COCONUT RESEARCH BOARD

COCONUT RESEARCH INSTITUTE OF SRI LANKA

REPORT FOR 1986

COCONUT RESEARCH INSTITUTE - REPORT FOR 1986

COCONUT RESEARCH BOARD

REPORT OF THE

COCONUT RESEARCH INSTITUTE

FOR 1986

Editors

D. T. Wettasinghe, BSc Agric (Cey), PhD (Reading)

R. Mahindapala, BSc (Cey), MSc (Exon), PhD (Exon)

COCONUT RESEARCH INSTITUTE OF SRI LANKA

LOCATION

The Head Office, Laboratories and Library of the Coconut Research Institute are situated at Bandirippuwa Estate, Lunuwila, 51 km from Colombo, 27 km from the Colombo International Air Port, Katunayake, 16 km from Negombo, 6 km from Dankotuwa, 5 km from Wennappuwa, and 3 km from the Lunuwila Railway Station.

Sub Stations

(1) Ratmalagara Estate - 34 km from Head Office.

(2) Pottukulama Research Station - 61 km from Head Office.

(3) Isolated Seed Garden - 56 km from Head Office.

(4) Passekudah Research and
Demonstration Farm, Kalkudah - 296 km from Head Office.

(5) Walpita Estate - 37 km from Head Office.

VISITORS

Visitors are always welcome. The working hours are from 8.30 a.m. to 12.15 p.m. and 1.00 p.m. to 4.30 p.m. The Institute will be closed on Saturdays, Sundays and all Public Holidays. It is necessary to make prior arrangement regarding visits by letter.

Guest House facilities are available to those visiting the Institute, at reasonable rates. However, advance bookings are essential.

CORRESPONDENCE

All correspondence should be addressed to Director, Coconut Research Institute, Lunuwila, Sri Lanka (Ceylon). Telephone : 0315 - 300, 030 - 3795 Telegrams : 'Cocos' Negombo.

CONTENTS

THE COCONUT RESEARCH BOARD

(as at 31st December, 1986)

Dr. D. V. Liyanage (*Chairman*)

Mr. K. F. J. Perera

Mr. Naomal S. Dias

Mr. P. R. Wijewardene

Mr. Merle E. Dalpathado

Mr. G. P. P. N. Perera

Dr. R. T. Wijewantha

Mr. R. I. Fernandopulle (*Observer*)

Mr. M. A. Warnakulasooriya (*Ministry Representative*)

Secretary to the Board — Mr. D. N. B. Perera.

COMMITTEES OF THE COCONUT RESEARCH BOARD

(as at 31st December, 1986)

1. The Research Committee

Dr. D. V. Liyanage (*Chairman*)
Mr. P. R. Wijewardene
Dr. R. T. Wijewantha
Mr. W. K. D. J. Waragoda
Mr. B. R. T. de Tissera
Dr. D. T. Wettasinghe
Dr. R. Mahindapala (*Convenor*)

2. The Administrative Committee

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Mr. Naomal S. Dias
Mr. M. A. Warnakulasuriya
Dr. D. T. Wettasinghe
Mr. D. N. B. Perera (*Convenor*)

3. The Estates Committee

Mr. Naomal S. Dias (*Chairman*)
Mr. A. R. W. Jayasekera
Mr. G. P. P. N. Perera
Dr. D. T. Wettasinghe
Dr. R. Mahindapala
Mr. P. S. Liyanagama (*Convenor*)

COCONUT RESEARCH INSTITUTE OF SRI LANKA

THE STAFF *

(as at 31 December, 1986)

DIRECTORATE

Director — D. T. Wettasinghe, B.Sc. Agric (Cey), Ph.D (Reading)

Deputy Director (Research) — R. Mahindapala, B.Sc (Cey), M.Sc (Exon), Ph.D (Exon) M.I.Bio. (S.L.)

Deputy Director (Administration and Finance) — D. N. B. Perera, B.Sc (Cey)

RESEARCH DIVISIONS

Soils and Plant Nutrition Division

Head	—	M. Jeganathan, B.Sc (Lond) M.Phil (Lond)
Assistant Soil Scientists	—	Miss. M. B. M. N. Dias, B.Sc Agric (Cey) * *. K. S. Jayasekera, B.Sc (Cey) L. L. W. Somasiri, B.Sc (Cey) N. A. Tennakoon, B.Sc Agric (Cey)
Senior Technical Assistants	—	T. W. Fernando, L.I. Chem.C G. D. George
Technical Assistants	—	Mrs. G. S. Amarasekera Mrs. N. H. R. M. de Silva B.Sc (Peradeniya) N. P. Gunaratne Miss S. D. Hemamala B.Sc (Peradeniya) D. P. Panditharatne U. S. S. Perera Miss S. Periyathamby, N.D.S. (Sri Lanka) Mrs. S. M. Ratnayake Mrs. D. M. D. I. Wijebandara
Lab and Field Assistants	—	A. M. P. Attanayake E. M. A. Thilakaratne Banda K. V. W. de Silva A. A. Fernando P. M. Harischandra

*When more than one officer is listed under a designation, the names appear in alphabetical order.

* *Overseas study leave.

		K. Murugiah
		S. A. Peiris
		B. C. E. Perera
		D. S. Wijetunga
Typist (English)	—	H. M. W. S. Athauda

Genetics and Plant Breeding

Head	—	Miss M. R. T. Wickramaratne, B.Sc (Cey) Ph.D (Lond), DIC
Assistant Genetisists/Plant Breeders	—	Mrs. W. M. U. Fernando, B.Sc (Cey)
		Miss I. J. S. Kondasinghe, B.Sc Agric (Cey)
		K. R. R. A. Peiris, B.Sc Agric (Cey) * *
		W. G. A. Ratnasiri, B.Sc Agric (Cey)
Technical Assistants	—	Miss M. A. S. Fernando
		Mrs. W. B. S. Fernando
		Miss H. S. G. Kularatne
		M. H. L. Padmasiri
		H. P. P. H. Pathirana
		H. Samarasinghe
Lab and Field Assistants	—	R. B. Attanayake
		H. M. Dharmadasa
		W. T. H. C. Fernando
		T. M. W. Peiris
Clerk	—	K. P. W. Perera
Clerk/Typist	—	Miss I. N. Jayawardene

Seed Production Unit

Seed Production Officer	—	P. Kariyawasam, Dip. Agric
Lab and Field Assistant	—	H. Bandappuhamy
Clerk/Typist	—	Mrs. Manel Rodrigo

Isolated Seed Garden

Superintendent	—	D. M. Pathirage
Field Officer	—	G. B. A. Wijesekera
Lab and Field Assistants	—	U. V. M. Fernando M. Victor
Clerk/Typist	—	R. P. Victor B. Raymond Fernando

Agronomy Division

Head	—	Mrs. L. V. K. Liyanage, B.Sc Agric (Cey) M.Sc (Australia)
Assistant Agronomists	—	K. B. Dassanayake, B.Sc Agric (Cey) D. N. S. Fernando, B.Sc Agric (Cey) T. G. L. G. Gunasekera, B.Sc Agric (Cey) H. A. J. Gunathilake, B.Sc Agric (Cey) H. P. S. Jayasundara, B.Sc Agric (Cey) M. de S. Liyanage, B.Sc Agric (Cey), M.Sc (Australia) R. A. J. R. Perera, B.Sc Agric (Cey)
Senior Technical Assistant	—	M. Bastian
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Clerk/Typist	—	A. A. D. N. Athauda

Crop Protection Division

Head	—	P. Kanagaratnam, B.Sc Agric (Cey), Ph.D (Lond), D.I.C., M.I. Biol. (S.L.)
Crop Protection Officer	—	P. A. C. R. Perera, B.Sc (Lond), M.Sc (Lond) DIC**
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Experimental Officer	—	V. Shivanandarajah, B.Sc (Cey)
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Technical Assistants	—	Mrs. I. W. Alvitigala K. A. S. Chandrasiri Miss P. K. K. Croos K. F. G. Perera M. S. Velu
Clerk	—	Mrs. Anula de Zoysa
Lab and Field Assistants	—	W. E. A. Fernando D. M. Jayakody A. S. M. Premalal

Coconut Processing Research Division

Officer-in-Charge	—	R. Mahindapala, B.Sc M.Sc Ph.D
Research Assistant	—	A. M. J. C. Wijesinghe, M.Sc (Moscow), Ph.D (Moscow)
Experimental Officer	—	G. M. R. Karunasekera, B.Sc (Cey),
Senior Technical Assistant	—	P. A. D. G. A. Appuhamy
Technical Assistants	—	A. H. Norman G. C. Perera
Lab and Field Assistant	—	L. W. Theodore

Biometry Unit

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Biometrician	—	T. S. G. Peiris, B.Sc (Cey), M.Sc (New Zealand)
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Senior Field Assistant	—	E. Ranjith Fernando
Lab and Field Assistants	—	A. Dassanayake W. E. R. C. Fernando M. W. L. G. Fernando W. B. P. Fernando P. J. C. Fernando U. T. G. Fernando D. T. Fernandopulle W. K. M. K. Herath J. Wijedasa A. Wilson
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Research Assistant	—	Miss L. K. Periyapperuma, B.Sc (Cey.)
Technical Assistants	—	Miss K. D. Cecily Miss C. K. A. Gamage
Lab and Field Assistants	—	Mr. W. H. N. Jayatissa

Plant Physiology Unit

Officer-in-Charge	—	Mrs. C. Jayasekera, B.Sc (Cey)
Assistant Physiologist	—	Miss S. P. Suriyapperuma, B.Sc (Cey)
Technical Assistant	—	R. D. N. Premasiri
Lab and Field Assistant	—	A. Jayathilake

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Senior Technical Assistant	—	J. K. F. Kirthisinghe, Dip. Agric
Technical Assistant (Photography)	—	T. R. W. Weralupitiya
Artist	—	D. W. Hapuarachchi
Clerk/Typist	—	R. A. L. C. Fernando

Coconut Information Centre/Library

Librarian/Project Leader	—	M. J. C. Perera, ALA
Documentation Officer	—	Miss P. A. S. F. Caldera, B.Sc (Cey)
Documentation Assistant	—	D. B. Jayasinghe
Library Assistants	—	Miss P. D. U. C. Dharmapala Miss T. I. I. Peiris Miss D. I. Piyasiri
Clerk/Typist	—	Miss S. N. Gunathilake
Machine Operator	—	W. G. L. Rodrigo

ADMINISTRATION

Deputy Director (Administration and Finance)	—	D. N. B. Perera, B.Sc (Cey)

Establishment

Administrative Officer	—	M. D. R. A. M. Senanayake, BA (Cey)
Personnel Officer (Acting)	—	J. E. A. Dalpathado
Office Assistant	—	J. E. A. Dalpathado
Administrative Assistant	—	M. Leelaratne, BA (Cey)

Supplies Officer	—	M. A. Somadasa
Secretary to the Chairman	—	Mrs. T. M. H. Fernando
Stenographers (English)	—	Mrs. M. J. Ariyadasa Miss B. G. Mallika Piyaseeli Mrs. S. Z. Suhair
Chief Clerk	—	P. Daluwatte
Clerk/Typists	—	Mrs. P. C. A. Fernando C. B. B. P. Fernando Mrs. M. M. M. R. Fernando T. Gunadasa Miss U. I. Gunasekera K. D. Jathiratne J. D. Ratnasekera Mrs. Y. A. N. Samarasinghe W. A. W. Wijesuriya
Clerks	—	B. M. Dingiribanda A. I. F. Fernando Miss H. D. Mangalika, BA (Cey)
Record Keeper	—	I. H. Nelson
Receptionist/Telephone Operator	—	Miss L. M. N. Jansz

Accounts

Chief Accountant	—	R. M. G. D. Rajapakse
Accountant	—	D. R. C. M. Handalage
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Book Keepers	—	B. M. Jayathilaka Banda Mrs. D. M. R. Fernando A. S. Nanayakkara Mrs. K. M. A. Nonis T. M. S. Peiris

Store Keeper	—	M. B. Upali
Shroff	—	P. A. Nonis
Assistant Shroff	—	H. B. Thalgahagoda
Head/Clerk	—	R. H. B. Silva
Clerk/Typists	—	D. M. C. B. Dissanayake R. D. Dayasena P. P. M. J. Fernando Mrs. A. R. S. Hettiarachchi Miss K. A. D. N. S. Marian Mrs. J. K. F. Perera Mrs. C. M. B. I. Salwatura D. G. M. Weerasinghe Y. H. Wijesena
Clerk	—	Mrs. C. Munasinghe Mrs. P. H. C. M. G. Rodrigo W. M. S. Wijetunge

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Checking Officer	—	P. R. Fernandopulle
Internal Audit Clerks	—	M. R. U. Attanayake Mrs. M. M. J. R. Fernando Mrs. R. D. Indrawathie
Typist	—	Mrs. W. J. M. D. U. A. Dias

Estate Management Division

Manager (Estates)	—	P. S. Liyanagama, B.Sc Agric (Cey)
Assistant Manager (Farm)	—	K. P. de Silva
Clerk/Typists	—	N. R. Ayagama W. P. R. Fernando
Clerk/Typist (English)	—	S. N. Weerapperuma
Field Assistant	—	P. P. Jayasundara

Bandirippuwa Estate

Superintendent	—	A. N. Ekneligoda
Field Officer	—	T. H. L. Peiris
Field Assistant	—	W. L. B. Silva
Field Assistant (Nursery)	—	B. A. L. Mendis
Field Assistant (Dairy)	—	J. M. S. N. Appuhamy
Supervisors	—	M. Chandrasoma H. H. D. B. K. Dissanayake U. C. Hettiarachchi T. H. M. D. P. Peiris
Clerk/Typist	—	H. H. J. E. Appuhamy

Kirimatiyana Estate

Officer-in-Charge	—	K. P. C. Fernando

Pothukulama Research Station

Superintendent	—	G. Vithanage
Field Officer	—	N. Gamage
Supervisor	—	M. J. David
Estates Clerk	—	J. A. Rexi Reginold

Ratmalagara Estate

Superintendent	—	M. R. L. A. Perera
Field Officer	—	D. L. J. Nettasinghe
Field Assistant	—	E. W. A. G. Gunasinghe
Supervisor	—	I. A. N. Hemasiri
Estate Clerk	—	B. L. Senaghosha

Walpita Estate

Officer-in-Charge — M. S. Perera

Makandura Seed Garden

Officer-in-Charge — J. I. Jayalath

Supervisor — W. M. Rathnayake

Maduruoya Seed Garden

Superintendent — S. M. Wijerathna Banda

Supervisor — T. M. Keerthirathna

Passekudah Research and Development Farm

Assistant Manager (Farms) — A. Thavaratnarajah

Minneriya Research and Development Farm

Officer-in-Charge — M. P. W. Fernando

Engineering Unit

Resident Engineer — L. U. Jayawardene, Dip. (C.Eng.) T

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

Foreman (Electrical) — M. D. Bernard Praxidus

Foreman (Mechanical) — M. J. M. D. S. Jayawardene

Foreman (Buildings) — R. M. Dayaratne

Draughtsman — Mrs. R. M. S. Ratnayake

Clerk/Typists — Mrs. K. A. P. Chandani
P. Premaratna Fernando, B.A. (Peradeniya)

REPORT OF THE CHAIRMAN FOR 1986

D. V. Liyanage Ph.D.

This report deals with the activities of the Coconut Research Board during the period 1 January, 1986 to 31 December, 1986.

1.1 THE COCONUT RESEARCH BOARD

The membership and attendance at meetings upto end of August are reported below:

Dr. D. V. Liyanage	(Chairman)	(attendance 8/8)
Dr. O. S. Peries	(resigned in April)	(attendance 2/4)
Mr. K. F. J. Perera		(attendance 7/8)
Mr. Naomal S. Dias		(attednance 8/8)
Mr. M. M. Razik		(attendance 0/8)
Mr. P. R. Wijewardene		(attendance 5/8)
Mr. Merle E. Dalpathado		(attendance 4/8)
Mr. R. I. Fernandopulle	(Observer)	(attendance 6/8)
Mr. M. A. Warnakulasooriya	(Ministry representative)	attendance 7/8)

A new Board with Dr. D. V. Liyanage as the Chairman was appointed with effect from 1 September 1986 for a period of three years. The membership and their attendance are given below :

Dr. D. V. Liyanage	(Chairman)	(attendance 4/4)
Mr. K. F. J. Perera		(attendance 3/4)
Mr. Naomal S. Dias		(attendance 4/4)
Mr. P. R. Wijewardene		(attendance 2/4)
Mr. Merle E. Dalpathado		(attendance 3/4)
Mr. G. P. P. N. Perera		(attendance 4/4)
Dr. R. T. Wijewantha		(attendance 3/4)
Mr. R. I. Fernandopulle	(Observer)	(attendance 4/4)
Mr. M. A. Warnakulasooriya	(Ministry representative)	(attendance 4/4)

Altogether the Board held 12 meetings, all of which were held at the Coconut Research Institute, Lunuwila.

The Board appointed the following Consultants :

Mr. T. K. G. Ranasinghe	—	Processing Research
Mr. A. S. Ranatunga	—	Farming Systems Research

1.2 COMMITTEES OF THE COCONUT RESEARCH BOARD

1.2.1 Research Committee

The Research Committee held four meetings to monitor and review the implementation of the research programme. The Committee continued to make a very valuable contribution in monitoring progress of the research programme and guiding the research staff.

The membership and attendance at the meetings upto end of August are as follows:

Dr. D. V. Liyanage	(Chairman)	(attendance 3/3)
Mr. P. R. Wijewardene		(attendance 3/3)
Mr. T. K. G. Ranasinghe		(attendance 3/3)
Mr. B. R. T. de Tissera		(attendance 3/3)
Mr. W. K. D. J. Waragoda		(attendance 1/3)
Dr. D. T. Wettasinghe		(attendance 3/3)
Dr. R. Mahindapala	(Convenor)	(attendance 3/3)

The Research Committee was reconstituted in September and the membership and attendance are given below :

Dr. D. V. Liyanage	(Chairman)	(attendance 1/1)
Mr. P. R. Wijewardene		(attendance 1/1)
Mr. B. R. T. de Tissera		(attendance 0/1)
Dr. R. T. Wijewantha		(attendance 1/1)
Dr. D. T. Wettasinghe		(attendance 1/1)
Dr. R. Mahindapala	(Convenor)	(attendance 1/1)

1.2.2 Administrative Committee

The Administrative Committee met eight times during the year to consider matters referred to it by the Board. The entire Committee was reappointed in September. The membership and attendance at meetings are given below :

Mr. K. F. J. Perera	(Chairman)	(attendance 8/8)
Mr. Naomal S. Dias		(attendance 8/8)
Dr. D. T. Wettasinghe		(attendance 8/8)
Mr. M. A. Warnakulasooriya		(attendance 6/8)
Mr. J. M. D. Jayaweera	(Convenor upto August)	(attendance 7/8)
Mr. D. N. B. Perera	(Convenor from September)	(attendance 1/1)

1.2.3 Estates Committee

The Estates Committee held four meetings during the year. The Committee made a valuable contribution by effective control of field activities and financial operations. The membership and attendance at the meetings upto end of August are reported below :

Mr. Naomal S. Dias	(Chairman)	(attendance 3/3)
Mr. C. C. de Silva		(attendance 2/3)
Dr. D. T. Wettasinghe		(attendance 0/3)
Dr. R. Mahindapala		(attendance 1/3)
Mr. P. S. Liyanagama	(Convenor)	(attendance 3/3)

The Estates Committee was reconstituted in September, and the membership and attendance at the meeting held in November are given below :

Mr. Naomal S. Dias	(Chairman)	(attendance 1/1)
Mr. A. R. W. Jayasekera		(attendance 1/1)
Mr. G. P. P. N. Perera		(attendance 1/1)
Dr. D. T. Wettasinghe		(attendance 1/1)
Dr. R. Mahindapala		(attendance 1/1)
Mr. P. S. Liyanagama	(Convenor)	(attendance 1/1)

1.3 GENERAL REVIEW

The five year research programme introduced in mid-1984 is giving a mass of, valuable information for improving production and productivity from coconut lands. It covers 19 projects with nearly 100 trials to study various aspects of coconut cultivation. A summary of these trials is given in the Director's report and the details in sectional reports. Some of the highlights are indicated below.

An ideal cover crop for coconut lands is one that gives an adequate supply of leaf litter and nitrogen to the soil, die back during dry weather and regenerate with the onset of rains, preferably with increased production of coconuts. The cover crop trials are designed to identify suitable species for this purpose.

Cultivation of cacao, pepper, cloves, cinnamon and annuals under coconuts in the wet zone does not have adverse effects on coconut production, provided the coconuts and intercrops are managed properly. Productivity from the land could be increased three to six fold compared to monoculture of coconuts only depending on the crop used.

A Consultant was appointed to assist the CRI in the implementation of the Farming Systems Research Programme. The Board made a policy decision that initially the study should be restricted to the wet and semi-wet intermediate zones.

The Isolated Seed Garden near Rajakadaluwa, 140 ha in extent, is designed for the production of CRIC 60 and CRIC 65 seed. In 1985 with a good distribution of rainfall the average yield of the Tall variety palms was 151 nuts per palm per year as against 69 nuts per palm per year in 1984 when the rainfall was low. In order to get a good production of seed irrespective of weather conditions irrigation was introduced through the assistance of the Coconut Development Project.

The fertilizer recommendations for adult coconut palms was revised and a single mixture was recommended, the dosage varying according to soil type and agroclimatic zone.

The collaborative research programme between the University of London and CRI funded by the Commission of European Communities indicated that outbreaks of coconut caterpillar were caused by the disruption of a stable pest/parasitoid interaction.

Another collaborative study with the Tropical Development and Research Institute London indicated that the virgin female moths of the coconut caterpillar exude a chemical-pheromone – to attract males. One of the compounds has been isolated and is being field-tested. These chemicals could be used to forecast outbreaks of the pest after the current studies are completed.

Some believe that miracle plants could be produced by tissue culture. Unfortunately in coconuts, since the final commercial product is a result of sexual propagation the task is not so easy. The importance of this technique for coconuts is the production of off-types that a breeder could utilize to produce improved varieties. However, we are still in the initial stages of development. Four rudimentary plants sprouted in leaf tissue culture of coconuts, but failed to grow further. A technique was developed to raise plants from the embryo of Macapuno coconut (dikiri pol).

The Coconut Research Board with the concurrence of the Ministry of Coconut Industries and the Coconut Development Authority decided that in future the Institute will undertake coconut processing research only on on-farm products. Research on other areas will be handled by the Coconut Development Authority on a contract basis with recognized organizations. This step had to be taken as the Board was unable to hire the required expertise for processing research, since the terms of service that could be offered to the candidates are unattractive.

In order to transfer the technology developed by the Institute to the coconut growers, estate management and extension staff of the Coconut Cultivation Board, the following were organized by the Institute: one coconut conference, three seminars, two field days, three issues of the periodical *Poi Pawath*, two issues of the *Coconut Bulletin*, five new advisory leaflets and revision of old advisory leaflets.

