, Austria from 07 September.

Ms W P K K Fernando, Technical Assistant, Plant Physiology Division returned to the island on 31 March after completing six months training on High Performance Liquid Chromatography and allied aspects, at the University of Western Australia, Australia.

Mr L L W Somasiri, Research Assistant left for United Kingdom to complete his postgraduate studies at the University of Aberdeen on Plant Nutrition, on 01 August.

The following officers continued their postgraduate studies:

Ms L C P Fernando, Assistant Crop Protection Officer at the University of Queensland, Australia
Ms W M U Fernando, Assistant Geneticist & Plant Breeder at the University of Birmingham, UK.
Mr P A Henry Nimal, Assistant Information Officer at the University of Reading, UK.
Mr R A J R Perera, Asst. Agronomist at the University College of North Wales, UK.
Ms L K Periyapperuma, Assistant Botanist at the Illinois State University, U.S.A.

Mrs C N K Rajapaksa, Asst. Crop Protection Officer at the University of Texas A&M, USA.
Mr N A Tennakoon, Assistant Soil Scientist at the University of Aberdeen, UK.
Mr L P Vidana Arachchi, Assistant Soil Scientist at the Universiti Sains Malaysia, Malaysia.

11.2 Overseas Visits

Mr M Jeganathan, Senior Research Officer, participated in the second International Symposium on Soil Testing and Plant Analysis for the Global Community held in USA from 21 to 29 August.

Dr R Mahindapala, Director participated in the International Workshop on Coconut Genetic Resources held in Cipanas, Indonesia from 08 to 11 October.

Dr R Mahindapala, Director, CRI participated in a Regional Expert consultation of the Asian Network on Oilseed Crops held in Thailand from 15 to 22 December.

Dr M de S Liyanage, Head, Agronomy Division participated in the International Seminar on Livestock Feed and Development in the Tropics, held in Indonesia from 25 to 29 October.

Dr K R R A Peries, Head, Genetics & Plant Breeding Division participated in the International Workshop on Coconut Genetic Resources held in Cipanas, Indonesia from 08 to 11 October.

The following officers participated in the International Symposium on Coconut Research and Development, held at the Central Plantation Crops Research Institute, Kerala, India from 26 to 29 November.

Ms Shyama C Fernando, Assistant Botanist (Tissue Culture)
Dr (Mrs) C Jayasekara, Head, Plant Physiology Division
Mr K S Jayasekara, Head, Soils & Plant Nutrition Division
Mr M Jeganathan, Senior Research Officer
Dr M de S Liyanage, Head, Agronomy Division
Dr R Mahindapala, Director
Mr T S G Peiris, Senior Biometrician
Dr P A C R Perera, Head, Crop Protection Division
Dr K R R A Peries, Head, Genetics & Plant Breeding Division

During this tour, **Mr Jayasekera** and **Dr Peries** also visited ICRISAT, Hyderabad, India for 30 November to 07 December.

12. 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, Board of Directors, Sri Lanka Cashew Corporation
Member, Working Committee on Agriculture and Animal Husbandry, National Resources, Energy and Science Authority of Sri Lanka.
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.
Member, Standing Committee on Research and Projects, Council for Agricultural Research Policy
Member, Standing Committee for Co-ordinating Postgraduate Studies in Natural Sciences
Joint Secretary, Institute of Biology.

Mrs S M Karunaratne
Visiting Research Associate, Institute of Fundamental Studies

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.

Dr P A C R Perera
Member, Sri Lanka Pesticides Formulary Committee
Joint Secretary, Institute of Biology.
Visiting Lecturer in Forest Entomology, University of Sri Jayewardenepura.

13. Academic and Professional Achievements

Dr H A J Gunathilake was awarded Ph D by the University of North Wales, Bangor, UK.

Dr L L W Somasiri was awarded Ph D by the University of Aberdeen, UK.

Dr R Mahindapala and **Mr J L J G Pinto** were awarded **Science Writing Award - 1991 (English Medium)** by the Sri Lanka Association for the Advancement of Science for their work, *Coconut Cultivation*, published by the CRI.

Dr R Mahindapala was elected a **Fellow** of the National Academy of Science, Sri Lanka.

STAFF PUBLICATIONS AND COMMUNICATIONS AT SCIENTIFIC MEETINGS

(CRI authors are shown in bold type)

Theses

Dr L L W Somasiri - *Ion exchange resin method for assessment of nutrient availability in temperate and tropical soils* (Ph D - University of Aberdeen, UK)

Dr H A J Gunathilake - *The role of roots in plant competition* (Ph D - University of Wales, Bangor, UK)

Others

M B M N Dias (1991). Effects of Water Stress on the growth panicle development of grain sorghum. Poster presented at the Postgraduate Institute for Agriculture, Peradeniya.

M B M N Dias (1991). Effect of Nitrogen Stress and Panicle Development of Grain Sorghum. Paper presented at the Postgraduate Institute for Agriculture, Peradeniya.

Jayasekara, C (1991). Current developments in the management of the coconut palm. Seminar on Scientific management of Plantations organized by SLAAS and Ex-Planters Association. 26 April, 1991; Colombo.

Jayasekara, C (1991). Physiology of growth, flowering and fruiting of palms. First Oil Palm Seminar. Sri Lanka State Plantations Corporation, Galle. 29 July, 1991.

Jayasekara, C, C S Ranasinghe & D T Mathes (1991). A physiological approach to screening for high hielding and drought tolerance in Coconut. Paper presented at the International Sysmposium on Coconut Research & Development (ISOCRAD II), Kerala, India; 26-29 November, 1991.

Jayasekara, K S (1991) Differential Fertilizer Recommendation for coconut based on nutrient and productivity level. Paper presented at the International Sysmposium on Coconut Research & Development (ISOCRAD II), Kerala, India; 26-29 November, 1991.

Jayasekara, K S (1991) Fertilizing palms. First seminar on Oil Palms. State Plantations Corporation, Galle. 29 July 1991.

Jayasekara, K S & C Jayasekara (1991). Efficiency of water use in coconut under different soil/plant management systems. Paper presented at the International Sysmposium on Coconut Research & Development (ISOCRAD II), Kerala, India; 26-29 November, 1991.

Jeganathan, M ((1991) Coconut nutrition: experiences in Sri Lanka. Paper presented at the International Sysmposium on Coconut Research & Development (ISOCRAD II), Kerala, India; 26-29 November, 1991.

Jeganathan M (1991) Nut water analysis as diagnostic tool in studies on coconut nutrition. Poster presented at the International symposium on Soil Testing and Plant Analysis for the Global Community, Florida, USA. 21-29 August 1991.

Karunaratne S (1991). Propagation by tissue culture. What it's all about. *Vidurava* 13 (1): 1-3.

Karunaratne, S (1991) Current status of embryo and Tissue Culture in Sri Lanka. Paper presented at the International Sysmposium on Coconut Research & Development (ISOCRAD II), Kerala, India; 26-29 November, 1991.

Karunaratne S, Sunil Santha & A Kovoor (1991). An *in vitro* assay for drought tolerant coconut germplasm. *Euphytica* 53:25-30.

Karunaratne S, C Gamage & A Kovoor (1991). Leaf maturity a critical factor in embryogenesis. *Journal of Plant Physiology* 139 (1): 27-31.

Liyanage, M De S & K B Dassanayake (1991). Experiences on coconut based farming/cropping system in Sri Lanka. Paper presented at the International Sysmposium on Coconut Research & Development (ISOCRAD II), Kerala, India; 26-29 November, 1991.

Liyanage, M De S & D N S Fernando (1991). Role of legume-based pasture, tree fodder and ~~paddy~~ straw in coconut/cattle farming system in Sri Lanka. Paper presented at the International Seminar on Livestock and Feed Development in the Tropics, Malang, Indonesia; October, 1991.

Liyanage, M de S & S Marasinghe (1991). Performance of some introduced gliricidia provenances in the Low Country Intermediate Zone of Sri Lanka. Proc. 2nd Reg. Workshop on Multipurpose Tree Species. Kandy, Sri Lanka (ed. H P M Gunasena) pp 8-18.

Liyanage, M De S, H P S Jayasundara & L V K Liyanage (1991). Evaluation of *Gliricidia sepium* provenances for the Low-Country humid zone of Sri Lanka. *International Tree Crops Journal* 7, 83-94.

Mahindapala, R (1991) Country paper for the Regional Expert Consultation of the Asian Network on oilseed Crops. Presented at the Expert Consultation of the Asian Network on Oilseed Crops held in Thailand; 17 to 20 December, 1991.

Peiris T S G (1991) The influence of rainfall on Coconut in Sri Lanka. Paper presented at the International Sysmposium on Coconut Research & Development (ISOCRAD II), Kerala, India; 26-29 November, 1991.

Peiris T S G (1991) Modelling approach in analysing field experimental date in coconut. Paper presented for the annual session of SLAAS, December, 1991.

Peries, R R A (1991) Coconut Germplams Conservation in Sri Lanka, IBPGR newsletter for Asia & the Pacific 6:14 - 15.

Peries, R R A (1991) Progress of Research in seednut and seedling selection in Sri Lanka. Paper presented at the International Sysmposium on Coconut Research & Development (ISOCRAD II), Kerala, India; 26-29 November, 1991.