2. REPORT OF THE DIRECTOR FOR 1986

D. T. Wettasinghe Ph.D.

2.1 GENERAL

The progress of the implementation of the research programme was very satisfactory. At the end of the year, nearly 100 experiments were in progress. During the year, several experiments were concluded and analyses of their data begun. Several new experiments also commenced.

In the field of processing research, the Coconut Research Board, with the concurrence of the Ministry of Coconut Industries, decided that in future the Institute will undertake research only on on-farm products such as copra and shell. Research on other areas will be handled by the Coconut Development Authority. Work on farming systems research and coconut processing research (ongoing projects on fibre and experiments on copra) was streamlined with the assistance of the two Consultants appointed by the Board.

The Institute purchased microcomputers to facilititate data manipulation and analyses. It is expected that these would facilitate the speedy analyses of available data from several long term experiments. Arrangements were made to train several staff members on the use of software.

Most of the long term field experiments were conducted satisfactorily. Majority of these experiments are in estates belonging to the Janatha Estates Development Board. The Institute staff continued to work in close cooperation with the staff of the JEDB in the conduct of these experiments.

Research projects funded by foreign agencies continued their progress satisfactorily.

The Plant Physiology Unit commenced work in September.

The team of scientists involved in the control of the coconut leaf miner, *Prome cotheca cumingi*, in the early 70's was awarded the Natural Resources Energy and Science Authority prize for outstanding scientific achievements. The team included the late Dr. U. B. M. Ekanayaka, Crop Protection Officer and Mr. P. A. C. R. Perera, Research Officer from the CRI, received the prize from H.E. the President in November.

2.2 Agronomy Division

Research projects on soil moisture conservation, rehabilitation of low yielding plantations, establishment and management of replanting/new plantings and farming systems progressed satisfactorily. At the end of the year, 28 experiments were in progress.

Covercropping trials in different agro-ecologiesindicated that *Mucuna utlis, Macroptilium atropurpureum* (Siratro) *Pueraria phaseoloides* and *Calopogonium mucunoides* established well. *P. phaseoloides* produced the highest top dry matter yields of more than 15 MT/ha at many sites. It performed better on lateritic gravel soils than on sandy soils. Although the performance of *Centrosema pubescens* was average during the previous year, it produced satisfactory top dry matter yields of around 12 MT/ha at most of the sites. *Mucuna utilis* performed poorly during the year, particularly on gravel soils. *Macroptilium atropurpureum* (Siratro) performed better on sandy soils than on gravel soils. During the year, *P. phaseoloides*, Siratro, *Centrosema pubescens* and *Calopogonium mucunoides* performed well at all sites and demonstrated their ability to conserve moisture satisfactorily during dry periods.

Bush covers, Ipil-Ipil and gliricidia produced dry matter yields of over 10 MT/ha during the year at all the sites, except on lateritic gravel soils in the Wet Intermediate Zone, where Ipil-Ipil produced only 10 MT/ha compared with 14.5 MT/ha top dry matter yields of gliricidia. These results demonstrated the better adaptability of gliricidia to a wide range of soils and climate.

In the cover crop/fertilizer trial, *Pueraria phaseoloides* produced the highest dry matter yield of 20 MT/ha at N, P. K and Mg levels of 35 kg M/ha, 80 kg P_2O_2 /ha, 60 kg. K_2O/ha and 25 kg MgO/ha respectively.

Trials on husk burial in sandy soil, started in 1981, were terminated during the year. Husk burial increased the copra weight by 19.9% over the control. In sandy soils, coconut husk was better than coir dust for moisture conservation. Also, placement of husks in pits was more economical than in trenches. However, in lateritic gravel soils, coir dust performed better than husks. Husk burying did not increase copra output significantly over the control, but coir dust in pits increased copra output by 11.7%. It is evident that in lateritic gravel soils, coir dust is better than husks in moisture conservation.

Preliminary results from rehabilitation trials indicated that opening quarter-circle trenches around the palm to prune the roots and filling them with green manure improved coconut production. The coconut/cattle/pasture system did not increase the coconut yields, but provided the entire nitrogen and 50% of the phosphate requirements of the palms.

A field survey of coconut smallholders in the wet intermediate zone was undertaken under the Farming System research programme. The results indicated that semi-perennial intercrops such as pineapple, passion fruit, banana, betel and ginger were very popular with farmers.

The advantages of intercropping were demonstrated in the field trials conducted in the wet zone. It was clearly shown that cultivation of cacao, pepper, cloves, cinnamon and annuals had no adverse effects on coconut provided coconuts and intercrops are managed properly. In fact, cultivation of cacao, coffee, cinnamon and annuals under coconut substantially increased coconut yields.

The intercropping trials have shown the economic advantages of intercropping and the potential for maximising income from coconut lands. The highest returns were from pepper.

In the cacao variety × fertilizer trial, the varieties NA 32 and Millawana continued to give the highest bean yields. The lowest bean yields were obtained from the variety Amelanado. In a trial conducted in the wet zone, pepper supported by gliricidia yieldde 100% more than from those trained onto coconut palms.

2.3 Genetics and Plant Breeding Division

The field experiments continued to progress satisfactorily. Five trials were completed and the data analysis begun.

Analysis of data on juvenile (pre-bearing) characters in the evaluation of cultivars trials showed that the performance of the cultivars was greatly affected by environmental differences associated with the different locations. A significant difference was noted in the performance of the different cultivars even at a single site but only a slight variety-site interaction. Early results confirmed that the hybrid is more vigorous than the tall and suggested some differences between the *dwarf green* × *tall* and *dwarf yellow* × *tall* hybrids. Differences among the tall cultivars (Ambakelle tall or CRIC 60, Moorock tall and plus palm tall) were not discernible at this stage.

The progeny from three different crosses, *tall* × *tall*, *tall* × *dwarf* and *tall* × *San Ramon*, where all parental palms were selected for a degree of drought tolerance and stability of production was planted in four different agroclimatic regions for comparing their performance.

Selected dwarf green palms were also included as seed palms in the pollination programme from 1985 so that the progeny from six different crosses would be available. Selection of dwarf yellow palms was completed and these also added to the pollination programme increasing the types of crosses to 12.

Self pollination of dwarf palms were continued for filling of vacancies at the Isolated Seed Garden (ISG). Crosses of selected elite tall palms in different combinations were carried out for the production of seednuts for use in the proposed 'super' seed garden at Kirimetiyana Estate. Pollinations of 51 palms were done and work for further selections begun.

Pollination of *San Ramon* palms at Bandirippuwa Estate and dwarf palms at Ratmalagara Estate were also continued.

Planting was continued in the new varieties block or crop museum. Nearly all local varieties are now represented. Seedlings of *rathran thembili*, *dikiri pol* and *spicata* were produced for planting. Indigenous gremplasm was purified by controlled pollinations.

Five forms of the variety *typica* were planted in ½ to 1 ac blocks at Bandirippuwa Estate. Two different colour forms of *San Ramon* (green and russet) were also propagated by selfing and two 1 ac blocks established. Arrangements were made to self-pollinate the small numbers of red, green and yellow palms originating from seednuts introduced from the Ivory Coast and the *tall* × *dwarf* hybrids resulting from the use of *Brazilian green dwarf* and *Ghana yellow dwarf* pollen on local talls in an attempt to accumulate genes of the exotic dwan palms.

A country-wide survey was undertaken to locate populations which should be conserved. Three estates where population known to have specific characteristics have been selected for this purpose. A survey to study the performance of the two improved cultivars CRIC 60 and CRIC 65 on a plantation scale showed that the poor performance sometimes encountered was due to improper choice of sites for planting and neglect. It was observed that two of the best estates in the state-owned sector which have the highest yields had relatively large extents under hybrid cultivation.

Flowering data from the trial at the Passekudah Research and Demonstration Farm, Kalkudah (Eastern Province) for evaluation of performance of F_1 progenise of tall (OP) and *dwarf* × *tall* were analysed. At six years from planting, 86/9% of the *dwarf* × *tall* hybrids were in flower with only 18.1% of the tall.

The crop at the Isolated Seed Garden (ISG) showed a 46% reduction from the outstanding crop of 1985. The total crop of 847,249 for 1986 was still well over the 10 year average. Eighty five percent of the crop was from *tall* palms. The mean number of nuts per *tall* variety palm was 99. The total seednut production at ISG was 686,905 with selection percentages ranging from 85 to 90; some of these nuts were used for research purposes and planting in seed gardens. Field maintenance at ISG was carried out satisfactorily. A total of 680 palms were uprooted, due mainly to the replanting programme. Replanting could not be completed as scheduled due to the adverse weather conditions but a total of 1,202 seedlings were planted both as replantings and as infills. There is now a total extent of over 100 of new plantaions. One of the nurseries at ISG was closed down and a new research nursery established at Bandirippuwa Estate, for raising seedlings for germplasm conservation and breeding trials.

The requirement of seednuts for the Coconut Cultivation Board was 1.79 million, which was lower than the normal requirement for meeting the recommended planting target of 2%. Due to the reduced requirements and the satisfactory crops, the demand was met without difficulty with 31.5% supplied from improved material from ISG.

The state-owned estates continued to obtain pollen for their pollination programmes. The demand for pollen by private estates declined during the year.

2.4 Soils and Plant Nutrition Division

Research projects on nutrient requirements of coconut and on improvement of soil organic matter status continued. Twelve long term experiments progressed satisfactorily. Three experiments were concluded.

The fertilizer recommendations for adult coconut were revised after considering the data available from the ongoing as well as past fertilizer trials. A single tea based fertilizer mixture, referred to as the Adult Palm Mixture, was recommended for the entire country. The dosage or application varies according to the fertility level of the soil and the climate. This mixture replaced the CU_1, CU_2, CU_3, CA_1, CA_2 and CA_3 fertilizer mixtures.

The joint CRI/CCB/FAO study on increasing yields of small holding by the popularization of the use of fertilizer and other related inputs was reviewed as the foreign funding was to be terminated the end of the year. The number of effective sites had decreased to 116 from the original 212 sites. The yield data from these sites upto the end 1985 were analysed. The increase due to fertilizer is 9% for Puttalam, 38% for Gampaha and 39% for Kurunegala.

Preliminary analysis of results from the field experiment on sources of nitrogen (urea, ammonium sulphate, ammonium chloride) was carried out. The differences in response of coconut to the three sources were statistically not significant.

Studies on the determination of fertilizer requirements of adult palms through leaf analysis progressed satisfactorily. Studies were confined to relatively large plantations where annual fertilizer requirements were formulated from the analytical data.

Attempts were made to use nut water analysis to study the nutrient status, particularly of Na, K, Ca, Mg and Cl of coconut. This showed much promise.

2.5 Crop Protection Division

Satisfactory progress was made on the collaborative research programme between the Silwood Centre for Pest Management (SCPM) of the University of London and the CRI on "Integrated and Biological Control of the Coconut Caterpillar and other Coconut Pests in Sri Lanka" funded by the Commission of European Communities. Analysis of population data of the coconut caterpillar and its parasites, collected over the past 20 years, was completed. The indications are that the outbreaks of coconut caterpillar are caused by the disruption of a stable pest/parasitoid interaction. However, these outbreaks are ultimately controlled by the parasitoids.

An integrated pest management programme was formulated for the coconut caterpillar, *Opisina arenosella*. Work on individual components of this programme commenced. The role of both inherent and environmentally induce host plant resistance was investigated by leaf analysis.

The collaborative research programme on the "role of pheromones in the control of coconut caterpillar" between the Tropical Development and Research Institute (TDRI) London and the CRI also progressed satisfactorily. Laboratory studies indicated the production of unsaturated hydrocarbon attractants by the virgin female moth. These chemicals elicited an electroantennogram response from the male moth. One of the compounds

was synthesised at the TDRI and field studies, using pheromone traps, were carried out at several locations in Sri Lanka. In the field, the maximum attraction of male moths to virgin female moths was observed four hours after darkness. There was no difference in the degree of attraction exerted by one to four day old female moths.

Good progress was made on the large-scale field evaluation of insecticides for the control of the coconut caterpillar. Trunk injection using electric drills and root feeding were the most effective techniques of application. Monocrotophos and methamidophos were the most potent insecticides. These techniques were used successfully for the control of other foliar pests such as the coconut scale, *Aspidiotus destructor* and the leaf miner, *Promecotheca cumingi*. However insecticides are seldom necessary as natural enemies are adequate for the control of these pests.

Investigations on the fungal pathogen of the black beetle, *Metarhizium anisopliae* were continued in the laboratory and in the field. The optimum temperature for the growth of six strains of the fungus, including a local strain, was 30°C. The fungus was cultured on maize grains and released in the specially-constructed "impregnation boxes" in the field and was effective in killing the larvae of *Oryctes rhinoceros*. The pathogenicity of three strains of this fungus was evaluated against the larvae of *O. rhinoceros* and was found to be similar. Fungus cultured on 50 g maize grains was adequate to infect and kill 90 of the larve in a pot containing 0.1 m^3 of moist coir dust.

Further improvements were made to the artificial diet for rearing red weevil. For laboratory rearing the artificial diet was preferred to sugarcane cuttings during the first 40 days because of the low larval mortality. The larvae are then transferred to sugarcane cuttings for further development. This system was found to be satisfactory for mass rearing of the red weevil in the laboratory.

Outbreaks of the nettle caterpillar, *Parasa lepida* occurred in two estates in the North Western Province and these were controlled by naturally-occuring parasitoids and predatory insects. Several outbreaks of the coconut caterpillar had to be treated by spraying BHC (one estate) and by trunk injection of systemic insecticides (several estates). The insectories at Lunuwila and Mylambavely continued to breed parasitoids of the coconut caterpillar.

Assistance was provided to the Sri Lanka State Plantations Corporation for the introduction of the oil palm pollinating weevil, *Elaeidobius kamerunicus* to Sri Lanka. The insects were imported to Sri Lanka through the Commonwealth Institute of Biological Control (CIBC). Quarantine screening and mass rearing of the weevil commenced. The approval of the Chief Plant Quarantine Officer of the Department of Agriculture was received for the field release of the insect.

2.6 Coconut Processing Research Division

In view of the policy changes, the research activities of the division were confined to on farm products such as copra and shell. However, ongoing experiments on fibre were continued.

Experiments on fuel saving techniques for copra drying indicated the possibility of reduced copra drying time by reducing the number of fires, thereby saving on coconut shells and labour. Although above-normal temperatures were recorded below the copra bed, the temperatures inside the copra layers appeared to be comparable with the standard method.

Preliminary designs on a solar dryer for copra for both estate as well as for small holder sector were completed.

A survey was undertaken to obtain data on the existing husk crushers with a view to determine the most suitable model of the husk crusher for Sri Lankan conditions.

In mill experiments conducted to improve mattress fibre cleaning, the recovery of fibre from wet and dry samples was better in paddle sifters than in turbo cleaners.

2.7 Tissue Culture Unit

The embryo culture technique developed earlier by the Unit was appropriately modified for use as a method of screening drought tolerant coconut palms in a population. A technique was developed to raise plants from embryos of *Dikiri* coconut (a non-germinating type). Two *Dikiri* coconut seedlings derived from embryos have been successfully transplanted in soil.

The tissue culture research, partly funded by a USAID grant, progressed satisfactorily. Embryogenesis has been induced in cultured leaf tissues. Four embryoids sprouted in culture but did not produce complete plants. It was possible to produce plants from cultured shoot apical meristems but their multiplication was unsuccessful.

2.8 Plant Physiology Unit

The Plant Physiology Unit was established in July.

A study was undertaken to identify the physiological and biochemical characters of drought tolerant and high yielding *tall* palms at the Isolated Seed Garden.

A survey of palms affected with Leaf Scorch Decline was completed to gather data to investigate the relationship between yield, age and variety of palms and soil type on the incidence of Leaf Scorch Decline.

2.9 Biometry Unit

The Unit continued to assist the research divisions in designing field experiments, recording data and their analysis and interpretation of results. Data from 51 experiments were analysed. Data manipulation and analyses were much facilitated by the acquisition of two microcomputers during the year.

In the calibration trial at Walpita Estate, the number of bunches per palm increased by 15.8% compared with 1985. However, the number of nuts per hectare declined by 14.8% over 1985. The husked nut weight and copra outturn for 1986 were improved with 667 g and 1191 nuts respectively. However, the overall copra yield per hectare was 10.8% less than in 1985.

The three agri-meteorological stations at Bandirippuwa Estate, Ratmalagara Estate and Isolated Seed Garden were maintained satisfactorily.

2.10 Estate Management Division

The division managed five estates, two research and demonstration farms and two seed gardens.

Work of the estates was monitored closely. This was possible through frequent inspections, both by Institute staff and some members of the Estates Committee. It was possible to effectively control the field operations and financial operations. The measures introduced in 1985 to reduce the cost of production in CRI estates were found to take effect.

Once the administrative matters were streamlined, an intensive programme was launched to adopt soil and moisture conservation practices. Husk burying was intensified using all available husks; on occasions husks had to be purchased from outside. Establishment of cover crops was intensively pursued. It has been possible to establish a cover crop in the sandy areas at Bandirippuwa Estate.

An extensive rehabilitation programme was launched at Bandirippuwa Estate. Improved cultivar, CRIC 60 was used to replant 48 ac. In addition to husk burying and establishment of cover crop, work on rehabilitation of areas with poor soils was undertaken. A similar programme of improvement was undertaken at the Pothukulama Research Station. Altogether 68 ac. were replanted at three estates. Twelve acres at the Minneriya Research and Demonstration Farm were planted to coconut.

Work on the establishment of the new seed garden in Mahaweli System 'B', Block 104, was hampered due to frequent elephant damage. The left-over jungle areas had to be under-brushed to drive away the elephants. About 60 ac were planted with material selected from the Isolated Seed Garden.

The outstanding yields obtained in 1985 could not be maintained due to adverse weather conditions in 1985. However, improvements to soils and moisture conservation practices undertaken during the previous two years in certain estates paid dividends. The drop in yield at Ratmalagara Estate over 1985 was only 4.8% whereas at Pothukulama Research Station, the decline in crop was nearly 40%.

Routine field operations were carried out on schedule. This was possible through the purchase of new tractors and other farm implements, notably tractor-driven weed slashers. The general condition of the estates continued to improve.

2.11 Information Services Unit, Library and the Coconut Information Centre

Three issues of *Pol Pawath* devoted to intercropping and Planting Materials were published. Two issues of the *Coconut Bulletin*, devoted to Intercropping were also published. Several advisory circulars in the new series were issued.

The technical publications, *Cocos* and the *Annual Report* (1984) were also published. A booklet titled 'Guide to the Coconut Research Institute' was published.

The Institute participated in the sixth anniversary Mahapola exhibition at Pannala, Fisheries Exhibition at Negombo organized by the Ministry of Fisheries to mark the World Food Day, Science Exhibition at the Joseph Vaz College, Wennappuwa and the 133rd Mahapola Exhibition at Nattandiya.

The Library functioned smoothly during the year. In addition to serving the CRI staff, it provided assistance to the Inter Library Loan Service and AGRINET Service. The number of books at the end of the year was 4,424.

Work of the Coconut Information Centre (CIC) progressed satisfactorily, with part financing by the International Development and Research Centre (IDRC), Canada. Collection and collation of information on all spects of coconut cultivation, processing and technology continued uninterrupted. Requests for literature from overseas were serviced. The Centre published the Annotated Bibliographical Series (No. 16 & No. 17) and the Retrospective Bibliographical Series on coconut diseases and their control. A considerable amount of work on the Retrospective Bibliography on Theses was completed. The newsletter COCONIS was published on schedule.

With the acquisition of a microcomputer and software, the Centre began to computerize the databases and information retrieval. The Centre personnel were trained locally in the use of software.

2.12 Administration Division

The total expenditure for the year was Rs. 27.6 million. The normal welfare activities were continued. The Establishment and Engineering Sections moved into more spacious accommodation. Civil works amounting to about Rs. 2 million were undertaken during the year.

3. FOREIGN AIDED PROJECTS

3.1 Coconut Development Project

Under this project, further support was provided to the CRI for improvements to infrastructural facilities. Arrangements were finalized to provide laboratory and field equipment worth nearly Rs. 5 million. Assistance was provided for the supply of mains electricity to Ratmalagara Estate and Walpita Estate.

The work on rehabilitation of the irrigation system at the Isolated Seed Garden proceeded satisfactorily. At the end of the year, about 95% of work was completed. The completed work includes expansion of pump houses, provision of new pumps, repair of existing pumps, repairs to the 'T' joints of the reticulation system and laying of a new pipe line of 250 m.

Work at the Makandura Seed Garden progressed smoothly. Routine maintenance work of the plantation with emphasis on seedling care was carried out. The vacancies were filled. Several low-lying patches were reclaimed and seedlings planted. The general performance and growth of seedlings were very satisfactory. Construction of several buildings was completed.

4. FIELD DAYS, SEMINARS

Two Field Days were held.

27 March	—	for smallholders and extension personnel of the Coconut Cultivation Board from Kurunegala district, at Bandirippuwa Estate.
28 October	—	for smallholders from special coconut project, Rambukkana, at Walpita and Bandirippuwa Estates.

In addition, the Agronomy Division conducted 18 Field Demonstrations for smallholders and school children from Puttalam district, at the Integrated Rural Development Project Farm of the CRI at Nattandiya.

The seminar series for planters from the Janatha Estates Development Board, National Livestock Development Board and Superintendents and extension personnel of the Coconut Cultivation Board was conducted on schedule. During the year, three seminars on "Coconut Breeding — Progress and Prospects", "Towards Profitable Management of Coconut Lands" and on "Coconut Extension work in Sri Lanka" were held.

The Institute conducted a very successful Coconut Conference for coconut growers in Colombo on 22 July.

The Institute conducted a course of training for the Diploma Course of the National Institute of Plantation Management. Attachment training programmes were provided to three batches of students from the National Apprenticeship Board. A five-month attachment training was provided to a trainee from the Peoples Republic of China.

Several short programmes were conducted for visitors/trainees from several countries, including a team of extension agents of member countries of the Asian and Pacific Coconut Community.

5. VISITORS

The important visitors to the Institute during the year included the following :—

Mr. H. L. Barkey, Coconut Development Project, Tanzania
Dr. Mathew Cock, Commonwealth Institute of Biological Control
Dr. J. Douek, British Council
Dr. Charles Godfry, Commonwealth Inst. Biological Control
Dr. David Hall, Tropical Development & Research Institute
Prof. M. P. Hassel, Imperial College, London
The Hon. Harold Herat, Minister of Coconut Industries
Dr. R. P. Jayewardene, Director General, NARESA
Mr. John King, Overseas Development Administration, London
Dr. John Mumford, Imperial College, London
Dr. Susanne Ornager, UNESCO
The Hon. Gamini Jayawickrama Perera, District Minister for Kurunegala
Mr. B. Pruniere, Cultural Attache, French Embassy
Mr. P. G. Punchihewa, Executive Director, Asian and Pacific Coconut Community, Indonesia.
Dr. Duong Tan Phuoc, Director, Centre for Oils and Oil Plants, Vietnam
Ms Janet Riley, Rothamstead Experimental Station
Mr. Oscar Santos, Chairman, Philippine Coconut Authority and party

6. STAFF MATTERS

6.8 Overseas Training

Mrs. L. V. K. Liyanage, Head of the Agronomy Division participated in the FAO/IAEA Interregional Training Course on the Use of Isotope and Radiation Techniques in studies on Soil/Plant relationship in Austria from 20 May to 20 June.

Mr. M. P. D. T. Mathes, Officer-in-Charge of the Biometry Unit undertook a training programme of five months in England on Crop Experimentation from 4 July.

Mr. P. A. C. R. Perera, Research Officer (Crop Protection Division) visited the Imperial College of Science and Technology, London for consultations on his research project from 25 January to 1 March, and again for six months from 15 August for completion of postgraduate studies

Mrs. C. W. Jayasekere, Officer-in-Charge of the Plant Physiology Unit returned to the island in May after postgraduate training in Australia.

Mr. K. S. Jayasekere, Research Assistant (Soils and Plant Nutrition Division) returned to the island in October after postgraduate studies in Australia.

Mr. G. D. George, Senior Technical Assistant (Soils and Plant Nutrition Division) returned to the island in April after completing the six months, International Course in Soil and Plant Analysis at the Royal Tropical Institute, Netherlands.

The following officers continued their postgraduate training :

Mr. K. R. R. A. Peiris, University of Queensland, Australia.
Ms M. B. M. N. Dias, University of Queensland, Australia.

6.2 Overseas Visits

Dr. P. Kanagaratnam, Head of the Crop Protection Division visited the Silwood Centre for Pest Management (SCPM) of the Imperial College, London, and a number of other research institutions in England under collaborative research programme between the CRI and the SCPM from 4 to 31 March.

Dr. Kanagaratnam and Mr. J. K. F. Kirthisinghe, Senior Technical Assistant visited the Central Plantations Crops Research Institute in Kerala, India from 25 November to 8 December along with a group of scientists from the Tea Research Institute to study the involvement of nematodes in diseases of coconut and intercrops.

Mr. H. A. J. Gunathilake, Research Assistant (Agronomy Division) undertook a study tour of the coconut smallholders in the Philippines from 26 May to 12 June.

6.3 Participation of CRI Staff in other Statutory Bodies, Committees

The following CRI staff members served in the Boards/Committees as indicated below :

Dr. D. T. Wettasinghe :

— Member, Board of Directors, National Institute of Plantation Management

— Member, Board of Directors, Sri Lanka Cashew Corporation

— Member, Board of Management, Postgraduate Institute of Agriculture, University of Peradeniya

— Member, Working Committee on Agriculture and Veterinary Science, Natural Resources, Energy and Science Authority of Sri Lanka

— Member, Board of Study in Crop Science, Postgraduate Institute of Agriculture, University of Peradeniya

Dr. R. Mahindapala :

— Member, Formulary Committee on Pesticides, Ministry of Agricultural Research and Development

— Member, Working Committee on Biological Sciences, Natural Resources, Energy and Science Authority of Sri Lanka

— Member, Drafting Committee on Pesticides, Sri Lanka Standards Institute

— Member, Special Committee for the import of Oil Palm, Ministry of Agricultural Research and Development

Mr. M. Jeganathan :

— Member, Fertilizer Coordinating Committee, National Fertilizer Secretariat

— Member, Agricultural Committee, Atomic Energy Authority

— Member, Technical Advisory Committee, Ceylon Fertilizer Corporation

— Member, Drafting Committee on Fertilizer, Sri Lanka Standards Institute

Mr. P. A. N. Ratnayake (up to March) :

— Member, Advisory Committee on Coir Fibre and Fibre Products, Export Development Board

REPORT OF THE AGRONOMY DIVISION

Head — L. V. K. Liyanage, M.Sc.

1. GENERAL

1.1 Staff Matters

Appointments : Mr. R. A. J. R. Perera and Mr. K. B. Dassanayaka were appointed Research Assistants and assumed duties on 8 August and 1 September respectively.

Mr. A. S. Ranatunga was appointed as a consultant to assist the farming systems research programme of the Division from July.

Resignations : Mr. M. A. Thilakasiri, Assistant Agricultural Economist, resigned from the service of the Institute on 1 October.

Promotions : Messrs. W. R. O. Fernando, K. S. A. J. Fernando and W. W. S. A. Fernando, Laboratory and Field Attendants were promoted from Minor Grade Class 1 to Special Class with effect from 1 January, 1984.

Transfers : Mr. E. M. Gunaratne Banda, Field Assistant and Mr. J. K. H. V. Perera, Laboratory and Field Attendant, were transferred to the Division from the Estate Management Division on 1 January,

Award of degrees : Mrs. K. C. P. Perera, Technical Assistant, obtained her BSc. degree in November as an external student of the University of Peradeniya.

1.2 Study Leave

Mr. D. N. S. Fernando, Assistant Agronomist who left the island on overseas study leave on 17 November 1985 for postgraduate studies in Crop Physiology at the University of Reading, England, under the Colombo Plan Technical Training Scheme returned on 6 October to conduct the research component of his studies at the Institute.

2. RESEARCH PROJECTS

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

In each of the following experiments 1.1.1 to 1.1.4 four plant samplings were done at three monthly intervals. Dry matter yields of cover crops were recorded by removing 1 m^2 quadrat samples. Soil samples at 0–22.5 cm. and 22.5–45 cm. depths were taken from each plot at six monthly intervals.

These experiments are carried out in collaboration with the Soils and Plant Nutrition Division.

Experiment 1.1.1 : Evaluation of creeping and bush covers for coconut lands with special emphasis on plant characters and the effect on physical and chemical properties of the soil at Bandirippuwa Estate, Lunuwila (Wet Intermediate Zone, Sandy soil) — 1984

Among the creeping cover crops *Pueraria phaseoloides* produced the highest top dry matter yields of around 15,000 kg./ha. followed by *Macroptilium atropurpureum* around 14,000 kg./ha. *Mucuna, utilis* and *Calopogonium mucunoides* around 12,000 kg./ha. and *Centrosema pubescens* around 10,000 kg./ha. during the year. The bush covers Ipil-ipil and gliricidia produced top dry matter yields of more than 12,000 kg./ha. during the year.

Experiment 1.1.2 : Evaluation of creeping and bush covers for coconut lands with special emphasis on plant characters and the effect on physical and chemical properties of the soil at Walpita Estate, Kotadeniyawa (Wet Zone, Lateritic gravel soil) — 1984.

During the year, *P. phaseoloides* produced the highest top dry matter yields of around 17,000 kg./ha. while *Calopoginium mucunoides* produced around 14,500 kg./ha. *Centrosema pubescens* produced satisfactory yields of around 13,800 kg./ha. Top dry matter yield of *M. utilis* was around 8,000 kg./ha. and was low compared to the first year's growth. Top dry matter yield from *M. atropurpureum* was 10,800 kg./ha. and was also lower than last year's yield. Gliricidia yielded top dry matter of more than 12,000 kg./ha.

Experiment 1.1.3 : Evaluation of creeping and bush covers for coconut lands with special emphasis on plant characters and the effect on physical and chemical properties of the soil at Heemmeliyagara Estate, Dummalasuriya (Wet Intermediate Zone, Lateritic gravel soil) — 1984.

During the year, *P. phaseoloides* and *C. pubescens* produced the highest top dry matter yields of around 16,000 kg./ha. *C. mucunoides* also gave satisfactory yields of 14,000 kg./ha. Performance of *Calopogonium caeruleum* was quite satisfactory during the year producing around 12,500 kg./ha. of top dry matter yields. *M. atropurpureum* gave top dry matter yields of 12,800 kg./ha. *M. utilis* gave top dry matter yields of 8,500 kg./ha. but its performance was poorer than previous year's performance.

Experiment 1.1.4 : Evaluation of creeping and bush covers for coconut lands with special emphasis on plant characters and the effect on physical and chemical properties of the soil at St. Johns Estate, Mangala-eliya (Dry Zone, Loamy sands) — 1984

M. utilis and *M. atropurpurem* produced the highest top dry matter yields of more than 15,000 kg/.ha. during the year. *P. phasioloides* and *C. pubescens* gave satisfactory yields of 14,000 kg./ha. and 12,300 kg./ha. respectively. Top dry matter production of Ipil-ipil was higher at this site, giving around 12,000 kg./ha.

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Experiment 1.2 : Effect of N P K and Mg on the early growth and uptake of *pueraria phaseoloides* grown under coconut, Ratmalagara Estate, Madampe 1984

During the year, four plant samplings were done by taking 1 m^2 quadrat samples.

The highest top dry matter yield of approximately 20,000 kg/ha with 10,000 kg./ha. of leaf litter was produced with 35 kg. N, 80 kg. P_2O_5, 60 kg. K_2O and 25 kg. Mgo/ha. However, the highest leaf litter production of around 16,000 kg./ha. was at 120 kg. K_2O/ha. in the presence of moderate levels of N, P and Mg (35 kg. N, 40 kg. P_2O_5 and 25 kg. Mgo/ha.

L. V. K. Liyanage and A. M. U. Wijeratne

Experiment 1.3 : Effect of green manuring practices on the improvement of organic matter content and water holding capacity of soil. Muthugala Maha-watte Estate, Dambadeniya — 1984

During the year two samplings were done on 19 March and 6 November. Samplings at regular intervals could not be done due to the poor growth of ipil-ipil and gliricidia. However, performance of gliricidia was satisfactory compared with ipil-ipil. Fresh leaf matter was obtained by lopping the trees at one meter height above the ground level.

Along with fertilizer application of 2 kg. of CU_2 per palm on 21 March, fresh leaf matter of 5 kg. of Gliricidia and 3 kg. of Ipil-ipil were incorporated to a depth of 22 cm. around the manure circle. Fresh leaf material obtained in November was added to the manure circle as a mulch at the rate of 10 kg. and 6 Kg of Gliricidia and Ipil-ipil respectively.

During the year, records on coconut yield, copra weight, number of female flowers and immature nut fall were maintained. Treatments did not appear to show any effect on nut production during the year.

L. V. K. Liyanage, H. P. S. Jayasundera and M. Bastian

Experiment 1.4 : Effect of planting sunhemp on the improvement of organic matters and water holding capacity of soil. Kiniyama Estate, Bingiriya — 1984 (Joint study with Soils and Plant Nutrition Division)

This trial was discontinued in March, because of the non-availability of the seeds in time and severe weed invasion after incorporating the sunhemp crop.

A. Tennakoon and L. V. K. Liyanage

Experiment 1.6 : Effect of three frequencies and two depths of ploughing on the performance of coconut on sandy soil. Jacintha Estate, Palavi — 1984

Once a year and once in two years ploughing treatments (F_1 and F_2) were imposed in November. Soil moisture measurements were taken at eight occasions during the dry periods. Records on coconut yield, copra weight, number of female flowers and immature nut fall were maintained.

There were no significant differences in coconut yields among the treatments. However, ploughing treatments showed a 1.8% increase in nut production over the no-plough treatments. Soil moisture measurements indicated a 5.65% increase in moisture content in ploughed plots compared with the control plots.

H. A. J. Gunathilaka and M. J. I. Costa

Experiment 1.6.2 : Effect of three frequencies and two depths of ploughing on the performance of coconut on lateritic gravel soil. Heemmaliagara Estate, Dummalasuriya — 1984

Once a year and once in two years ploughing treatments were imposed in November. Soil moisture measurements were taken on seven occasions during the dry periods. Records on nut yield, copra weight, number of feamle flowers and immature nut fall were maintained.

There were no significant differences in coconut yields among the treatments. A 7.12% increase in moisture content was observed in ploughed plots compared with the control.

H. A. J. Gunathilaka and M. J. I. Costa

Experiment 1.7 : Effect of four methods of placement of husk and coir dust on moisture conservation in deep sandy soil. Shanthil Estate, Pallama — 1982 (Joint study with Soil and Plant Nutrition Division)

During the year, records on nut yield, copra weight, female flowers and immature fallen nuts were kept. The cumulative nut and copra yield for the year are given in Table 1.

Table 1 *Effect of different placement of husk and coir dust on the Yield of coconut, Shanthil Estate, Pallama.*

Treatment	*nuts/palm*	*Copra weight/Palm (kg.)*
Control	47.2	8.57
Husk pits	56.5	10.28
Husk trenches	55.3	9.95
Coir dust pits	54.8	8.81
Coir dust trenches	53.5	8.26
Sig.	*	*
LSD (P=0.05)	7.6	1.38
CV %	15.9	28.0

The data indicate that the placement of husk and coir dust produced a marked increase in nut yield over the control. Between treatments, however, husk pits (19.7%) increase over control) gave only a marginal increase in nut production over husk trenches (17.2%) and coir dust pits (16.1%), while treatment with coir dust in trenches was the least effective. Morever, copra weight of palms in plots treated with husk in pits followed by trenches increased by 19.9% and 13.5%, respectively over the control.

Based on these observations, it is concluded that the use of coconut husk is more effective than using coir dust for moisture conservation in sandy soils and the adoption of pit system appears to be more economical than the trench system.

The experiment was terminated during the year.

M. de S. Liyanage and M. N. Dias

Experiment 1.8 : Comparison of using husk and coir dust on moisture conservation in lateritic gravel soils. Ratmalagara Estate, Madampe — 1981 (Joint study with Soil and Plant Nutrition Division)

During the year, records on nut yields, copra weight, number of bunches, female flowers and immature fallen nuts were maintained. The cumulative nut and copra yields are given in Table 2.

Table 2 — *Effect of coconut husk and coir dust on the yield of coconut, Ratmalagara Estate, Madampe.*

Treatments	*nut yield/ palm*	*Copra weight/palm (kg)*
Control	72.9	14.52
Husk pits	83.2	14.87
Coir dust pits	90.9	16.22
Sig.	*	*
LSD (P=0.05)	8.3	1.89
CV %	7.8	10.8

The data clearly indicate that both husk and coir dust induced a substantial increase in the yield of nuts over the control. Furthermore, the response to coir dust (24.7%) was better than that to husk (14.8%). In addition, coir dust treatment improved the copra yield by 11.6% compared with the control.

It is therefore concluded that the use of coir dust is more beneficial than using coconut husk for moisture conservation in lateritic gravel soils.

The experiment was terminated during the year.

M. de. S. Liyanage and K. S. Jayasekara

Experiment 1.9.1 : Effect of different methods of placement of husk and coir dust on moisture conservation in lateritic gravel soils. Kiniyama Estate Bingiriya — 1984

The treatments in this experiment are described in the annual report (1984). Of the ten treatments imposed, the cumulative nut yield data for the year showed that 8 ′×4 ′ 3 ′ pits filled with either husk alone or husk mixed with coir dust and linear trenches filled with husk gave higher nut yields than the control. Furthermore, mixture of husk and coir dust in pits appeared to be more effective than husk alone for increased production. Treatments involving circular trenches appeared to be harmful to the palm and less economical.

The experiment is in progress.

M. de S. Liyanage

Experiment 1.9.2 : Effect of different methods of placement of husk and coir dust on moisture conservation in sandy soils. Jacintha Estate, Palavi — 1984.

During the year, records were kept on nut yield, copra weight, number of female flowers, fallen immature nuts. Preliminary observations suggest that two pits of 4 ′×4 ′× 3 ′ on either side of the palm and filled with husk gave a better response than the control in terms of both nut and copra yields. However, both nut yields and copra weight of palms with circular trenches decreased compared with the control.

The experiment is in progress.

M. de S. Liyanage

PROJECT 2 : REHABILITATION OF LOW YIELDING PLANTATIONS

Experiment 2.1 : Effect of various cultural practices on the performance of low yielding palms in sandy soil. Jacintha Estate, Palavi — 1984

During the year, records of coconut yield, copra weight, number of female flowers, immature nut fall were kept.

Treatments did not show any effect on nut production during the year.

T. G. L. G. Gunasekara

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

Records of coconut yield, copra weight, number of female flowers and immature nut fall were maintained during the year.

The results are given in Table 3. There were significant differences in copra weights of nuts and copra weights/ha. among the treatments. It appears that opening up of $\frac{1}{4}$ circle trench around the palm and filled with gliricidia and ipil-ipil caused an increase in copra weight of nuts over the control.

Table 3 *Copra yield in different cultural operations Heemmaliagara Estate, Dummalasuriya*

Treatment	*Copra content (g/nut)*	*Copra weight (MT/ha.)*
T_1	202.8	1.99
T_2	191.4	1.78
T_3	182.3	1.86
T_4	174.4	1.63
T_5	193.3	1.73
T_6	194.1	1.83
T_7	192.0	1.66
T_8	181.1	1.51
T_9	162.1	1.41
T_{10}	175.8	1.53
T_{11}	174.2	1.31
Sig.	*	*
LSD (P=0.05)	20.40	0.36
CV %	14.01	12.85

T_1 =Opening up of $\frac{1}{4}$ circle trench and filled with Gliricidia and Ipil.

T_2 =Opening up of $\frac{1}{4}$ circle trench and filled with Goat dung.

T_3 =Opening up of $\frac{1}{4}$ circle trench and filled with Sandy Soil.

T_4 =Opening up of $\frac{1}{2}$ circle trench and filled with Gliricidia and Ipil.

T_5 =Opening up of $\frac{1}{2}$ circle trench and filled with Goat dung.

T_6 =Opening up of $\frac{1}{2}$ circle trench and filled with Sandy soil.

T_7 =Opening up of full circle trench and filled with Gliricidia and Ipil.

T_8 =Opening up of full circle trench and filled with Goat dung.

T_9=Opening up of full circle trench and filled with Sandy soil.

T_{10}=Opening up of full circle trench and filled with same soil.

T_{11}=Control.

T. G. L. G. Gunasekera

Experiment 2.2.2 : Effect of cultural operations designed to induce root formation on the re-habilitation of low yielding plantations in lateritic gravel soil. Puwakwatte Estate, Kotadeniyawa — 1984.

During the year, records on nut yields, copra weight, number of female flowers and immature nut fall were kept.

The results are given in Table 4. There were significant differences in copra weight of nuts among the treatments. Opening up of $\frac{1}{4}$ circle appears to be superior to the ress of the treatments in increasing copra weights of nuts. Opening up of $\frac{1}{2}$ circle appears to be better than the full circle.

Table 4—*Copra yield in different cultural operations at Puwakwatte Estate, Kotadeniyawa*

Treatments	*Copra content (g/nut)*	*Copra weight (MT/ha.)*
T_1	227.5	1.69
T_2	225.0	2.03
T_3	220.1	1.73
T_4	205.4	1.47
T_5	231.9	1.70
T_6	221.2	1.84
T_7	194.2	1.30
T_8	194.7	1.45
T_9	185.2	1.23
T_{10}	187.7	1.34
T_{11}	210.3	1.89
Sig.	*	n.s.
LSD (P=0.05)	20.14	—
CV %	17.74	20.11

T_1 =Opening up of $\frac{1}{4}$ circle trench and filled with Gliricidia and Ipil.
T_2 =Opening up of $\frac{1}{4}$ circle trench and filled with Goat dung.
T_3 =Opening up of $\frac{1}{4}$ circle trench and filled with Sandy soil.
T_4 =Opening up of $\frac{1}{2}$ circle trench and filled with Gilricidia and Ipil.
T_5 =Opening up of $\frac{1}{2}$ circle trench and filled with Goat dung.
T_6 =Opening up of $\frac{1}{2}$ circle trench and filled with Sandy soil.
T_7 =Opening up of full circle trench and filled with Gliricidia and Ipil.
T_8 =Opening up of full circle trench and filled with Goat dung.
T_9 =Opening up of full circle trench and filled with Sandy soil.
T_{10}=Opening up of full circle trench and filled with same soil.
T_{11}=Control.

T. G. L. G. Gunasekara

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

Experiment 3.1 : Effect of shade cropping on the establishment and growth of coconut seedlings in the Intermediate Zone. Kirimetiyana Estate, Lunuwila 1985

During the year, Tall×Tall (CRIC 60) coconut seedlings were established in the field at a spacing of 7.5×6.6 m. giving a density of 200 palms/ha. The shade crops banana, ipil-ipil and gliricidia were fertilized and supplementary irrigation was provided during the prolonged dry period. Plots were weeded twice during the year.

The experiment is in progress.

M. D. S. Liyanage

Experiment 3.2 : Quantitative studies of the light distribution pattern in replanted/ newly planted coconut plantations – 1985.

For this study, both young and mature plantations of different age groups planted in the square system were selected from Bandirippuwa Estate, Ratmalagara Estate, Poththukulama Research Station and Isolated Seed Garden, Ambakelle.

Three uniform palms of each age group were selected at random and instantaneous light transmitted in the canopy zone was measured on clear days between 11.00 and 13.00 hours. The amount of light transmitted to the ground at 1.0 m. 1.75 m. and 3.76m, radial distance from the palm was measured using a LI 1776 solar monitor with a line quantum sensor. The mean value of light transmission at each distance was calculated by taking four measurements, and the light transmission in the canopy zone of each palm was estimated from the means of all three distances. Almost simultaneously, light reading was taken in an open area and the relative values of light transmission were expressed as a percentage of full sunlight (Table 5).

Table 5 : *Variation in light transmision in coconut plantations.*

Age of Palms year	*Planting density* palms/ha.	*Actual light transmission values* + ($UEm^{-2}{}_{6}{}^{-1}$)	*Relative light transmision values* (%)
2	164	1990 *	80
3½	164	1773	68
5½	164	950	45
7½	173	751	35
12	164	349	17
20	173	614	33
27	164	830	40
35	164	988	45
40	173	1102	52
50	164	1280	59
60	164	1505	70

* mean values of three palms.

As expected, data clearly show that the amount of light transmitted to the ground in coconut plantations varies considerably with the age of palms. It was revealed that young plantations from the 2nd year up to about 5½ years provide sufficient light to grow a range of annual and semi perennial intercrops. From about the 7½ to 19 years, the quantity of light is insufficient for successful intercropping. In mature plantations, intercropping can be recommended after the 20th year and continue until the 60th year.

The experiment was terminated during the year.

M. de S. Liyanage and H. A. Abeysoma

Experiment 3.3 : Quantitative study of the relative yields of grain legumes grown under different shade levels. Kirimatiyana Estate, Lunuwila — 1984.

In this study, the yield performance of three *Vigna* species of grain legumes namely green gram, cowpea and black gram in response to shading was compared by growing them in plots transmitting 100, 70, 50, 30 and 20% of full sunlight.

It was observed that cowpea adapted to shaded conditions better than green gram or black gram. The bigger size of seeds and the greater number of seeds per pod largely contributed to the yield advantage in cowpea under shade over the other two species. Although black gram outyielded green gram in the open and at 30% shade level the performance of the latter improved with increasing intensity of shade, suggesting that green gram is adapted to shaded environment better than black gram.

The experiment was terminated during the year.

M. de S. Liyanage and H. A. Abeysoma

PROJECT 4 : STUDIES IN FIELD MANAGEMENT SYSTEMS

Experiment 4.1.1 : Utilization of animal husbandry for optimization of coconut production, Bandirippuwa Estate, Lunuwila — 1984.

The performance of *Brachiaria miliiformis*, *Pueraria phaseoloides*, ipil-ipil and gliricidia in the five paddocks was satisfactory during the year. In addition to grazing in paddocks, animals were fed with 6 kg. of fresh ipil-ipil per head per day throughout.

Coconut palms in the control plot were fertilized with CU_1 at the rate of 3 kg/palm in October. Palms in the treatment plots with cattle/pasture were fertilized with muriate of potash and saphos phosphate at the rate of 0.75 kg./palm and 0.18 kg./palm respectively. In addition, fresh gliricidia was applied as a mulch at the rate of 7.5 kg./palm.

Records of the coconut yield, copra weight, number of female flowers and immature nut fall were kept during the year. Weekly live weight gains were measured on each animal before moving to each paddock. An average of 3.5 to 4.2 kg. of fresh cowdung was added by an animal for a day. Total returns of cowdung by the system were around 43–52 kg./palm during the year. Live weight gains were satisfactory from July onwards gaining an average of 0.308 kg./head/day.

Although there were no significant differences in nut yields due to the treatments over the control, it was apparent that coconut/cattle/pasture system is a useful substitute for fertilizers especially nitrogen, to coconut, and also to provide organic matter.

H. P. S. Jayasundera and R. Marasinghe

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

Brachiaria miliiformis and *Pueraria phaseoloides*, ipil-ipil and gliricidia planted in Maha, 1985 established during the year. The experiment is in progress.

It is expected to introduce cattle by early 1987.

H. P. S. Jayasundera and W. S. M. A. Fernando

Experiment 4.2 : Survey on coconut small holdings to identify target group for farming system research and development.

An attempt was made to investigate the present status of the coconut based farming systems, operated by small holders (three to ten acres) and their socio–economic characteristics through a survey conducted in the major coconut growing area (Intermediate–Semi Wet Zone) of Sri Lanka.

The main objective of the survey was to identify the present situation of the farm holdings, their potential for development and to investigate the constraints for possible development approaches.

The survey was conducted among 29 successful farmers selected in Divulapitiya (5 farmers), Lunuwila (10 farmers), Kuliyapitiya (6 farmers), Narammala (6 farmers) and in Dambadeniya area (2 farmers).

The predominant intercrops in most of the areas was pineapple, but high initial capital requirement, lack of disease–free planting material and high disease incidence prevent its further expansion. Passion fruit had great potential as an important intercrop in the Semi-Wet area of the coconut triangle if marketing facilities are provided. Some farmers had a high income generated from ginger cultivation, but the crop of most farmers was affected with the soft rot disease. Banana was very popular among the farmers which made their income stable. Shortage of disease free planting material,

high disease incidence and lack of knowledge on disease control prevented its further expansion.

Betel cultivation was popular with farmers who had higher skill for its management practices; vegetable cultivation under coconut was promising in Kuliyapitiya area and the popular crops were cucumber, bitter gourd, snake gourd and bottle gourd.

Almost all the farmers used coconut fertilizer for intercrops.

Further studies required to identify farmers' problems and to determine the potential development methods for farming systems are in progress.

R. A. J. R. Perera and S. D. J. N. Subasinghe

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

No data are available to quantify the production of fuel wood and timber of *Leucaena* grown under coconut. Furthermore, its effect on coconut production, when grown for fuel wood without lopping for several years has not been investigated. This experiment was set up to study the production of fuel wood and timber of *Leucaena* planted in four different planting systems under coconut and to determine its effects on the production of nuts.

Treatments :

(*i*) Two rows of *Leucaena* 2 m. apart and 2.9 m. away from coconut and within row spacing of 0.6 m. under coconut.

(*ii*) Single row of *Leucaena* 3.9 m. away from coconut and within spacing of 0.6 m. under coconut.

(*iii*) *Leucaena* double row planting in alternate rows under coconut.

(*iv*) *Leucaena* single row planting in alternate rows under coconut.

(*v*) Control (Without *Leucaena*).

Design : Randomized block with 04 replicates.

This experiment was planted in April.

T. G. L. G. Gunasekera and L. V. K. Liyanage

PROJECT 20 : INTERCROPPING

Experiment 20.1 : Effect of three levels of fertilizer on four cacao selections grown under coconut. Walpita Estate, Kotadeniyawa — 1977

There were significant differences in cacao bean yields among the varieties. NA 32 and Millawana produced the highest bean yields of more than 810 g/tree during the year. Amelanado produced the lowest yields of around 500 g/tree. There was no response to different levels of fertilizer by different varieties indicating that ½ normal is sufficient for satisfactory yields.

H. A. J. Gunathilaka and M. J. I. Costa.

Experiment 20.0: Mixed cropping model 1 to study the agronomic and economic feasibility of growing cacao, coffee and pepper together as mixed crops under coconut. Walpita Estate, Kotadeniyawa — 1977

The yield data from the mixed crop model are given in Table 6.

Table 6: *Yield and production from the mixed cropping model–1 at Walpita in the 9th year*

Crop	*No. of plants*	*No. of plants in production*	*Yield per plant (in mixed model)*	*Yield per plant (grown separately with coconut)*
Coconut	24	24	91.0 nuts	79.5 nuts
Cacao	48	48	1006.0 g	1108.8 g
Coffee	98	62	220.0 g	488.0 g
Pepper (on gliricidia)	81	81	2.08 kg	2.5 kg
Pepper (on coconut palms)	24	24	1.08 kg	1.20 kg

All cacao and pepper plants (on gliricidia and coconut palms) were in full bearing during the year. About 37% of the coffee plants were not in production, perhaps due to their close proximity to vigorously growing cacao. Yields of cacao and pepper (on gliricidia stakes) in this model were satisfactory in comparison with these crops grown separa-

tely under coconut. The coconut yield increased by 14.5% in the mixed cropping models compared with the rest of the area in the estate. Large quantities of leaf litter and better control of weeds were apparent in this mixed cropping model.

H. A. J. Gunathilaka and M. J. I. Costa

Experiment 20.3 : Effect of intercropping perennial crops and rotation of annual crops on the yield of coconut. Sirikandura Estate, Dodanduwa — 1978

The annual crops planted during the year were ginger and turmeric.

The coconut yields during the period 1978 to 1985 and in 1986 and other data are given in Table 7.

Table 7 *Effect of various intercrops on yield of coconut*

Treatments	*Average yields of nuts/ha./year* (1978–1985)	*Yield of nuts/ha.* (1986)	*Copra weight/ nut (g)*	*Copra production MT/ha.*
Control (no intercrops)	6289	7733	218.5	1.69
Coconut+Cacao	7529	9867	214.3	2.11
Coconut+Coffee	8224	9973	220.7	2.20
Coconut+Pepper	6418	8533	222.9	1.90
Coconut+Cloves	6896	9600	204.1	1.93
Coconut+Cinnamon	8507	10347	211.7	2.19
Coconut+Rotation with annuals	7694	9973	194.9	1.94
Sig.		*	**	**
LSD (P=0.05)		1569	11.8	0.24
CV %		9.4	3.2	6.62

During the year, intercropping with cinnamon, coffee, rotation with annuals and cacao increased nut yields by 33.8%, 29%, 29%, and 27.6% respectively over the control. Pepper did not induce an increase in coconut yields over the control. There were no significant differences in copra weight/nut due to the cultivation of intercrops, except cloves and rotation with annuals. Copra production too was significantly increased by cacao, coffee, cloves, cinnamon and rotation with annuals compared with the control.

H. A. J. Gunathilaka and K. M. Punchibanda

Experiment 20.4 : Mixed cropping model II to study the agronomic and economic feasibility of growing cacao and pepper together as mixed crops under coconut. Walpita Estate, Kotadeniyawa — 1977

Yield data from this model are given in Table 8

Table 8 *Yield data from the mixed cropping model II at Walpita in the 6th year*

Crop	*No. of plants*	*No. of plants in production*	*Yield per plant*	
Coconut	25	25	83.8	nuts
Cacao	100	82	720.0	g
Pepper (on gliricidia)	81	81	1180.0	g
Pepper (on coconut palms)	25	25	626.0	g

All pepper plants (on gliricidia and coconut) and 82% of cacao plants were in production during the year. Yield of pepper on gliricidia was approximately 200% of the yield of pepper trained onto coconut palms.

There were no differences in coconut yields between the trial area (83.8 nuts/palm/year) and the rest of the estate (79.5 nuts/palm/year).

H. A. J. Gunathilaka and M. J. I. Costa

Experiment 20.5 : Effect of four levels of nitrogen and five levels of potassium on the growth and yield of cacao mixed with coconut. Walpita Estate, Kotadeniyawa—1981

During the year, nitrogen showed a marked influence on the vegetative growth by maintaining a better growth rate and plant structure of cacao compared with different levels of potassium application.

H. A. J. Gunathilaka and M. J. I. Costa

MISCELLANEOUS EXPERIMENTS

AGRO 2.1 : Demonstration of integrated farming systems in coconut lands at Dambuwa Mukalana Estate, Nattandiya—1981

General : Funds from the Integrated Rural Development Project—Puttalam were provided up to June and thereafter the project was maintained from the income generated from the farm. Also arrangements were made to purchase the land from the Land Reform Commission. In the future, this project is expected to continue as an on going project of the Division.

Performance of coconut and intercrops

In spite of the exceptionally low rainfall (1125 mm.) for the year compared with 1975 mm. in the previous year, both coconuts and intercrops were maintained satisfactorily. The coconut crop recorded 15,734 nuts/ha. compared with 15,067 in 1985, showing an increase of 4%, despite the fact that there was no marked change in rainfall between 1984 and 1985. Of the six improved varieties of coconuts, Dwarf × Tall and Tall × Tall showed vigorous growth and heavy bearing. Due to adverse weather conditions, supplementary irrigation was provided for coffee, pepper, cacao and citrus. Among annuals, yams such as cassava, sweet potato and colocasia and turmeric mixed with banana performed well.

M. de S. Liyanage and M. H. F. G. Ivan Appuhamy

3. NEW RECOMMENDATIONS

New recommendations on intercropping in coconut lands were made in the following advisory circulars, which were published during the year:

- Intercropping in coconut lands—General guidelines (Advisory Circular No. C 1)
- Growing cacao in coconut lands. (Advisory Circular No. C 2)
- Growing Coffee in coconut lands. (Advisory Circular No. C 3)
- Growing pepper in coconut lands. (Advisory Circular No. C 4)
- Mixed cropping models for coconut lands. (Advisory Circular No. C 5)

Five thousand coffee and 3,000 cacao seedlings were raised at Walpita and Siri kandura Estates and issued to coconut growers. The total annual requirement of coffee seed material (Varieties CC–1 and GCR) was supplied to the nurseries managed by the Minor Export Crops Department in Kurunegala District and Mattamagoda Nursery (Kegalle District) of the Coconut Cultivation Board.

Several training programmes were conducted for trainees from the Coconut Development Training Centre, Lunuwila, the National Apprenticeship Board and for many school groups. A four month training course was held for four National Diploma Holders in Technology (Agriculture) and for one trainee from the Technical College, Kuliyapitiya.

Several foreign and local visitors including trainees from the National Institute of Plantation Management visitied Walpita Estate to inspect intercropping activities. Trainees from the Coconut Development Training Centre, Lunuwila, also visited Walpita Estate on Several occasions.

The division staff participated at a Field Day organized at Bandirippuwa Estate, Lunuwila, on 27 March. Mr. M. de S. Liyanage conducted 18 field days at the IRDP Farm, Thabbowa, for coconut small-holders and school children in the Puttalam District. Mr. H. A. J. Gunathilaka participated at two field days for coconut growers in Kurunegala District at Polgahawela, organized by the Coconut Cultivation Board and for coconut growers of the Rambukkana Special Project at Walpita Estate, organized by Coconut Cultivation Board and Coconut Research Institute on 26 July and 28 October respectively.

5. VISITS, LECTURES AND SYMPOSIA

Messrs. H. P. S. Jayasundera and R. Marasinghe attended the International Workshop on Straw Utilization at the Faculty of Agriculture, University of Peradeniya from 24–29 March.

Mrs. L. V. K. Liyanage participated in the FAO/IAEA Interregional Training course on the use of isotope and radiation techniques in studies on soil/plant relationships in Seibersdorf, Austria, from 20 May – 20 June.

Mr. H. A. J. Gunathilaka undertook a study tour in the Philippines, sponsored by the FAO under the Coconut Development Training Centre, from 26 May – 12 June.

Mrs. L. V. K. Liyanage participated as a resource person at the Workshop on "Dairy Development" in Colombo, organized by the Dairy Development Foundation from 14–17 July.

Mrs. L. V. K. Liyanage and Mr. M. de S. Liyanage delivered lectures to the trainees from the National Institute of Plantation Management. Mr. H. A. J. Gunathilaka delivered a lecture on Fertilizer Usage for Intercropping in Coconut Lands for Coconut Cultivation Board Officers organized by the Coconut Cultivation Board and National Fertilizer Secretariat on 20 April.

Mr. H. A. L. Gunathilaka also delivered lectures on Intercropping to extension personnel from the Asian and Pacific Coconut Community, Agricultural Officers at Regional Research Station, Makandura, coconut growers in Hettimulla, Tolangamuwa, Baddegama and Matale.

6. PUBLICATIONS

Liyanage, L. V. K. (1986) — Pasture Management and Animal Husbandry in Coconut Lands. *Coconut Bulletin* 3 (1) : 19–22.

Gunathilaka, H. A. J. (1986) — Growing Coffee as an Intercrop. *Coconut Bulletin* 3 (1): 1–5

Gunathilaka, H. A. J. (1986) — Cinnamon Under Coconut. *Coconut Bulletin* 3 (1) : 7–8.

Gunathilaka, H. A. J. (1986) — Growing Cloves as an Intercrop. *Coconut Bulletin* 3 (1) : 12–15.

Gunathilaka, H. A. J. (1986) — Ginger and Turmeric Cultivation in Coconut Lands. *Coconut Bulletin* 3 (1) : 23–27.

Gunathilaka, H. A. J. (1986) — Mixed Cropping Models for Coconut Lands. *Coconut Bulletin* 3 (1) : 29–31.

Gunasena, H. P. M. and Gunathilaka, H. A. J. (1986) — A Study on Maize/Winged bean Intercrop System. *Sri Lanka Journal of Agricultural Science* 23 (1) : 177–190.

7. PAPERS PRESENTED AT CONFERENCES

Liyanage, L. V. K. (1986) — Cover Cropping and Soil Moisture Conservation. Paper presented at the Coconut Research Conference held in Colombo on 22 July.

Gunathilaka, H. A. J. (1986) — Intercropping in Coconut Lands. Paper presented at the Coconut Research Conference held in Colombo on 22 July.

Thilakasiri, M. A. (1986) — Farming Systems Research : Its relevance to Sri Lanka Agriculture. Paper presented at the 42nd Annual Session of Sri Lanka Association for the Advancement of Science in December.

Thilakasiri, M. A. : Peiris, T. S. G. and Gunasekara, T. G. L. G. (1986) — Some Socio-economic Characteristics of Coconut-based Farming Systems. Paper presented at the 42nd Annual Session of Sri Lanka Association for the Advancement of Science in December.

REPORT OF THE GENETICS PLANT BREEDING DIVISION

Head — M. R. T. Wickramaratne Ph.D.

1. GENERAL

1.1 Appointments

Ms. I. J. S. Kondasinghe and Mr. W. G. A. Ratnasiri were appointed Research Assistants on 2 September. Mr. G. B. A. Wijesekera was appointed Field Officer on 7 February and assumed duties at the Isolated Seed Garden (ISG). Ms. Manel Rodrigo was appointed Clerk/Typist on 3 February.

1.2 Resignations and Retirements

Mr. M. T. Siridasa, Field Attendant, resigned with effect from 11 March. Mr. H. M. Karunadasa, Field Assistant, retired on 2 April after serving in this division for 35 years.

1.3 Study leave

Mr. R. R. A. Peiris, Research Assistant, continued his postgraduate studies at the Department of Agriculture, University of Queensland, Australia.

1.4 Transfers

The following transfers were effected :

Mr. D. M. Pathirage from Ratmalagara Estate of the Estate Management Division to the Isolated Seed Garden, Ambakelle as Superintendent with effect from 1 March.

Mr. M. H. L. Padmasiri, Technical Assistant, from Head Office to ISG with effect from 18 March.

Mr. B. Raymond Fernando, Clerk/Typist, from Head Office to ISG with effect from 14 February.

Mr. W. Hugh C. Fernando, Field Assistant, from ISG to Head Office from 2 June.

Mr. M. M. Padmasena, Field Attendant, from the Estate Management Division on 1st January and then from Head Office to Ratmalagara Research Station with effect from 1 February.

Mr. M. W. Sirisena, Field Attendant, from Ratmalagara to Head Office on 1 January and to the Plant Physiology Unit on 1 September.

Mr. A. G. Nandasena, Office Attendant from the Estate Management Division from 1 January.

1.5. Promotions

The following officers were promoted :

Mr. R. B. Attanayake from Operative Grade Class II to Class I, Mr. R. P. Victor from Clerical & Allied Grade Class II to Class I and Messrs. M. Somapala and K. G. Dhanapala from Minor Grade Class 1 to Minor Grade Special Class, all with effect from 1 January 1984.

1.6 Collaborative Research

The collaborative project funded by ODA made little progress as the proposals for continued support were reviewed in London well into the last quarter.

1.7 Space

The division acquired additional space to have a separate pollen collection and processing laboratory, computer room, record room and storage space in addition to the general laboratory and office areas.

2. RESEARCH PROJECTS

PROJECT 5. PRODUCTION OF IMPROVED COCONUT VARIETIES

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

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

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

Growth parameters such as girth at collar, height from ground to the tip of the last fully-opened leaf and the number of new leaves produced during the last six-month period were recorded at 18 months from planting for each seedling at all three sites. The data were combined in an analysis of variance which showed that the performance of the cultivars was greatly affected by environmental differences associated with the different locations. There was also a significant difference in performance of the different cultivars even at a single site. Variety-site interaction was significant only at the 5% level but not at 1%.

Table 1 shows the growth parameters for the five cultivars at the three different sites. At each site, there was a significant difference in leaf production between the cultivators. The hybrids had the highest number of new leaves produced during the six-month period with the *dwarf green* × *tall* hybrid often a little ahead of *dwarf yellow* × *tall*. Leaf production was clearly less at Bandirippuwa than at the other two locations,

Table 1 *Growth parameters for five coconut cultivars at three sites, eighteen months from planting out in the field*

Mean Girth at collar (cm)

	Dambakande	*Thammenna*	*B/E*
DG × tall	41.19	36.50	46.25
DY × tall	39.39	36.24	50.00
Ambakelle	33.06	36.34	45.28
Moorock tall	35.06	34.27	44.25
Plus palm tall	32.34	38.40	43.45
S.E. diff.	2.157	1.56	2.25
	*	*N.S.*	*N.S.*

Mean Height (m)

DG × tall	2.98	2.61	2.98
DY × tall	3.01	2.54	3.18
Ambakelle tall	2.73	2.51	3.00
Moorock tall	2.86	2.50	3.10
Plus palm tall	2.75	2.75	3.00
S.E. diff.	0.13	0.16	0.09
	N.S.	*N.S.*	*N.S.*

Leaf production (mean no. of new leaves produced during six months)

		Range		*Range*		*Range*
DG × tall	3.67	3.05–3.9	3.56	3.5–3.7	2.55	2.5–2.7
DY × tall	3.33	3.0 –3.6	3.40	3.3–3.6	2.63	2.5–2.9
Ambakelle tall	2.64	2.35–3.0	2.74	1.8–3.1	2.35	2.3–2.4
Moorock tall	2.94	2.65–3.35	3.08	2.9–3.3	2.28	2.1–2.5
Plus palm tall	2.55	2.4 –2.7	3.19	3.1–3.3	2.33	2.2–2.5
S.E. diff.	0.22		0.22		0.08	
	*		*		*	

The cultivars also showed clear differences in girth at collar at Dambakande Estate. The hybrids were again much better in performance than the tall cultivars with the *dwarf green* × *tall* a little ahead of the *dwarf yellow* × *tall* although this difference between the two hybrids was not significant. At the other two locations, the differences between cultivars for this character were not significant but trends were similar.

There were no significant differences in height of cultivars at any of the locations. However, at Dambakande, the hybrids were again slightly taller than the others.

The three characters measured are believed to be indicators of seedling vigour and have been shown to be positively correlated with adult palm yield. (Liyanage, 1953; Liyanage & Abeywardena, 1957). The results, therefore, imply that hybrids are likely to be more vigorous and better yielders than the tall cultivars. They also hint at a possible difference between the two hybrid cultivars, *dwarf green* × *tall* and *dwarf yellow* × *tall.*

Of the three locations, Bandirippuwa has the most favourable conditions for coconut cultivation. It is noteworthy that while mean girth at collar and height of seedlings achieved the highest values at this location, leaf production was lowest here. It is possible that increased growth of the stem is accompanied by lower leaf production. Similar effects of slower trunk growth compensated for by a higher leaf production have been reported by Iyer *et al* (1981) for some selected elite coconut palms.

W. M. U. Fernando, W. B. S. Fernando, H. Samarasinghe. H. P. P. H. Pathirana and M. R. T. Wickramaratne.

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

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

Although planting of the trial at Palugaswewa was completed in December 1985, planting at Suriyapura went on into January 1986. These trials were maintained satisfactorily during the year. Growth parameters were recorded at planting and again at six-monthly intervals.

There was severe damage by black beetle at Palugaswewa Estate. This was soon brought under control with assistance from the Crop Protection Division and served as a test for susceptibility of the different cultivars to this pest. It appears that the two hybrid varieties are more susceptible to this pest than the tall varieties. This will be studied further.

W. M. U. Fernando, I. J. S. Kondasinghe, M. A. S. Fernando 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)

Reselection of tall and dwarf palms. Reselection of palms for use in the breeding programme, based on records of husked and split nut weights and leaf production as well as number of nuts per palm per pick is in progress. This is somewhat behind schedule due to the standstill in the collaborative project, as indicated elsewhere.

M. R. T. Wickramaratne, W. M. U. Fernando and W. B. S. Fernaudo.

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

It has not been possible to use the flower stripper as planned due to defects in construction. We await modification of the machine.

The freeze drier has also not been commissioned due to the lack of certani accessories which will be purchased during 1987.

M. R. T. Wickramaratne and H. Samarasinghe.

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 : Pollination of selected tall palms (Ambakelle special) at ISG Ambakelle, using tall, dwarf green or San Ramon pollen from palms believed to be drought tolerant (1984)

The crosses were carried out during 1984 and nuts harvested in 1985. Evaluation trials were planted in Yala 1986 as follows :

Experiment 5.4.1.1 Trial at Bandirippuwa Estate, Lunuwila, for evaluation of progeny from *tall* × *tall*, *tall* × *dwarf green* and *tall* × *San Ramon* crosses (1986)

Experiment 5.4.1.2 : Trial at Ratmalagara Estate/ Madampe, for evaluation of progeny from *tall* × *tall*, *tall* × *dwarf green* and *tall* × *San Ramon* crosses (1986)

These trials were planted at Bandirippuwa and Ratmalagara Estates in June and July respectively. The design was a 3×3 factorial with three varieties and three fertilizer levels giving 9 treatments, replicated thrice with ten seedlings per plot, at a spacing of 25 ft triangular. Open pollinated tall seedlings from Ambakelle were used in guard rows.

Growth parameters were recorded at time of planting and again at about six months from planting.

W. M. U. Fernando, I. J. S. Kondasinghe, H. P. P. H. Pathirana and M. A. S. Fernando.

Experiment 5.4.1.3 : Observation trial at NLDB, Andigama Farm, Giriulla, for evaluation of progeny from *tall* × *tall*, *tall* × *dwarf green* and *tall X San Ramon* crosses (1986)

Experiment 5.4.1.4 : Observation trial at JEDB Mangala Eliya Estate, Puttalam, for evaluation of progeny from *tall* × *tall*, *tall* × *dwarf green* and *tall* × *San Ramon* crosses (1986)

The planting material left over after planting Experiments 5.4.1.1 and 5.4.1.2 were reserved for two observation trials planned to be planted during Maha 1986 at the NLDB Andigama Farm at Giriulla and the JEDB Mangala Eliya Estate, Puttalam. The trial at Andigama was in the same design as the trials at Bandirippuwa and Ratmalagara and planting was completed in December 1986 and growth measurements recorded shortly after.

At Mangala Eliya, the land had already been holed at 24 × 24 ft. square. In addition to the three varieties employed in the other trials, a fourth, using open-pollinated material from Ambakelle special palms was used as a control. The holes were filled but planting could not be carried out due to insufficient rain. Planting will be completed in early 1987 provided weather conditions are suitable.

W. M. U. Fernando, I. J. S. Kondasinghe, W. G. A. Ratnasiri and M. H. L. Padmasiri.

Experiment 5.4.1.5 : Observation trial at Bandirippuwa Estate, Lunuwila (1986)

Arrangements were made to plant the remaining material, after the above trials were planted, at two different sites at Bandirippuwa estate, in a fully randomized design. These will serve as observation blocks for evaluation of these crosses under conditions of management by the estate.

M. R. T. Wickramaratne and M. H. L. Padmasiri.

Experiment 5.4.2 : Pollination of selected *tall* and *dwarf* palms, using *tall*, *dwarf green* and *San Ramon* pollen from palms selected for high and stable yields (1984)

A total of 3729 nuts were harvested during the year from 972 pollinations carried out in 1985 using mixed *tall* pollen, mixed *dwarf* pollen or mixed *San Ramon* pollen on selected seed palms of the *tall* or *dwarf green* forms. This was nearly 500 short of expected

nut yield of 4200 calculated as 22% of the total number of female flowers. The percent fruit set ranged from 5.23 for *dwarf green* × *dwarf green* to 31.4 for *tall* × *San Ramon*. Details are given in Table 2. As observed last year, the crosses using *San Ramon* pollen were again the most fruitful and production over the period April to August generally higher than during the rest of the year. This is being investigated further.

Table 2 *Nuts harvested from hand pollinations carried out in 1985*

*Cross**	*No. of inflorescences pollinated*	*No. of female flowers/buttons/nuts at*				*Percent harvest*
		bagging	*3 months*	*6 months*	*harvest*	
Tall seed parent						
Tall × tall	207	4 431	1 257	1 190	1 111	25.07
Tall × DG	197	4 140	764	654	621	15.00
Tall × SR	190	3 333	1 152	1 094	1 047	31.40
Dwarf seed parent						
DG × tall	131	2 537	466	391	360	14.19
DG × DG	124	2 086	279	189	109	5.23
DG × SR	124	2 558	595	542	481	18.80
			Total		3 729	19.54

* DG, dwarf green; SR, San Ramon

The percent fruit harvested from hand pollinations was generally higher than last year. In view of the fact that there was a considerable drop in overall yields at Ambakelle from last year to this year, this increase can perhaps be attributed to improvements in techniques of pollination, pollen collection and processing.

This programme was continued until April when selection of the *dwarf yellow* palms made it possible to include them also in the programme (Experiment 5.4.3). Results of hand pollinations during the first quarter of this year are given in Table 3. A total of 177 pollinations were carried out and about 600 nuts are likely to result.

M. R. T. Wickramaratne, W. M. U. Fernando and M. H. L. Padmasiri.

Table 3 *Results of hand pollinations in 1986 (first quarter)*

*Cross**	*No. of inflorescences pollinated*	*No. of female flowers/buttons/nuts at*		
		bagging	3 *months*	6 *months*
Tall seed parent				
Tax × tall	38	1 193	124	123
Tall × DG	35	889	132	129
Tall × SR	28	635	133	126
Dwarf seed parent				
DG × tall	29	521	118	107
DG × DG	23	340	78	71
DG × SR	24	370	94	88

*DG, Dwarf green; SR, San Ramon

Experiment 5.4.3 : Pollination of selected *tall* and *dwarf* palms at ISG using *tall*, *dwarf green*, *dwarf yellow* and *San Ramon* pollen from palms selected for high and stable yields Isolated Seed Garden (1986)

This crossing programme commenced in April by which time the *dwarf yellow* palms had also been selected on the same basis as the *dwarf green*. Seven more *tall* palms and 25 *dwarf yellow* palms were included in the pollination programme bringing the total number of palms to 104. The distribution of the palms was as follows : 24 on field No. 1 and 27 on field No. 2 making a total of 51 *tall* palms, 12 on field Nos. 5 and 16 on field No. 9 making a total of 28 *dwarf green* and 25 *dwarf yellow* palms on field No. 10A One of the palms on field No. 9 (palm No. 9078 or 9.4) had to be uprooted due to red weevil attack.

All the above palms were used as seed palms but the 10 best *tall*, *dwarf green* and *dwarf yellow* palms together with 6 of the best *San Ramon* palms from field No. 16 at Bandirippuwa making a total of 36, were selected as pollen parents. Since there were 4 different types of pollen parent, the seed palms were divided into four groups containing a total of 25–27 palms of the three different forms. A crossing plan was drawn up for each group and a pollen sample from the four forms issued for use on each group for a period of two weeks. The crossing plan was kept confidential and inactivated pollen or lycopodium issued occasionally for checking pollination techniques.

A total of 12 different types of crosses were carried out using unmixed pollen so that nuts will be full sibs of known parentage. One thousand and eighty nine inflorescences were pollinated. A high proportion of button shed and immature fruit fall is likely due to the poor weather conditions during the year. However, a minimum of 3000 nuts are expected to result. Details of the crosses are given in Table 4.

M. R. T. Wickramaratne, W. M. U. Fernando and M. H. L. Padmasiri.

Table 4 *Results of hand pollinations (April to December 1986)*

Cross	*No. of inflorescences pollinated*	*No. of female flowers at bagging*
Tall seed parent		
Tall × tall	127	3 853
Tall × DG	138	2 873
Tall × SR	137	3 654
Tall × DY	139	3 964
Tall × DY*	10	145
Dwarf green seed parent		
DG × tall	71	1 627
DG × DG	82	1 958
DG × SR	52	1 210
DG × DY	58	1 335
Dwarf yellow seed parent		
DY × tall	80	1 838
DY × DG	74	1 402
DY × SR	57	1 241
DY × DY	64	1 502

* These 10 crosses were done at the end of the first quarter.

Experiment 5.4.4 : Self pollination of *dwarf green* and *dwarf yellow* palms Isolated Seed Garden (1982)

The programme of self pollination of dwarf palms at Ambakelle was continued so as to produce material for replacing the dwarf palm casualties at the seed garden. 40 inflorescences were pollinated of 5 *dwarf green* palms in field 10A over the period February to December while 27 inflorescences were pollinated on 25 *dwarf yellow* palms in the same field in February and March. At least 400 seednuts are expected to be harvested. It

is planned to intensify this programme next year, using all the selected dwarf palms on fields 5 and 9 as well.

Experiment 5.4.5 : Production of planting material for the proposed "super" seed garden, Isolated seed Garden (1986)

Arrangements were made to cross selected tall palms in different combinations for production of seednuts to be used as source material for the super seed garden. The 51 selected tall palms in fields No. 1 and 2 at the isolated seed garden are being used for this purpose until the reselection is done. Data for field No. 3 were also tabulated and are being processed for the selection of additional palms to be used in the crossing programme.

M. R. T. Wickramaratne, I. J. S. Kondasinghe, W. G. A. Ratnasiri and W. B. S. Fernando

Experiment 5.5 : Establishment of germplasm collection (1983)

Experiment 5.5.1 : New variety block of Crop Museum, Bandirippuwa Estate, Lunuwila (1983)

Several forms of the *tall* variety were planted in the new varieties block or crop museum established on block No. 5, Bandirippuwa Estate. This block was maintained satisfactorily. Details of this collection are given in Table 5.

Table 5 — *Details of seedlings in crop museum, block No. 5, Bandirippuwa Estate*

Variety and form	*Source**	*Planting date*	*Seedhole numbers*
Nana			
N. eburnea (*dwarf yellow*)	Johanawatte	01.11.83	1 — 7
N. pumila (*dwarf green*)	ISG	01.11.83	8 — 14
N. regia (*dwarf red*)	B/E	20.03.85	15 — 21
Aurantiaca			
King coconut (*rath thembili*)	B/E	20.03.85	22 — 28
Rathran thembili	Negombo	20.03.85	29
Typica			
San Ramon (*russet*)	B/E	15.05.86	36 — 42
San Ramon (*green*)	B/E	15.05.86	43 — 49
Kamandala	B/E	15.05.86	50 — 56
Gon thembili	B/E	15.05.86	57 — 63
Navasi	B/E	15.05.86	64 — 70
Bodiri	B/E	15.05.86	71 — 77
Pora pol	B/E	15.05.86	78 — 84
Ran thembili	B/E	15.05.86	85 — 91

*Seedlings from Johanawatte and Negombo were open pollinated, those from ISG self-pollinated (and include one twin seedling in hole No. 13). and those from B/E are the result of hand pollinations of palms on the Variety Block on field No. 9.

Flowering was observed this year in the *dwarf yellow* palms from Johanawatte and the first fruits were harvested from the *dwarf green* palms both at 2 1/2 to 3 years from planting.

Arrangements were also made to plant the *rathran thembili* seedlings from controlled pollinations carried out in Colombo and open pollinated seedlings of *dikiri pol* and *spicata* during the Maha season but this could not be completed due to unsuitable weather conditions. Planting will be carried out with the onset of the rains.

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

Progeny from the programme of controlled pollination on the variety block at, Bandirippuwa (ie. selfing or crossing within forms of the different local coconut varieties were planted in Yala, 1986, in 1/2 to 1 ac. (0.2 to 0.4 ha) blocks, at the "fifty acre block)" at Bandirippuwa Estate. Five forms of the variety *typica* were planted, namely *gonthembili navasi, bodiri, porapol* and *ranthemibili.* Growth parameters were recorded at planting, and again after six months. The trial was maintained satisfactorily.

M. R. T. Wickramaratne, W. G. A. Ratnasiri and M. H. L. Padmasiri

Experiment 5.5.3 : Conservation of *San Ramon*, Bandirippuwa Estate (1984)

Two different colour forms (russet and green) of the *San Ramon* were propagated by selfings and two 1 acre blocks established in the 50 ac. block at Bandirippuwa Estate.

M. R. T. Wickramaratne, W. G. A. Ratnasiri and M. H. L. Padmasiri

Experiment 5.5.4 : Self-pollination of *dwarf* palms at Ratmalagara Estate (1984)

A total of 200 inflorescences of *dwarf* palms comprising *63 dwarf green, 59 dwarf yellow* and *78 dwarf red* were self-pollinated at Ratmalagara Estate over the period April to December. There were a total of 4332 female flowers at pollination. Considerable button shed and immature nut fall is expected due to poor weather conditions but sufficient numbers of seednuts to set up a new *dwarf* palms block are expected.

W. M. U. Fernando and H. Samarasinghe.

Experiment 5.5.5 : Germplasm from other countries (1985)

It has still not been possible to obtain the seed material from Indonesia, as planned.

Arrangements are underway for self-pollinating the small number of *red, green* and *yellow dwarf* palms originating from seednuts introduced from the Ivory Coast and the *tall x dwarf* hybrids resulting from the use of *Brazilian green dwarf* and *Ghana yellow dwarf* pollen on local *talls*, presently available at Bandirippuwa Estate, in an attempt to accumulate genes of the exotic *dwarf* forms.

M. R. T. Wickramaratne, I. J. S. Kondasinghe and H. S. G. Kularatne.

Experiment 5.5.6 : Survey of germplasm prior to collection and conservation (preprospection) (1986)

A systematic survey, country wide, was undertaken to locate populations which should be conserved. Both biased and unbiased sampling will be carried out. Biased sampling will be from populations known to have specific characteristics. Three estates, Moorock Pitiyankande and Palugaswewa have already been earmarked for this purpose in addition to the *San Ramon* population at Clovis Estate, Uhumiya and *dwarf* populations at Johana, watte, Kundasale and Kalutara; the exploration continues. Unbiased sampling will be from other areas of the country, mainly smallholdings and scattered gardens, within the coconut triangle and outside, where random sampling will be done.

M. R. T. Wickramaratne, P. Kariyawasam and W. G. A. Ratnasiri.

Experiment 5.6 : Isolation of genotypes showing drought tolerance, Passekudah Farm, Kalkudah (1983)

Experiment 5.8 : Identification of drought tolerant palms, Passekudah Farm, Kalkudah (1982)

The above trials were maintained by the Farm Manager. Visits for inspection to these trials were not possible due to continued disturbances in the area.

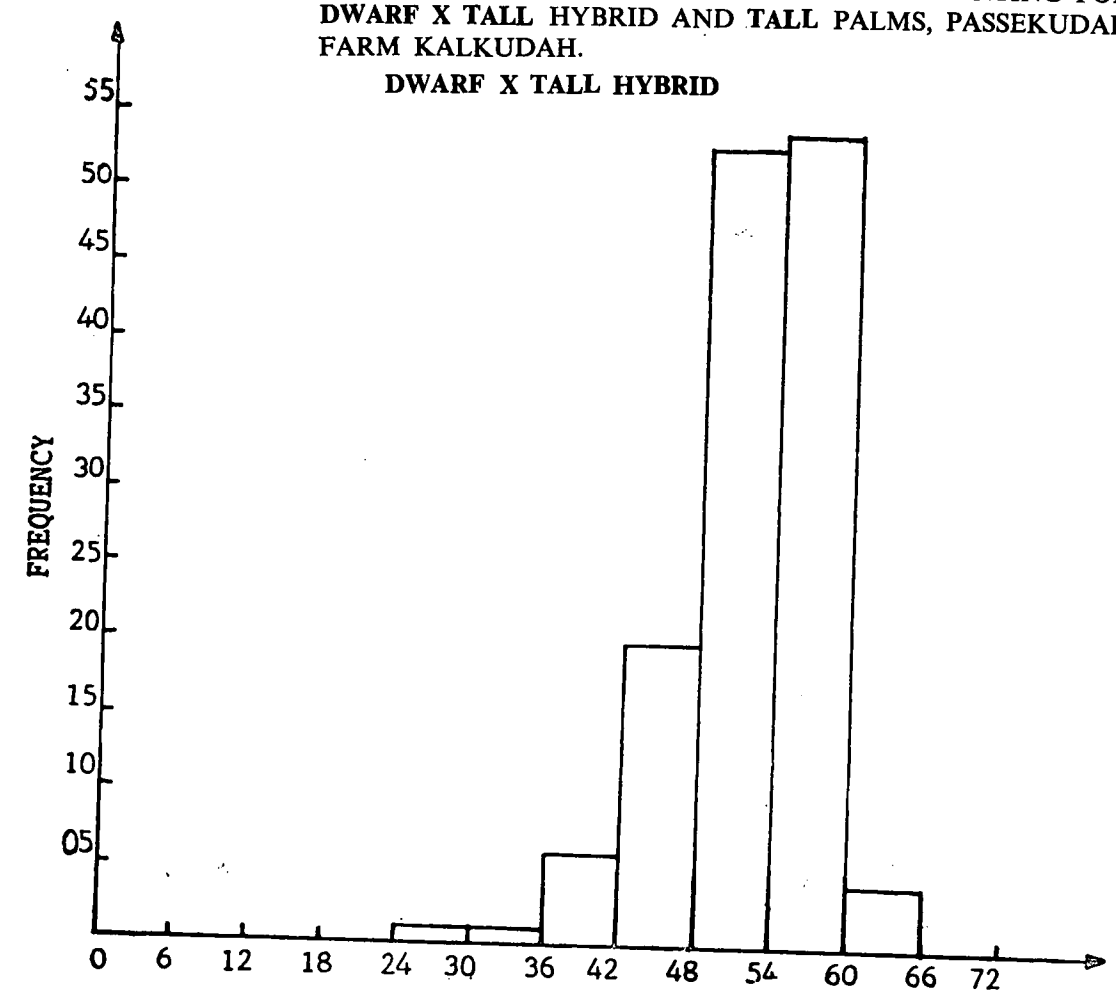
M. R. T. Wickramaratne.

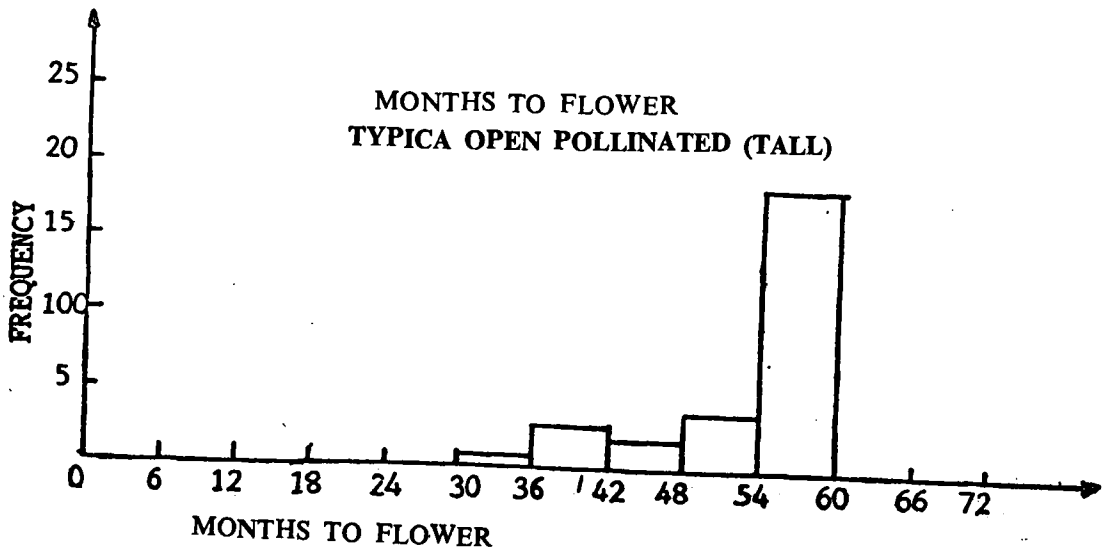
Experiment 5.7 : Evaluation of the performance of F1 progenies of *tall* (*OP*) and *dwarf* × *tall* on the East Coast, Passekudah Farm, Kalkudah (1981)

This trial too could not be visited but the flowering data collected by the Farm Manager were analysed. At five years from planting, 86.88% of the *dwarf* × *tall* hybrid palms were in flower compared with 18.13% of the *tall*. Figure 1. illustrates the data.

W. G. A. Ratnasiri, H. P. P. H. Pathirana and M. R. T. Wickramaratne.

Fig. 1. FLOWERING DATA AT FIVE YEARS FROM PLANTING FOR DWARF X TALL HYBRID AND TALL PALMS, PASSEKUDAH FARM KALKUDAH.





Experiment 5.9 : *San Ramon* **crosses, Bandirippuwa Estate, Lunuwila (1984)**

A total of 62 inflorescences of palm Nos. 4. 14, 15, 16, 17 and 18 on field No. 16 at Bandirippuwa Estate were successfully pollinated. Setting percent ranged from 13.3 to 46.8 A further 29 inflorescences had to be abandoned due to damage to bags by insects.

M. H. L. Padmasiri and H. S. G. Kularatne

PROJECT 6 — PRODUCTION OF HIGH QUALITY SEEDS AND SEEDLINGS

Experiment 6.1 : Study of yield fluctuations in the Isolated Seed Garden, Ambakelle (1982)

Further progress was slow due to the delay in the collaborative project with University of Reading.

A paper on the preliminary study is under preparation.

M. R. T. Wickramaratne and W. B. S. Fernando.

Experiment 6.4 : To test efficiency of seednut selection, Bandirippuwa Estate, Lunuwila (1982)

The study was completed and a publication is in the manuscript stage.

M. R. T. Wickramaratne and M. A. S. Fernando

Experiment 6.5 : Study of variation in seedling characters of different coconut types/ cultivars, ISG, Ambakelle (1982)

This study is in progress.

W. M. U. Fernando, M. H. L. Padmasiri and H. S. G. Kularatne

Experiment 6.6 : Effect of maturity of *dwarf* × *tall* **hybrid nuts on sprouting, ISG, Ambakelle (1982)**

This trial was completed and data analysis is in progress.

W. M. U. Fernando, M. H. L. Padmasiri and M. A. S. Fernando.

Experiment 6.7 : Evaluation of criteria used in plus palm selection (1983)

Data collected from 30 palms at each of five different sites up to the end of the year were processed for computerisation and analysis.

P. Kariyawasam, M. A. S. Fernando and H. S. G. Kularatne.

3. MISCELLANEOUS EXPERIMENTS

3.1 Fruit component studies (1985)—Recording of number of nuts and weight of fruit components for 50 *dwarf* × *tall* hybrid palms at Bandirippuwa Estate and 50 *tall* palms at ISG, Ambakelle, was continued over the year. The data collected are sufficient for analysis

M. R. T. Wickramaratne, W. B. S. Fernando, H. Samarasinghe and H. P. P. H. Pathirana

3.2 Trials at the East Coast

Experiment G 3.8 : Evaluation of the performance of *tall* × *tall*, *dwarf* × *tall* and *Moorock tall* in the dry zone, Minneriya (1983)

This trial was maintained by the Farm Manager. Visits were not possible during the year.

M. R. T. Wickramaratne.

3.3. Experiment G 1.3 : Flowering and cropping patterns in *dwarf* palms (1983)

The study is in progresss.

M. R. T. Wickramaratne, W. M. U. Fernando and M. H. L. Padmasiri

3.4: Study of performance of improved cultivars (CRIC 60 and CRIC 65) on a plantation scale (1985)

Six properties were visited during the year, namely Lenawa Estate, Melsiripura, managed by the CCB, the Government Farm, Welisara, and private-owned lands located in Wanathavillu, Kandana and two in Kochchikade. The poor performance of one tall plantation and one hybrid plantation was due to neglect and improper choice of planting site, respectively. The other plantations, two tall and three hybrid, were doing well and the growers expressed complete satisfaction with the material they had used. The study will be continued.

M. R. T. Wickramaratne, P. Kariyawasam and M. A. S. Fernando

3.5: Effect of vertical/horizontal placement of nuts on growth of seedlings, Isolated Seed Garden (1986)

A preliminary analysis of the data indicates that germination is faster and a higher percent germination achieved when nuts are placed horizontally. The trial is in progress.

W. G. A. Ratnasiri and M. H. L. Padmasiri.

4. THE ISOLATED SEED GARDEN, AMBAKELLE

4.1 Extents and details of planting are given in Table 6 and classification of palms is shown in Table 7. There are a total of 7279 *tall*, 2517 *dwarf green* and 1325 *dwarf yellow* palms in bearing.

Table—6 *Extent and details of planting*

Field no.	*Extent** ac.	*ha.*	*Planting material*	*Planting distance** and sysyem*	*Planting date*
1	4.5	1.82	Tall	26 Equilateral triangular	Dec. 1955
2	4	1.62	Tall	26 × 18 Hedge	Nov 1956
3	4	1.62	Tall	26 × 22 Rectangular	Nov 1956
4	34	13.80	Tall	26 Equilateral triangular	Nov 1956/57
5	7	2.84	(i) dwarf (ii) Tall and dwarf	22 × 18 Triangular 24 × 24 Square	Nov 1959
6	20	8.10	Tall	22 × 18 Triangular	Dec 1983
7	20	8.10	Tall	25 Equilateral triangular	Nov 1960
8 A	10	4.05	Tall	24 × 18 Hedge	Nov 1961
8 B	5	2.03	Tall	25 × 25 Square	June 1962
8 C	5	2.03	Tall	25 × 25 Square	Nov 1962
9	25	10.13	Tall and dwarf	32 × 12 Hedge Between rows 26 within rows tall 26 dwarf 22	May 1963 Oct 1966
10 A	25	10.13	Tall and dwarf	22 × 22 Square	Nov 1972
10 B	25	10.13	Tall and dwarf	22 × 22 Square	May 1973
11 A	30	12.15	(i) Tall and dwarf	22 × 22 Square	Oct 1973
	(10)	(4.05)	(ii) Tall (part)	24 × 24 Square	Nov 1985
11 B	20	8.10	(i) Tall	25 Equilateral triangular	Dec 1985/86
12	22	8.91	(ii) Tall	25 Equilateral triangular	April 1985
13	37	14.99	(ii) Tall	25 Equilateral triangular	June 1984/85
14	37	14.99	Tall and dwarf	22 × 22 Square	Nov 1974
Total	334.5	135.54			

* Figures in parenthesis indicate extent of the part with new (second) planting where only part has a second planting.

(i) First plantation (ii) Second plantation

**Planting distance is given in feet.

Table 7. *Classification of palms*

Field No.	TALL							DWARF													Total for field
								Dwarf Green							Dwarf yellow							
	B	PB	YP	S	D	V	Total	B	PB	YP	S	D	V	Total	B	PB	YP	S	D	V	Total	
1	241	4	83	—	—	2	330															330
2	251	—	—	29	—	136	416															416
3	269	—	3	66	—	3	341															341
4	1891	9	13	167	—	482	2562															2562
5 (1)	—	—	—	—	—	—	—	146	—	—	—	—	—	146								146
5 (2)	—	—	—	417	—	2	419	—	—	215*	35	—	(4)	254								673
6	868	—	—	3	—	508	1379															1379
7	686	—	—	—	4	727	1417															1417
8 (A) 8 (B) 8 (C)	893	—	—	—	—	662	1555															1555
9	623	—	—	178	—	10	811	310	—	—	593	—	41	944								1755
10 A	181	—	—	—	—	23	204	101	—	—	53	—	—	154	871	—	72	8	—	562	1513	1971
10 B	129	—	—	—	—	30	159	328	—	11	145	—	266	750	322	—	35	—	—	136	493	1402
11 A (1)	297	—	9	—	1	53	360	514	—	5	—	2	506	1027	131	—	3	—	1	122	257	1644
11 A (2)	—	—	564	—	—	81 (24)	669															669
11 B (1)	241	—	—	—	—	—	241															241
11 B (2)	—	—	—	690	—	(25) 31 874†	1620															1620
12 (1)	168	—	—	—	—	—	168															168
12 (2)	—	—	—	1401	—	43	1444															1444
13 (1)	210	—	—	—	—	76§	286															286
13 (2)	—	—	—	2426	—	18	2444															2444
14	307	—	7	—	6	142	462	1116	—	—	—	—	1530	2646								3108
Total	7255	13	679	5377	11	3952	17287	2515	—	231	826	2	2347	5921	1324	—	110	8	1	820	2263	25471

B, bearing palms; PB, partially bearing palms; YP, young palms; S, seedlings; D, duds.
V, Vacancies; (), not planted as old palms are still not ready for uprooting;
† seedholes ready for planting with onset of rains;
§ vacancies in guard rows.
(1) and (2), first and second plantations.
* Some of these would be partially bearing by now but inflorescences are cut away before they open.

Table 8. *Rainfall intensity and distribution* 1977 – 1986

	1977		1978		1979		1980		1981	
Month	*A*	*B*	*A*	*B*	*A*	*B*	*A*	*B*	*A*	*B*
January	—	—	—	—	13.1	2	0.5	—	36.9	3
February	27.4	2	—	—	60.0	6	—	—	11.5	2
March	168.7	8	23.3	5	17.6	5	23.7	1	93.5	6
April	110.2	5	158.7	7	59.8	7	164.5	16	48.4	10
May	451.1	20	405.1	15	11.4	4	87.8	7	147.8	13
June	21.6	5	11.1	2	34.8	5	147.9	9	148.9	15
July	25.0	4	16.4	3	19.4	3	5.8	2	72.5	9
August	19.7	4	10.1	3	10.6	3	10.0	4	54.3	5
September	31.7	3	32.9	6	197.8	13	106.9	8	68.4	14
October	759.9	22	521.6	16	160.6	14	272.1	13	280.3	15
November	247.2	12	582.9	12	356.6	21	251.0	16	295.9	19
December	34.0	2	97.6	12	172.1	9	82.7	15	54.3	7
	1896.50	87	1859.7	81	1113.7	92	1152.9	92	1312.7	118

Month	1982		1983		1984		1985		1986		*Average for* 10 *yrs.* 1977 - 1986	
	A	*B*	*A*	*B*	*A*	*B*	*A*	*B*	*A*	*B*	*A*	*B*
January	—	—	—	—	96.9	11	38.3	07	59.1	09	24.48	3.3
February	—	—	2.1	1	228.9	19	113.4	04	65.8	03	50.91	3.7
March	176.3	4	1.6	1	279.7	11	94.6	09	55.3	04	93.43	5.4
April	61.7	8	52.8	4	821.4	17	100.0	07	104.9	12	168.24	9.3
May	281.8	13	248.8	13	155.5	6	171.4	11	121.9	09	208.26	11.1
June	110.7	17	73.4	14	29.1	11	88.8	13	74.5	06	74.14	9.7
July	32.1	9	26.4	7	117.0	10	17.9	06	4.2	03	33.67	5.6
August	91.6	4	78.0	9	3.8	2	10.7	02	47.4	05	33.62	4.1
September	35.6	4	89.4	17	164.7	9	107.4	13	37.4	12	87.21	9.9
October	199.9	20	105.7	10	227.3	14	108.7	15	200.0	17	283.6	15.6
November	152.7	18	199.3	13	210.6	18	334.8	14	236.1	07	286.71	15.0
December	93.4	13	331.4	16	53.6	6	118.6	09	7.6	03	104.53	9.2
	1235.7	110	1208.9	105	2389.1	134	1304.6	110	1014.2	90	1448.8	101.9

A, rainfall intensity in mm; B, Number of rainy days; —, Zero rainfall.

4.2 Rainfall Table 8 gives rainfall intensity and distribution for the last 10 years together with the 10-year average. Total rainfall for the year was only 1014.2 mm. This is the lowest received during the 10-year period from 1977 to 1986 and 434.6 mm lower then the 10-year average. The number of wet days was also lower than average, reaching only 90. Although the year started off well with no long dry spell in January, this was not sustained and there was little rain in the Yala season followed by a long dry inter-monsoonal period. Consequently, crops in 1987 are expected to be much lower than usual.

4.3 Crops Total crop figures for 1985 and 1986 together with the 10-year average for 1977-1986 are given in Table 9. The crop of 1985 was outstanding consequent to the exceptionally good rainfall in 1984. There was a 46% drop in crop from 1985 to 1986 but the total crop of 847249 nuts for 1986 was still well over the 10-year average. This is as expected due to the satisfactory rainfall figures during 1985.

Table 9 : *Total crop figures for 1985 and 1986 and 10-year average for 1977 - 1986*

Year/Pick	*1985*	*1986*	*10-year average 1977 — 1986*
1	158 683	130 420	91545.9
2	259 047	126 262	134783.5
3	380 258	152 956	150221.1
4	336 154	162 710	138743.9
5	268 775	153 294	124503.5
6	166 579	121 607	92671.7
Total	1 569 496	847 249	732469.6
No. of bearing palms	11 664	11 121	
Average no. of nuts per palm	135	76	

Separate crop figures for *tall* and *dwarf* palms are given in Table 10. The cropping patterns over the year show clearly that the two varieties are very different in their response to changes in weather. Whereas the tall variety shows a 27.8% decrease in crop from 1985 to 1986, the *dwarfs* show as much as a 77.5% decrease and is less than a quarter of the 1985 *dwarf* crop. This may be attribu ted in part to the reduction in the number of *dwarf* palms in bearing, due to the removal of *dwarf* palms in fields 12, 13, 11A and 11B which have been replanted with *tall*. However, fields which have not lost palms during the

year also show a considerable reduction in yield. Moreover, the pickwise cropping, pattern with mid-year peak is completely lost in the *dwarf* palm yields for 1986 with the mid-year picks showing a distinct trough instead of the expected peak. For the *tall*, the peak is not high but still discernible. The average nuts per palm were 99 for *tall* and 34 for *dwarf* during 1986.

Table 10 :—*Total numbers of nuts harvested from tall and dwarf palms in 1985 and 1986*

	Tall		*Dwarf*	
Pick	*1985*	*1986*	*1985*	*1986*
1	98 718	100 501	59 965	29 919
2	147 082	102 581	111 965	23 681
3	230 810	135 677	149 448	17 279
4	209 023	150 377	127 131	12 333
5	191 093	128 435	77 682	24 859
6	118 664	100 681	47 915	20 926
Total	995 390	718 252	574 106*	128 997
No. of palms in bearing	7 233	7 279	4 431	3 842
Nuts/palm	138	99	130	34

*Includes mainly D × T hybrid nuts and a small number of selfed dwarf nuts.

A comparison of the pick-wise cropping patterns for *dwarf green* and *dwarf yellow* separately is also of interest. For *dwarf green*, the drop in yields was very great for the first four picks and somewhat less towards the end of the year while in the *dwarf yellow*, the reduction generally increased in magnitude as the year progressed (Table 11). This will be investigated further under Experiment G1.3.

Table 11 : *Pick-wise cropping patterns for dwarf green and dwarf yellow palms in* 1985 *and* 1986

	Dwarf green		*Dwarf yellow*	
Pick	1985	1986	1985	1986
1	43 021	11 724	16 938	18 195
2	81 555	9 381	30 410	14 300
3	103 934	8 533	45 514	8 746
4	73 324	5 879	53 807	6 454
5	40 320	19 856	37 262	5 003
6	24 974	16 101	22 941	4 825
Total	367 134	71 474	206 972	57 523
No. of palms in bearing	2 789	2 517	1 642	1 325
Nuts/palm	132	28	126	43

4.4 Seednut production Total seed production from the Isolated Seed Garden during the year amounted to 686 905 nuts comprising 595 198 *Ambakelle tall* (CRIC 60 or T × T), 3 472 *Ambakelle special*, 52 341 *dwarf green* × *tall* (CRIC 65 hybrid) and 35 894 *dwarf yellow* × *tall* (CRIC 65 hybrid) for which selection percentages were 86.0 89.7, 89.5 and 88.3 respectively. Details of crop-wise selection of *typica* and hybrid seed nuts during 1986 are given in Tables 12 and 13 respectively.

Table 12: *Crop-wise selection of typica seednuts duirng* 1986 (*excluding Ambakelle special and nuts from controlled pollination*)

Pick no.	*Harvested*	*Heaped*	*Selected*	*Percent of heap selected*
1	100 501	97 085	85 150	87.7
2	102 581	98 602	88 393	89.6
3	135 677	130 584	109 055	83.5
4	150 377	146 009	125 345	85.8
5	128 435	123 642	105 520	85.3
6	100 681	96 496	81 735	84.7
Total	718 252	692 418	595 198	86.0

Table 13 : *Crop-wise selection of hybrid seednuts during 1986*

	Dwarf green × *tall*			*Dwarf yellow* × *tall*		
Pick	*Heaped*	*Selected*	*Percent of heap selected*	*Heaped*	*Selected*	*Percent of heap selected*
1	9 277	8 056	86.8	14 324	12 985	90.6
2	7 099	6 150	86.8	10 771	9 599	89.1
3	6 798	5 916	87.0	6 191	5 294	85.5
4	4 775	4 289	89.8	4 208	3 411	81.0
5	17 455	16 433	94.1	2 892	2 617	90.4
6	13 102	11 497	87.7	2 263	1 988	87.8
Total	58 506	52 341	89.5	40 649	35 894	88.3

4.5 Emasculation of *dwarf* palms for the production of CRIC 65 hybrid nuts—There was a reduction in the number of palms emasculated over the year as all *dwarf* palms on field 11B were uprooted to be replaced with *tall* variety.

A total of 52 982 inflorescences were emasculated during the year, details of which are given in Table 14. A total of 1 525 immature inflorescences were destroyed due to infestation by ants or premature splitting of spathes.

Table 14 — *Emasculation of dwarf palms for the production of* **nana × typica** *(CRIC 65) hybrid seednut*

Field no.	*No. of palms emasculated*		*No. of inflorescences emasculated*		*No. of buttons at emasculation*	
	DG	DY	DG	DY	DG	DY
05	135	—	2 012	—	49 540	—
09	281	—	2 688	—	63 342	—
10A	104	877	1 519	11 649	44 322	220 722
10B	337	322	4 845	4 760	165 712	99 442
11A	516	131	7 890	1 905	159 294	26 987
14	1 143	—	15 714	—	316 916	—
Total	2 516	1 330	34 668	18 314	793 036	347 151

DG *dwarf green;* DY *dwarf yellow*

4.6 Controlled pollinations Pollen collection and the pollination programme were intensified and made satisfactory progress. Details are given in section 6 entitled "Pollen and pollination" and in section 2 experiments 5.4.2 5.4.3 and 5.4.4.

4.7 Crop disposal—Crop disposal figures are given in Table 15.

Table 15—*Crop disposal as at* 31 *December*

Method of disposal	*No. of nuts from*			*Total*	*Percent of total production*
	Tall	*DG*	*DY palms*		
1. Delivered as seednuts	488 035	28 340	27 023	543 398	64.14
2. Husked and split nuts*	18 184	11 852	16 871	46 907	5.54
3. For research purposes; Genetics & Plant Breeding Division	02	03	03	08	0.05
Other divisions	404	—	—	404	
4. Nut allowance to staff	17 346	—	—	17 346	2.05
5. Sold on contract (crops 1—4)	25 460	—	—	25 460	3.01
6. Cured into copra (excluding item 2 of this table)	21 468	455	457	22 380	2.64
7. Rejections (not suitable for curing)	20 086	7 035	8 004	35 125	4.15
8. To be disposed**	127 267	25 099	3 855	156 221	18.44
Total crop :	718 252	72 784	56 213	847 249	100.00

*From fields nos. 1, 2, 3 and 4 (*tall*) and fields nos. 5, 9, 10A and 10B (*dwarf*)*a*, used for recording of weights of nuts.

**Includes seednuts awaiting delivery and nuts to be sold.

4.8 Field operations and maintenance

4.8.1 Manuring. Although the rainfall was poorly distributed and the Yala rains inadequate, the little rainfall received was fully exploited and fertilizer application carried out whenever possible. Adult palms in fields 1 to 5 were manured during Yala and the other fields in Maha, using CU 3 fertilizer mixture at the rate of 2 kg per palm. The seedlings were given urea based young palm mixture in two split doses at 525 g per seedling. The young palms in field no. 5 were also scheduled to receive fertilizer in two split doses, but at the rate of 700 g per palm, but the second split dose, scheduled for Maha, had to be postponed to early 1987 due to the late start of the Maha rains and lack of rain in December.

4.8.2 Mulching and collection of fallen fronds. The young palms and seedlings were mulched with husks and weed trash and the adult palms with fallen fronds.

The fallen fronds were collected during the dry season and used as a mulch. The butt ends were transported out of the field and burnt whenever possible.

4.8.3 Weeding. Great efforts were made to control the weeds *Imperata cylindrica* (illuk) and *Pennisetum polystachyon* (mana) which remained a problem. Particular attention was given to fields 11A, 11B, 12 and 13 which were recently planted so that, extensive weed growth would not cause a set back to the seedlings. Repeated mammoty weeding rounds were carried out for uprooting clumps of mana, and illuk was kept under control by use of the tractor-driven rotaslasher. However, frequent slashing appeared to enhance flowering of this weed, making control difficult. *Chromolana odorata* which was also found in replanted fields was kept in check by repeated mammoty weeding. Harrowing followed by the use of a nine-tyne tiller was also carried out for purposes of weed control, in some instances. Fields 4, 6, 7 and 8, which have tall palms only were given a deep harrowing so as to avoid compaction and promote soil aeration as little cultivation had been done here for a long time.

In extensive vacant patches in the area along the jungle barrier adjoining fields 11B, 12 and 13, mana was controlled by the use of the chemical weedkiller Gramoxone followed by removal of the withered remains by use of mammoty.

4.8.4 Cover crops. Attempts were made to establish *Pueraria phaseoloides* in fields 11A, 11B, 12 and 13. The land was prepared using the disc harrow and nine-tyne tiller after which the seeds were sown between coconut rows. A total of 95 kg of seed, 60 of which were collected from ISG, were used for this purpose. Satisfactory germination was observed but growth was poor due to adverse weather conditions.

In fields 4 and 9, *Calapogoniuom mucunoides* seed (4 kg collected at ISG) was sown on top of the recently closed husk pits. Thirty kg of *Crotolaria juncea* (sun hemp) seed collected from ISG was planted in the vacant area in field 10B, near Tank B.

Pueraria seed (5 kg) and *Calapogonium* seed (4 kg,) all collected at ISG, were also sown on field No. 5.

4.8.5 Husk burying. Husk burying was completed on field no. 4. These pits were of dimension 2.5 × 1.25 × 0.9 m (8 × 4 × 3 ft) at a distance of 2.5 m (8 ft) from the palm between palms within rows. On field No. 9, a programme of husk burying was started, using pits of dimension (1.25 × 1.25 × 0.9 m) 4 × 4 × 3 ft on one side of each palm just outside the manure circle. A part of the requirement of husks was obtained from Bandirippuwa Estate. The programme could not be completed due to lack of sufficient husks. Arrangements are being made to procure the balance.

4.8.6 Drains. Contour drains (3851.6 m or 2107 fathoms) in fields 10B, 6 and 7 were repeatedly weeded, deepened and desilted and the bunds repaired so as to check surface run off during the rainy season. This was necessary as the land here slopes towards the tanks. Drainage drains (4300.4 m or 2352.5 fathoms) on fields 4, 8, 11A, 12 and 13 were cleared and weeded to allow free flow of excess water as these areas tend to get water-logged during the monsoons.

4.8.7 Pests and diseases. There was an outbreak of nettle grub attack on fields 2, 4, 10A and 11B. The infested dwarf palms were sprayed with BHC in order to protect the emasculating labourers who had to climb those trees. The infestation was brought under control by the naturally occurring parasitoids and predators.

The Coconut scale pest in field No. 4 was also controlled by naturally-occurring predators.

Black beetle attack was kept under control by regular and systematic inspection and collection. The Red Weevil pest was also observed. Palms detected during the early stages of infestation were treated with Metasystox. A number of severely infested palms were destroyed.

4.8.8 Uprooting of palms. A total of 680 palms comprising 5 *tall*, 302 *dwarf green* and 373 *dwarf yellow* were uprooted, their distribution being as follows :

	Field No.	5	8	9	10A	10B	11A	11B	14
No	Tall	—	1	1	1	—	—	—	2
of	DG	1	—	11	2	14	22	195	57
palms	DY	—	—	—	10	5	29	329	—
	Total	1	1	12	13	19	51	524	59

The large numbers uprooted in 11B are due to replanting of this field with tall seedlings. The others were due to pest damage, mainly by red weevil, and also to other causes such as wind damage and general weakness.

4.8.9 Replanting. Replanting of a part of field 11B, begun last year, was completed in early 1986. Steps were taken to replant the remaining portion of this field, also with *Ambakelle special* seedlings at 7.62 m (25 ft) equilateral triangular. However, this could not be completed due to unfavourable weather conditions. Opening of the 874 planting holes was completed and they were filled with two layers of husk, cowdung and top soil.

Planting will be done in early 1987, with the onset of rains. The total planted area on 11B will then approach 8 ha (approx. 20 ac)

4.8.10 Filling of vacancies Casualties in the young plantations were filled as follows: 59, 15 and 2 *tall* vacancies in fields 13, 11A and 5 respectively and 35 *dwarf green* vacancies in field no. 5.

All vacancies in field no. 9 were filled during the year. Some of the self-pollinated *dwarf green* seedlings planted in Yala had to be replaced in Maha due to the adverse conditions of the intervening dry period. A total of 173 *tall* (*Ambakelle special*) and 712 self-pollinated *dwarf green* seedlings were utilized for this purpose. Vacancies in fields 10A and 10B were also filled using a total of 198 *dwarf green* and 8 *dwarf yellow* self-pollinated seedlings.

4.8.11 Fences.—A minor repair was done to the fence bordering the Attangane Government School.

4.8.12 Roads, paths and buildings.—All field roads and paths were maintained satisfactorily, with weeding and filling up carried out whenever necessary. Boundaries and boundary roads were also maintained. Paths within the jungle barrier were cleared when necessary to facilitate patrolling the jungle barrier. A need for a path alongside the perimeter fence of the Welipelessa Attangane area was identified and arrangements made to begin this work.

The culverts in the eastern barrier road and the northern boundary which were damaged by floods in 1984 were filled up locally but the culvert pipes were not placed. Construction work of Grade III house was contracted.

4.8.13 Electricity and water supply—The electricity supply was generally satisfactory. Construction of the central water service system was contracted. Domestic requirements of water were met by pumping from wells to the overhead tanks of the residential quarters.

4.8.14 Vehicles, machinery and tools.—The four tractors, Nos. 36/2642, 36/2643, 36/988 and 37/90 were maintained satisfactorily. The jeep 31/5093 met with an accident and was temporarily replaced with jeep No. 31/6208. A Howard rotaslasher was obtained at the beginning of the year, for use in weed control.

4.8.15 Tanks and irrigation project.—A complete renovation of this project was carried out. Two new pumps were installed. Repairs were done to the main delivery lines in the irrigation system. All riser points were reinforced with concrete pillars and painted to avoid damage by tractors during transport and cultivation operations. The project was nearing completion towards the end of the year.

Irrigation of young plantations and nurseries continues to be done by means of bowsers.

4.8.16 Cattle.—The herd of cattle was transferred to Bandirippuwa Estate.

4.8.17 Jungle barrier. Illicit felling of timber was minimized by employing two watchers. Two instances of illicit felling were detected and immediate action taken. Investigations were made and the stolen timber was recovered.

4.8.18 Watchers.—The main gate was manned day and night by three temporary watchers from the checkroll working 8-hour shifts. All other gates were kept locked and opened only when the need arose.

4.8.19 Research nursery.—A detailed report is given in section 7 entitled Research Nursery.

D. M. Pathirage.

5. SEED PRODUCTION

5.1 Seednut supply.—The seednut requirements of the Coconut Cultivation Board (CCB) was exceptionally low, being well below 2 million and was hence met without difficulty, with over 30% of the seednuts being improved material from the Isolated Seed Garden.

Sudden mid-season reductions in the CCB requirements of seednuts for Yala disrupted the plans for the second year in succession, resulting in a surplus of seednuts which had to be returned to suppliers.

Details of seednut supply for the three seasons, Maha 1986/87, Yala and 1987 Maha 1987/88 are given in Table 16. A total if 1 650 045 seednuts comprising 1 079 746 plus palms seednuts, 518 657 CRIC 60 (T×T) and 51 642 CRIC 65 (D × T) seednuts were supplied during the year. In addition, 3 120 seednuts of *king coconut*, *dwarf red*, *dwarf yellow* and *dwarf green* were also supplied, details of which are given in Table 17.

5.2 Plus palms.—Due to the low demand for seednuts, only a part of the plus palms pool was utilized for seednut selection. The NLDB Melsiripura Farm has more or less withdrawn from the scheme due to difficulties encountered with their pickers. The plus palms on their Walpolayaya, Wagolla and Pamburukaduwa Estates total approximately 4000. The total number of available plus palms over the 24 remaining estates within the three disricts of Kurunegala, Puttalam and Gampaha in the coconut triangle stands at just over 50,000.

5.3 Seednut selection.—Seednut production at ISG Ambakelle amounted to a total of 686 905 comprising 598 670 *tall* and 88 235 *dwarf* × *tall* hybrids. Selection percentages were generally maintained at over 86%' Details are given in section 4.4 and Tables 12 and 13.

Due to the very low demand for seednuts of CCB, it was not possible to use all available seednuts. Attempts were made to use as much as possible from ISG, especially the talls. However, inspite of slight adjustments to delivery times to accommodate the

Table 16. *Seednuts supplied for each season.*

Year & quarter	*Planting season*	*CCB nurseries*			*Total*	*CRB nurseries*			*Total*	*Others**			*Total*	*Grand total*
		PP	*T × T*	*D × T*		*PP*	*T × T*	*D × T*		*PP*	*T × T*	*D × T*		
1985/4	Maha 86/87	289 250	240 185	23 000	552 435	120 60**	350**	2 000	2 530	—	10 200	7 200	17 400	572 365
1986/7	Maha 86/87	486 440	94 660	10 668	591 768	320 120**	5 000 150**	—	5 590	—	—	—	—	597 358
1986/2	Maha 86/87	54 970	62 000	16 764	133 734	—	11 500	—	11 500	—	—	—	—	145 234
Total	**Maha 86/87**	**830 660**	**396 845**	**50 432**	**1 277 937**	**620**	**17 000**	**2 000**	**19 620**	**—**	**10 200**	**7 200**	**17 400**	**1 314 957**
1986/2	Yala 87	190 524	86 945	—	279 469	—	8 500	—	8 500	—	—	—	—	287 966
1986/3	Yala 87	246 922	135 960	8 910	391 792	—	1 557	—	1 557	—	15 000	10 000	25 000	418 349
Total	**Yala 87**	**437 446**	**224 905**	**3 910**	**671 621**	**—**	**10 057**	**—**	**10 057**	**—**	**15 000**	**10 000**	**25 000**	**706 318**
1986/4	Maha 87/8	99 450	73 735	4 500	177 685	1 000**	10 200	—	11 200	—	11 450	800	12 250	201 135
Total supplied during 1986		**1 078 306**	**455 300**	**40 842**	**1 574 448**	**1 440**	**36 907**	**—**	**38 347**	**—**	**26 450**	**10 800**	**37 250**	**1 650 045**

PP, plus palm seednuts ; T × T, CRIC 60; D × T, CRIC 65
* for export, JEDB and the general public; **for research purposes.

nuts from ISG, part of the fifth crop could not be used as seednuts and had to be disposed

P. Kariyawasam.

Table 17. *Supply of seednuts of other varieties*

Variety	*CCB**	*CRB***	*For export*	*Total*
King coconut	—	43	—	43
Dwarf red	824	1 153	100	2 077
Dwarf yellow	—	—	500	500
Dwarf green	—	—	500	500
Total	824	1 196	1 100	3 120

* CCB, Coconut Cultivation Board Nurseries.
**CRB, Coconut Research Board Nurseries.

6. POLLEN AND POLLINATION

6.1 Pollen collection and issue—Details of pollen collection and issue are given in Table 18.

Pollen of the *typica* variety was collected during the year from 10 inflorescenes from 10 selectcd palms on fields Nos. 1 and 2 of the Isolated Seed Garden Ambakelle. A total of 624 ampoules of unadulterated pollen from these palms were sealed. Pollen from different palms of the same variety (*typica*) were mixed together, adulterated with lycopodium and re-sealed; a total of 780 such ampoules were produced during the year.

Pollen of *nana pumila*, was collected from 10 inflorescences from selected palms on field Nos. 5 and 9, new plantation of field No. 5 respectively of ISG, Ambakelle. Two hundred and eighty three ampoules of unadulterated pollen, and 62 ampoules of mixed, adulterated pollen were sealed.

Two hundred and sixry two ampoules of unadulterared pollen of *nana eburnea* were sealed from 10 inflorescences from selected palms on field no. 10 A at ISG.

San Ramon pollen was collected from 6 inflorescences from selected palms on field nol 16, Bandirippuwa Estate. Two hundred and twenty eight ampoules of unadulterated pollen and 41 ampoules of mixed, adulterated pollen were sealed.

A total of 765 ampoules of *typica* pollen were issued to Palugaswewa, Pitiyakande and Daisy Valley estates of the JEDB and to a private estate, Walahapitiya Group, at Rs. 10/- per ampoule.

Two hundred and thirty five ampoules of *nana pumila and nana eburnea* pollen sealed in 1985 were found to have lost viability. These sealed ampoules were immersed for 30 minutes in water brought up to boiling point to ensure inactivity and then used as checks in the pollination programme.

7. RESEARCH NURSERY

7.1 Ambakelle Nursery.—Details of seednuts laid and seedlings issued are given in Tables 19 and 20 respectively. Availability of planting material as at 31 December is indicated in Table 21.

Table 18. *Pollen collection and issue*

	No. of Ampoules			
	Typica	*Nana pumila*	*San Ramon*	*Nana eburnea*
Carried over from 1985 :				
Pollen from individual palms	280	289	92	156
Mixed pollen adulterated with lycopodium	89	21	5	—
Sealed in 1986 :				
Pollen from individual palms	624	283	228	262
Mixed pollen adulterated with lycopodium	780	62	41	—
Issued to estates (at Rs. 10/– per ampoule) :				
Mixed pollen adulterated with lycopodium	765	—	—	—
Issued for pollination programmes :				
Mixed pollen adulterated with lycopodium (first quarter)				
(1) at ISG	47	41	40	—
(2) at B/E	—	—	6	—
Pollen from individual palms (Issued for pollination programme starting on 01.04.86)				
(1) at ISG	204	163	183	176
(2) at B/E	—	—	8	—
Other Uses (Viability tests, demonstrations breakages etc.)				
Pollen from individual palms	32	30	26	35
Special Use* (No Viability/low viability)				
Pollen from individual palms	—	126	—	67
Mixed pollen adulterated with lycopodium	—	42	—	—
Balance as at 31/12/86				
Pollen from individual palms	452	203	91	140
Mixed pollen adulterated with lycopodium	57	—	—	—

*This pollen was found to have lost viability. It was inactivated and used for checking of pollination programme.

Table 19. *Seednuts laid at Ambakelle research nursery*

Variety	*Source*	*Number*
From directed pollinations		
Ambakelle special	ISG	803
Dwarf green × tall	ISG	400
Dwarf yellow × tall	ISG	400
Total		1 603
From controlled pollinations		
Tall	ISG	2228
Dwarf green	ISG	719
San Ramon	B/E	67
Pora pol	B/E	5
Rathran thembili	Colombo	5
Total		3 024
Abandoned pollinations		
Tall	ISG	471
From Other Estates		
Plus palms tall	Plus palm estates	2 000
Grand total		7 098

Table 20. *Seedling issues from Ambakelle nursrey*

Variety	*Issued commercially*	*Issued to seed gardens*		*Issued to*	*Total*
	thro' CRB	*Mahayaya*	*ISG*	*GPB Division*	
Ambakelle special	2 135	101	249	348	2 833
Ambakelle Tall (CRIC 60 or T×T)	478	—	—	—	478
DG×T (CRIC 65)	217	—	—	74	291
DY×T (CRIC 65)	445	—	—	67	512
Dwarf green	6	—	945	—	951
Dwarf red	19	—	—	01	20
Dwarf yellow	5	—	8	—	13
Gon thembili	—	—	—	77	77
Bodiri	—	—	—	82	82
San Ramon	—	—	—	104	104
Navasi	—	—	—	17	17
Ran thembili	—	—	—	22	22
Kamandala	—	—	—	07	07
Pora Pol	—	—	—	62	62
King coconut	—	—	—	02	02
Hand pollinated Tall	100	—	—	830	930
Hand pollinated dwarf	100	—	—	—	100
Total	3 505	101	1 202	1 693	6 501

Table 21. *Availability of planting material as at 31 December 1986*

	Seedlings over 5 months from laying		*Total*
	in beds	*in poly bags*	
Ambakelle speical	1 929	338	2 267
Ambakelle special (HP)	—	1 350	1 350
Ambakelle special (abandoned pollinations)	249	—	249
Ambakelle tall (CRIC 60 or T × T)	164	—	164
Dwarf green × tall	977	—	977
Dwarf yellow × tall	850	—	850
Dwarf green (HP)	—	475	475
Dwarf green (selfed)	64	320	384
Dwarf yellow (selfed)	35	01	36
Dwarf red (selfed)	92	14	106
San Ramon	—	21	21
Rathran thembili	—	04	04
Pora pol	—	01	01
Kamandala	04	02	06
Ranthembili	—	02	02
Gon thembili	—	01	01
Nawasi	—	02	02
Bodiri	—	02	02
King coconut	—	02	02
Plus palms tall	1 493	—	1 493
Total	5 857	2 535	8 392

HP, hand pollinated

The following nursery trials were completed during the year :

(i) Study of variation in seedling characters of different coconut types/cultivars.

(ii) Effect of maturity of D × T nuts on sprouting.

(iii) Comparative study of vertical and horizontal placement of nuts in the nursery.

Seednuts were laid and seedlings raised for the following :

(i) Filling of casualties in trials for the evaluation of cultivars in five different locations.

(ii) Planting at the Isolated Seed Garden, Ambakelle, for both replanting and filling of vacancies.

(iii) Nuts from controlled pollinations for varieties, blocks and evaluation trials.

Since much of the scheduled replanting of Ambakelle seed garden has now been completed it was decided to close down one of the nurseries and use part of that site for erection of a new bungalow. One nursery will be carried on, essentially for raising material for infilling vacancies at Ambakelle itself. Raising of material for germplasm collections and breeding trials will be done mainly at Bandirippuwa.

7.2 Bandirippuwa Research Nursery.—A new research nursery for the Division was established, mainly for raising seedlings for germplasm conservation and for breeding trials.

A site, approximately 2.5 ac (1 ha) in extent located in the fifty-acre block of Bandirippuwa Estate was selected towards the middle of the year. Since the land was gently undulating, 9 terraces were constructed and the edges turfed. *Sesbania grandiflora* seedlings were planted at the edge of each terrace at a distance of 9.3 m (30 ft) apart.

Laying of seednuts was started from 23 October. A total of 3498 seednuts were laid during the year. Details are given in Table 22.

W. G. A. Ratnasiri, M. H. L. Padmasiri and M. A. S. Fernando.

8. EXTENSION ACTIVITIES

Several applications for pollen and seedlings and a few advisory letters were dealt with. One pollinator was trained for Walahapitiya Estate, Nattandiya. Many school groups, students of Agriculture from Aquinas College, trainees from the Coconut Development Training Centre (CDTC), National Institute of Plantation Management (NIPM) and National Apprenticeship Board (NAB) were shown around the laboratories and informed of the activities of the Division. Some of these also visited the Isolated Seed Garden.

Table 22. *Seednuts laid at Bandirippuwa research nursery.*

	Variety†		*Source*	*No. of seednuts*
(i)	**From pollination programme**			
	Tall × *tall*	(HP)	ISG	184
	Tall × *tall*	(*)	ISG	30
	Tall × *DG*	(HP)	ISG	152
	Tall × *DG*	(*)	ISG	24
	Tall × *SR*	(HP)	ISG	222
	Tall × *SR*	(*)	ISG	16
	DG × *Tall*	(HP)	ISG	53
	DG × *DG*	(HP)	ISG	28
	DG × *SR*	(HP)	ISG	63
		Total	ISG	772
	SR × *SR*		B/E f. no. 16	26
(ii)	**From directed pollinations at ISG**			
	Tall × *Tall*		ISG	1000
	DY × *tall*		ISG	800
	DG × *tall*		ISG	700
		Total		2500
(iii)	**From other estates**			
	Plus palm seednuts		St. Annes	100
	Plus palm seednuts		Palugaswewa	100
		Total		200
		Grand Total		3498

† DG, dwarf green; SR, San Ramon; DY, dwarf yellow; HP, hand pollinated;
* pollinations abandoned due to damage to bags.

Mr. Ronghua Gao, FAO fellow from South China Academy of Tropical Crops spent nearly three months in the Division. One NAB trainee and two trainees from Technical Institutes also spent three month training periods in the Division.

Distinguished visitors included the District Minister for Kurunegala, Hon. Jayawickrema Perera and the Board Members of the Coconut Cultivation Board.

Visitors from overseas were Mr. Hans Joachim Fuchs, Research Scholar from West Germany, Mr. Taufikkurahman, Statistical Officer of the Asia and Pacific Coconut Community (APCC), a representative of Tanzanian officials, a group of Coconut Instructors from Indonesia and 30 delegates attending the Regional Seminar on Scientific and Technical Information Policy, organized by UNESCO and hosted by NARESA. Two Vietnamese officers on a study tour and Extension Agents of APCC member countries were shown around the Division and visited the Isolated Seed Garden at Ambakelle too.

Members of the Division participated in a field day for 30 coconuts growers from the Rambukkana special project.

Mr. P. Kariyawasam, Seed Production Officer, and Mrs. W. M. U. Fernando, Research Assistant, participated in a Radio Programme featuring the progress of Divisional Activities.

9. LECTURES, SYMPOSIA, STUDY TOURS, ETC.

The first Quarterly Seminar for the year was on "Coconut Breeding — Progress and Prospects". Members of the division participated, the titles of their presentations being "Breeding goals and strategies" and "Future prospects — Breeding coconuts for less favourable environments" by Dr. M. R. T. Wickramaratne, "Progress in Breeding — a review" by Mrs. W. M. U. Fernando and "Production of planting material" by Mr. P. Kariyawasam.

Dr. M. R. T. Wickramaratne and Mrs. W. M. U. Fernando presented two papers entitled "Breeding coconut for adaptation to drought" and "San Ramon — a promising introduction" respectively, at the Coconut Conference held in Colombo on 22 July.

Lectures for the Diploma in Plantation Management course of the National Institute of Plantation Management were delivered as follows : "Varieties and improved planting material" and "Planting distances and systems" by Dr. M. R .T. Wickramaratne, "Techniques of controlled pollination" by Mrs. W. M. U. Fernando and "Production of planting material" by Mr. P. Kariyawasam. For the same course, field demonstrations on Estate Management were given by Mr. D. M. Pathirage and field demonstrations at the Isolated Seed Garden, Ambakelle by Messrs. D. M. Pathirage and H. Samarasinghe.

Lectures for the training programme for Extension Agents of APCC member countries were as follows : "Varieties of coconut" and "Systems and methods of planting coconut" by Dr. M. R. T. Wickramaratne, "Production of improved varieties" by Mrs. W. M. U. Fernando and "Production of planting material" by Mr. P. Kariyawasam.

Mrs. W. M. U. Fernando also delivered some lectures for the training course for Coconut Development Officerrs of the Coconut Cultivation Board, held at the Coconut Development Training Centre.

10. PUBLICATIONS

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5. Padmasiri, M. H. L. (1986) Nursery practices. *Coconut Bulletin*, 3 (2) : 39–41.

6. Padmasiri, M. H. L. (1986) How to select a good seedling for planting. *Coconut Bulletin*, 3 (2) : 42.

7. Wickramaratne, M. R. T. (1986) Know your nuts. *Coconut Bulletin*, 3 (2) : 32–34.

8. Wickramaratne, M. R. T. (1986) Genetics — A Thorny Rose. *Aquinas Journal* 3 (1) : 64–80.

9. Wickramaratne, M. R. T. and M.H.L. Padmasiri (1986) Some observations on the position of the soft eye in *Cocos nucifera*. *Cocos* 4 : 35–37.

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1. Liyanage, D. V. (1953). Selection of coconut seednuts and seedlings. *Ceylon Coconut Quart.* 4 : 127–129.

2. Liyanage, D. V. & V. Abeywardena, (1957). Correlations between seednut, seedling and adult palm characters in coconut. *Trop. Agric.* (*Trin.*) 113: 326–340

3. Iyer, R. D., E. V. V. Bhaskara Rao, C. K. Sukumaran & P. M. Jacob (1981) Towards ideal plant type concept in Coconut. *Proc. Placrosym IV :* 29–37.

12. ACKNOWLEDGEMENTS

The assistance of the staff of the Genetics & Plant Breeding Division in compiling this report is gratefully acknowledged. Again, a special word of thanks to our field staff who have worked enthusiastically to make our research programme a success.

REPORT OF THE SOILS AND PLANT NUTRITION DIVISION

Head — M. Jeganathan, M.Phil

1. GENERAL

Appointments :

Miss M. G. F. S. Ferdinandis, Research Assistant, 1 September.
Mr. L. P. Vidhana Arachchi, Research Assistant, 8 September.

Promotions :

Mrs. N. H. R. M. Silva, Technical Assistant, Technical Grade, Class II to Class I. 1 January, 1984.
Mr. K. V. W. de Silva, Laboratory and Field Assistant, Operative Grade, Class I to Special Class, 1 January 1984.
Mr. D. E. V. R. Wijetunge, Laboratory and Field Attendant, Minor Grade, Class I to Special Class, 1 January 1984.

Resignations :

Mr. B. J. A. F. Mendis, Senior Technical Assistant, 1 December.
Mr. W. H. Warnasiri, Technical Assistant, 22 December.

Study Leave and Training

Mr. K. S. Jayasekera, Research Assistant, returned from 3 1/2 years overseas study leave on 3 October. He carried out research at the Department of Agriculture, University of Queensland, Adelaide, Australia, on the effect of root size on the resistance to water flow in sorghum. The training was supported by the Government of Australia under the Colombo Plan Scheme.

Miss M. N. Dias, Research Assistant, continues her overseas study leave at the University of Queensland, Australia.

Mr. G. D. George, Senior Technical Assistant, completed a six months training (14 October, 1985 — 13 April, 1986) under the International Training Course in Soil and Plant Analysis, conducted by the Royal Tropical Institute, Amsterdam, supported by a fellowship from the Government of Netherlands.

The following officers participated in the Second Workshop on Repair and Maintenance of Analytical Equipment, sponsored by the British Council and held in Colombo from 12 to 29 August.

Advanced Course :
Mr. B. J. A. F. Mendis, (12 – 29 August) Senior Technical Assistant

Short Introductory Course : (20 – 22 August)
Mr. W. H. Warnasiri, Technical Assistant

Basic Electronics Course : (14 – 15 August)
Mr. N. P. Guneratne, Technical Assistant

2. LABORATORY, GLASSHOUSE AND FIELD INVESTIGATIONS

Studies on physical and chemical characteristics of coir dust

Studies were carried out on the physical and chemical properties of coir dust, which could be used as a soil ameliorent for improving the organic matter status an water holding capacity. It was found to have 1112 $\pm$ 18% moisture content at field capacity (48 h drain) on an oven dry basis (by weight).

K. S. Jayasekara and L. P. Vidhana Arachchi.

Estimation of mineral concentration in coconut water (Liquid endosperm)

In the past, chemical analysis of coconut water had been used to study P and K in the nutrition of coconut. However this method had not been used thereafter due to the laborious and time-consuming nature of the work.

With the introduction of instrumentation, especially the Atomic Absorption Spectrophotometer, attempts were made to develop methods for the estimation of macro and micro elements in nut water, as a tool in routine analysis.

This study indicated that an aliquot of 5 cm3 of nut water is adequate for the estimation of N, K, Ca, Mg and Mn, while 25 cm3 are required for the estimation of P, Fe, Zn and Cu. Na, K, Ca, Mg, Fe, Mn, Zn and Cu were estimated directly on the Atomic absorption Spectrophotometer, after appropriate dilutions of the nut water. However, the normal acid digestion and estimation by microkjeldhal procedure was necessary for N estimation while the colorimetric method was used for the estimation of P. The latter two methods are again time-consuming and further work has been undertaken to investigate speedier procedures.

The concentration of elements in nut water from *typica* palms is as follows :

Element	*Concentrations (ppm)*
N	199.00
P	50.00
Na	258.50

K	1600.00
Ca	475.00
Mg	134.00
Fe	0.22
Mn	6.55
Zn	0.22
Cu	0.23

L. L. W. Somasiri, W. H. Warnasiri, G. D. George and M. Jeganathan.

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 at Heemeliyagara Estate, Hiruwalpola (1984)

Coir dust was applied in February and the regular yield records were maintained. The coir dust was applied in the entire experimental area including the manure circle, in the years 1985 and 1986. The continuation of the experiment is under review.

Experiment 1.5.2 : Effect of coir dust on the physical condition of the soil at Marichchikati Estate, Madurankuliya (1984)

Coir dust was applied in January and regular yield records were maintained. Coir dust was applied excluding the area of the manure circle, in the years 1985 and 1986. Preliminary analysis of results indicate the necessity for higher rates of coir dust. A suitable modification of the treatments will be introduced when laboratory and glasshouse studies on some basic properties of coir dust and its mixtures with soil are completed.

K. S. Jayasekera and L. P. Vidhana Arachchi.

PROJECT 7 : STUDIES ON THE NUTRIENT REQUIREMENT OF COCONUT, PARTICULARLY UNDER STRESS CONDITIONS

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

All the palms were given uniform application of 4.5 kg/palm/year of the CU-1 mixture in December 1985. Half the palms (3) in each treatment plot received 20 kg. of goat dung in March. Soil and leaf samples were collected in August.

This particular field experiment was plagued with magnesium deficiency for nearly 3 years, and despite the biannual application of kieserite at the rate of 0.5 kg/palm in 1984 and 1985, the deficient palms did not recover. Therefore, a more soluble and readily available source of Magnesium, commercial Epsom salt, was applied at the rate of 1.5 kg per palm, to all palms in September.

The yield records were maintained in terms of nuts from the inception and copra from August.

A preliminary analysis of data at the end of the third year indicated an increase in yield in plots receiving 20 kg goat dung+CU-1 over those plots receiving CU-1 only. However the data have to be statistically analysed, taking into consideration the treatments recieved prior to the imposition of modified fertilizer treatments and the fact that the yield levels are not uniform in the experimental plams (due to age).

L. L. W. Somasiri and N. A. Tennakoon.

Experiment 7.3 : Modified response curve experiment on adult palms Ratmalagara Estate, Madampe (1979).

At the end of 1986, seven year cumulative yield data (1980-1986) were compiled to observe overall changes in withdrawal and restoration of fertilizer. The results are given in Table 1.

Table 1 *The Effect of Withdrawal and Restoration of Fertilizer on Yield of Copra (kg/ha/yr – 160 palm/ha)*

(a) **Withdrawal of Fertilizer**

Before modification	*After modification*	*Cumulative Loss*
$N_3P_3K_3$	$N_0P_0K_0$	743 kg
$N_3P_2K_3$	$N_0P_0K_0$	2956 kg

(Restoration of Fertilizer)

Before modification	*After modification*	*Cumulative Gain*
$N_1P_1K_1$	$N_3P_3K_3$	1265 kg
$N_1P_2K_1$	$N_3P_3K_3$	446 kg

Treatments (kg/palm/yr) *Level*	*N(SA)*	*P (SP)*	*K(MP)*
0	0	0	0
1	0.68	0.454	0.568
2	1.36	0.909	1.136
3	2.04	1.36	1.70

SA — Sulphate of Ammonia
SP — Saphos Phosphate
MP — Muriate of Potash

The data indicate that withdrawal of fertilizer reduced yield while restoration increased albeit not dramatic.

The last soil and leaf samples were collected in December to study the nutrient status of both, with special emphasis on soil reserves.

The experiment was concluded in December.

M. Jeganathan.

Experiment 7.4: Effect of nitrogen and potassium on adult coconut 3 × 3 NK experiment, Kobeigana Estate, Hettipola (1978).

From the inception, yield records were maintained in terms of nuts only. However, yield in terms of copra was maintained for the years 1984 and 1985. Statistical analysis of this two-year data showed no significant differences in yield to the treatments.

Soil and leaf sampling of this experiment were completed in April. Analysis of leaf samples was completed and the results are being statistically processed. Soil samples are awaiting analysis.

The experiment was terminated in April.

M. Jeganathan and M. N. Dias.

Experiment 7.5 : Comparison of three forms of N Ammonium chloride, Ammonium sulphate and Urea in sandy soils. Manakkulama Estate, Kakkapalliya (1976).

Statistical analysis of the yieid (nuts and copra) for the period April 1985 to February, 1986 showed no differences in response to the three sources of nitrogen.

The 6th and 14th leaves were analysed specifically for nitrogen, chlorine, and sulphur for possible changes due to the treatment combinations. Statistical analysis showed no significant changes in nutrient concentration.

The experiment was terminated in February.

M. N. Dias, N. A. Tennakoon and M. Jeganathan.

Experiment 7.6.1 : Levels of organic manure (goat dung) supplemented with inorganics, at Heemmeliyagara Estate, Hiruwalpola (1984).

The chemical analysis of the second soil and leaf sampling done in November/ December, 1985 is in progress. The second differential application of organic manure with inorganic supplements was completed in April. The third soil and leaf sampling was completed in December.

Statistical analysis of yield, in terms of nuts and copra, at the end of the first year showed no significant differences between treatments.

Experiment 7.6.2 : Levels of organic manure (goat dung) supplemented with inorganics, at Saraswathie Estate, Divulapitiya (1985).

The initial analysis of soils and leaf samples collected prior to treatment was completed.

The first differential application of organic manure (goat dung) with inorganic supplements was done in April/May. Soil samples for organic manure transformation studies were collected at 45 day intervals after the first differential treatments.

Four such samplings have been completed. Four more samplings, eight in all will be done before the data are statistically analysed.

Experiment 7.6.3 : Levels of organic manure (goat dung) supplemented with inorganics, at Kiniyama Estate, Weerapokuna (1984).

The chemical analysis of the second set of soil and leaf samples, collected in November/December, 1985 is in progress.

The second application of treatments was done in March.

The Third soil and leaf sampling was completed in December. Yield records in terms of nuts and copra were maintained.

Statistical analysis of the yield in the first year showed no significant difference between treatments.

N. A. Tennakoon.

Experiment 7.7 : Nutrient requirements of coconut/based on soil and tissue analysis (1984).

(a) Leaf analysis was used as a diagnostic tool and for fertilizer modification in eight Estates. Deficiencies due to K, Mg, N and S were identified.

(b) **FAO Fertilizer Project for Small Farmers**

There was uncertainty and delay in the implementation of the second phase of the programme and funds were not made available for fertilizer application in 1986.

The yield recording in the 113 sites was maintained by the Coconut Development Officers of the Coconut Cultivation Board (CCB). The reporting of the yield data was transferred to the CCB from July.

Leaf sampling was done for the 25 sites in Puttalam (7) and Gampaha (18) in December.

Analysis of nut yields for 1986 from 53 sites in the coconut triangle, where the full complement of six harvest yields available is given in Table 2.

Table 2 *Yield data from 53 sites from the coconut triangle.*

		Yield (Nuts/palm/year)		
		Control	*Fertilizer*	*Package**
Kurunegala	(31 sites)	35	50	50
Gampaha	(16 sites)	40	52	57
Puttalam	(6 sites)	75	81	81

*Package includes fertilizer, husk burial and cover crop but in these sites, only fertilizer application has been done. As far as treatments are concerned, "fertilizer" and "Package" are therefore similar.

The overall response to fertilizer in 1986 showed a trend similar to 1985. The increase due to fertilizer is 8% for Puttalam, 36% for Gampaha and 43% for Kurunegala as against 9%, 38% and 39% respectively for 1985.

At the end of December, the number of sites in operation are indicated in Table 3.

M. Jeganathan

Table 3 *FAO Small Farmer Project — Position Regarding the Sites.*

District	*Code*	*Sites* *Selected*	*Functioning*	*Rejected*
Ampara	AM	6	0	6
Anuradhapura	AN	12	4	8
Batticaloa	BT	10	8	2
Colombo	CO	9	0	9
Galle	GL	8	6	2
Gampaha	GP	32	17	15
Hambantota	HM	11	9	2
Jaffna	JF	7	4	3
Kegalle	KG	6	6	0
Kalutara	KL	9	5	4
Kurunegala	KR	56	33	23
Kuliyapitiya	KP	15	8	7
Matara	MT	8	6	2
Puttalam	PU	23	7	16
Total		212	113	99

Experiment 7.8 : Effect of chloride and sulphate of K, Mg, and Na on the yield of coconut at Heemmeliyagara Estate, Hiruwalpola (1984).

Soil and leaf samples were collected in May after the first differential fertilizer treatment. Chemical analysis of leaf samples was completed in October. Soil samples await chemical analysis.

The second differential fertilizer treatment was completed in August/September. The treatment was delayed by five months due to prolonged drought.

Yield records in terms of nuts and copra are being maintained.

L. L. W. Somasiri and N. A. Tennakoon.

Experiment 7.9.1 : Studies on K Mg interaction in coconut at Heemmeliyagara Estate, Hiruwalpola (1984)

The first year's yield records, for the period January, 1985 to December 1985 (6 harvests), in terms of nuts and copra per hectare, showed no significant differences to differential fertilizer treatments. The first differential fertilizer application was introduced in January 1985.

The premanurial soil samples collected (October 1984) from two depths, 0-25 cm and 25-50 cm of the manure circle and centres of squares, representing all plots were analysed for Exchangeable Na, K, Ca, Mg and water soluble Cl. Variations were observed in the values for the parameters analysed necessitating repeat analysis for confirmation of the values. In addition, a detailed plot-wise soil survey was also done to study variations in the soil types.

The second set of leaf samples, collected in November 1985 before the second differential fertilizer application, was analysed for N, P, K, Ca, Mg and Cl. The data await statistical analysis.

Nut water sampling and analysis was also completed in November, 1986 for Na, K, Ca, Mg and Cl. The data are being statistically processed for variation study and also for treatment effect.

The second differential fertilizer application was completed in February.

The third soil and leaf sampling was carried out in December.

Experiment 7.9.2 : Studies on K Mg interaction in coconut at Sirikandura Estate, Dodanduwa (1984)

Statistical analysis of the yield data, covering the period May 1985 to September 1986, in terms of nuts and copra showed no significant differences to differential fertilizer treatments.

Soil samples collected prior to application of treatments (October 1984) from two depths, 0-25 cm and 25-50 cm, of the manure circles and centres of squares, were analysed for Exchangeable Na, K, Ca, Mg and water soluble Cl. The first set of soil samples from the manure circles, collected in April before the second differential fertilizer treatments was analysed for the same parameters. Here too, as in the case of Experiment 7.9.1, variations in analytical values were observed necessitating repeat analysis for confirmation and also a detailed plot-wise soil survey to identify soil types.

The second set of leaf samples, collected in May before the second fertilizer application was analysed for N, P, K, Ca, Mg, Cl and S. The data await statistical analysis.

Nut water sampling and analysis were completed in October for Na, K, Ca, Mg, and Cl. The data await statistical analysis.

The second fertilizer treatment was done in May.

M. Jeganathan and M. N. Dias

4. NEW FERTILIZER RECOMMENDATION

Fertilizer recommendations for coconut were revised and the Advisory Circular No. A 4 was issued in March.

The main feature of the change is the introduction of a single urea-based Adult Palm Mixture (APM) replacing the existing Urea-based CU CU_2 and CU_3 mixtures and Sulphate of ammonia-based CA_1 CA_2 and CA_3 mixtures.

The composition of the APM is as follows :

Urea (46% N)	— 4 parts by weight
Saphos phosphate (27.5% P_2O_5)	— 3 parts by weight
Muriate of potash (60% K_2O)	— 8 parts by weight

(Approximate composition : 12 – 6 – 32)

The rates of application of the APM would vary depending on the soil type climate and the yield. Upto 1½ times these rates may be applied to improved cultivars, high-yielding blocks or blocks with a potential for high yield. A maintenance dose of at least 1.5 kg per palm per year was recommended during periods of unfavourable market conditions and financial constraints. The composition of the Young Palm Mixture (YPM) remains the same and is as follows :

Urea	— 2 parts by weight
Saphos phosphate	— 3 parts by weight
Muriate of potash	— 2 parts by weight

(Approximate composition : 13 – 12 – 17)

The rates of application for seedling and young palms were changed.

The use of locally-available organic manures supplemented with appropriate inorganic fertilizer to meet the recommended balanced mixture was also incorporated into the Advisory Circular.

5. THE ANALYTICAL CHEMISTRY LABORATORY

One thousand five hundred and fifteen (1515) soil samples were analysed for pH, electrical conductivity, organic matter, total N, available P. available S, Total Exchangeable Bases (TEB) and water soluble Cl.

Leaf Analysis : One thousand four hundred and thirty-five (1435) leaf samples were analysed for total N, P, K, Ca and Mg. Sulphur was determined in 380 samples while Cl was determined in 290 samples.

Fertilizer Analysis : Twenty (20) fertilizer samples (organic/inorganic) were, analysed for quality standards.

The Atomic Absorption Spectrophotometer which was out of order since July 1985, was recommissioned in February 1986. This together with the refurbishing of the laboratory which commenced in November, considerably reduced the output of the laboratory.

M. Jeganathan and L. L. W. Somasiri.

6. THE ELECTRONIC INSTRUMENT WORKSHOP

During the year, servicing and repair of some equipment were effected. Some unused items of equipment were also recommissioned with minimal servicing.

Spares and accessories necessary for the smooth functioning of the more important analytical equipment were obtained.

The Workshop has completed preparation of a complete inventory of equipment, maintenance schedules and maintenance log books for the Institute.

B. J. A. F. Mendis and N. P. Guneratne.

7. ACKNOWLEDGEMENTS

Mr. D. T. Mathes, Officer in Charge and Mr. T. S. G. Peiris, Assistant Biometrician of the Biometry Unit for design of experiments and for the statistical analysis of the data.

REPORT OF THE CROP PROTECTION DIVISION

Head — P. Kanagaratnam, Ph.D

1. GENERAL

Collaborative Research Project

The Collaborative Research Programme between the CRI, Silwood Centre for Pest Management (SCPM) at the Imperial College of Science and Technology of the University of London and the Tropical Development and Research Institute (TDRI), London on "Integrated and biological control of the coconut caterpillar and other coconut pests" funded by the Commission of European Communities progressed satisfactorily with Prof. M. J. Way as the Project Leader and Dr. P. Kanagaratnam as the Co-organiser. Arrangements were made for Mr. P. A. C. R. Perera to complete his postgraduate studies under this programme. The division participated in this collaborative programme by undertaking the relevant field studies and providing facilities to the collaborating scientists.

Staff Changes

Mrs. Anula De Zoysa and Mr. W. W. F. Noel Fernando were transferred from the Coconut Processing Research Division on 25 June and 11 June respectively.

Miss P. K. K. Croos, Technical Assistant who was on temporary transfer from the Coconut Processing Research Division since 1985 continued to work in the division throughout the year.

Trainees

The following two final year students from the University of Ruhuna conducted research for their degree in the division from 2 June to 30 September.

Miss G. C. De S. Weerawardene — Studies on absorption and translocation of systemic insecticides in the crown,

Miss K. N. Narangoda — Control of *Oryctes rhinoceros* with *Metarhizium anisopliae*.

Miss W. S. A. Rangani, Miss T. Hirimutugoda, Miss M. P. Withana, Mr. Jayakanthan and Miss. J. Chitrangani underwent training in the division as part of the programme for the National Diploma in Technology/Agriculture.

2. RESEARCH PROJECTS

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

GENERAL

Some components of the project were under the Collaborative Research Project between the CRI and the Silwood Centre for Pest. Management (SCPM). Data collected over the past several years were analysed with the assistance of the collaborating scientists.

A critical review of the role of natural enemies in the control of outbreaks of *O. arenosella* was undertaken. Based on field observations and available data it was inferred that the outbreaks of the caterpillar are caused by the disruption of a stable host/parasitoid interaction, but are ultimately controlled by the parasitoids.

Experiment 8.1 : The effect of humidity and temperature variations on population fluctuations of *Opisina arenosella* (1984).

The collection of data for studies on the possible relationship between weather and changes in *O. arenosella* population was continued. Pest/Parasitoid population studies were made at Udappuwa (N.W.P.), Delatura (W.P.), Ambalangoda and Vitharandeniya (S.P.)

Preliminary analysis of these data indicated a relationship between temperature and *O. arenosella* populations, but population studies at more frequent intervals were required to obtain more precise information on the relationship. The data from the monthly population census at Dickowita estate (W.P.) for the period of 1964—1966 and the weekly population census for the periods 1981 to 1983 at Goluwapokuna and January to December 1986 at Horakelle are being analysed with the assistance of collaborating scientists from Imperial College.

P. A. C. R. Perera, K. F. G. Perera, K. A. S. Chandrasiri and I. Alwitigala.

Experiment 8.2.1 : The effect of natural status of plant and variety on susceptibility to pest attack (1984)

Four replicates of the experiment on the relationship between nutrient status of potted coconut seedlings and susceptibility to pest attack were completed. Nutrient deficiency in the potted seedlings was obtained by maintaining the seedlings in sand culture and using the nutrient exclusion technique. The susceptibility to pest attack was studied through bioassay using third instar larvae of *O. arenosella*. The results of these experiments are being analysed.

P. A. C. R. Perera, K. F. G. Perera and K. A. S. Chandrasiri.

Experiment 8.2.2 : Host plant relations of the coconut caterpillar (1986)

Preliminary investigations on the possible role of both inherent and environmentally induced host plant resistance were carried out under the collaborative programme with the S. C. P. M. Leaf samples from infested, uninfested and apparently resistant palms to infestation by *O. arenosella* were collected, freeze dried and taken for analysis for mineral elements and amino acids. These investigations are in progress.

P. A. C. R. Perera, M. E. Cammell and M. J. Way.

Experiment 8.3 : The introduction of *Antrocephalus pandens* (Chalcididae) (1984)

The breeding and release of *A. pandens* were continued throughout the year. Regular collections of *O. arenosella* pupae from the release areas were examined but no recoveries of *A. pandens* were made.

P. A. C. R. Perera, M. S. Velu, K. F. G. Perera and K. A. S. Chandrasiri.

Experiment 8.5 : The functional responses of the important parasitoids of *O. arenosella* (1984)

Laboratory studies on the functional response of *Eriborus trochanteratus*, the larval parasitoid of *O. arenosella* were completed.

The parallel study on the functional responses of natural populations of parasitoids and predators was also conducted using infested coconut seedlings raised to foliage level of young palms 3–5 m. in height at Palaicholai Estate in the N.W.P. The results of these experiments are being analysed.

P. A. C. R. Perera, K. F. G. Perera and K. A. S. Chandrasiri

Experiment 8.6 : Use of pheromones in the control of *O. arenosella* (1985).

The Collaborative Research Programme on the role of pheromones in the control of the coconut caterpillar, between the Tropical Development and Research Institute (TDRI) and the CRI which commenced in 1985 progressed satisfactorily.

Consignments of pupae of *O. arenosella* were sent regularly to the TDRI for extraction and identification of sex pheromones. The virgin female moths were found to produce unsaturated hydrocarbon attractants which elicited electroantennogram responses from male moths.

Field tests using virgin female moths were carried out in April by Dr. John Mumford of the SCPM at Netolpitiya. These tests demonstrated that—

(*a*) female moths attract male moths.

(*b*) virgin female moths aged 1–4 days showed no difference in attraction.

(*c*) Female moths attract most male moths during the period four hours after dark. No moths were attracted during daylight.

(*d*) vertical sticky boards and horizontal sandwich traps were effective trap designs; funnel shaped traps caught no moths,

(*e*) the traps were most effective when placed in the crown.

Further field experiments were carried out in October at Kurunegala using one of the compounds synthesized by the TDRI. The male: female moth ratio was high in all the traps, indicating perhaps that the glue used in the traps may have substances similar to female sex pheromones.

These experiments are in progress.

J. D. Mumford, D. R. Hall, P. C. A. R. Perera and P. Kanagaratnam

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

Experiment 9.1.1 : Evaluation of techniques of treating coconut palms with systemic insecticides, against the caterpillar, *Opisina arenosella* at Dalatura, Ja-ela (1984)

The treatments and the design of the experiment were described in the report for 1984.

Results obtained on the insecticidal effect on caterpillar in the bioassay carried out in the laboratory using leaves collected from experimental palms at weekly intervals until 15 weeks after treatment were analysed, using arcsine transformation. From the analysis of variance for percentage larval mortality, a significant difference was observed between treatments ($P=0.001$) and between periods ($P=0.001$) of observation after treatment.

The highest mean mortality of 63.08% was obtained with trunk injection while the control had the lowest value of 23.53% as given in Table 1, over the duration of 15 weeks.

Table 1 *Mean percentage mortality of caterpillars in the laboratory when fed with leaves collected from experimental palms at Ja-ela*

Treatments	*Mean percent mortality*	
	Detrans-formed	*Trans-formed*
Trunk injection	77.4	63.1
Feeding through exposed roots	65.8	56.2
Drenching into the crown	48.0	43.9
Bole injection	46.0	41.9
Drenching around palm base	41.6	39.7
Application on trunk surface	23.0	28.0
Leaf axil placement	22.5	27.8
Control	18.7	23.5
		LSD=7.7

P. Kanagaratnam and L. C. P. Fernando.

Experiment 9.1.3 : Evaluation of systemic insecticides for the control of the coconut scale, *Aspidiotus destructor* at Yakwila (1985)

The treatments and the design of the experiment were described in the report for 1985. The results on the mortality of scale insects were analysed using arcsine transformation. The mortalities of scale insects were significantly different between treatments ($P=0.001$) and between periods ($P=0.001$). There was no significant difference between the two techniques of application *viz.* trunk injection and feeding through roots.

The mortalities of scale insects were significantly different between insecticides (P=0.001) when applied by both techniques.

Monocrotophos and methamidophos were the most effective insecticides and carbofuran and isofenphos were the least effective insecticides (Table 2). There was on development of new generation of scales in the treated palms.

Table 2—*Mean percent mortality of sacle insects on palms treated with five insecticides by trunk injection and root feeding at Yakwila*

Treatment	*Mean mortality*	
	Trans-formed	*Detrans-formed*
Trunk injection		
Monocrotophos	60.8	76.2
Methamidophos	61.3	76.9
Metasystox	39.4	40.8
Isofenphos	22.5	14.6
Carbofuran	24.6	17.3
Root feeding		
Monocrotophos	60.4	76.0
Methamidophos	54.9	66.9
Metasystox	28.8	23.2
Isofenphos	27.4	21.1
Carbofuran	23.2	15.6
Control	21.1	13.0

LSD=20.1

Table 3 *Mean percentage mortality of scale insects on the palms treated with four concentrations of three different insecticides by root feeding at Demanhandiya*

Treatment/Levels of insecticides (g of a.i.)	*Mean percentage mortality*	
	Before treatment	*18 days after treatment*
Monocrotophos 7.5	6.8	100.0
" 6.0	13.0	100.0
" 4.5	10.8	100.0
" 3.0	9.4	68.4
Methamidophos 7.5	20.0	100.0
" 6.0	11.5	100.0
" 4.5	12.7	100.0
" 3.0	7.8	81.9
Metasystox 7.5	11.9	6.9
" 6.0	8.4	31.0
" 4.5	5.3	17.5
" 3.0	18.7	7.3
Control	10.1	13.6

The results of the experiment carried out at Demanhandiya are given in Table 3. Monocrotophos 60% and methamidophos 60% at 4.5 g. 6.0 g. and 7.5 g, a.i. caused 100% mortality of scales 18 days after treatment. Hence the results were not analysed. The scale insects shed their wax coverings before death. Metasystox caused very low mortality.

The experiment was terminated because 33 days after treatment, the scale insects on the control palms were also brought under conrol by the natural enemies.

P. Kanagaratnam and L. C. P. Fernando.

Experiment 9.1.4 : Evaluation of two concentrations of three systemic insecticides against the coconut caterpillar, *O. arenosella* at Madurankuliya (1985)

Observations on the insecticidal effect on natural population of coconut caterpillar on the experimental palms were completed and the results analysed. Feeding systemic insecticides through the root was very effective in controlling the caterpillars on treated palms.

The mortalities of caterpillars were significantly different between treatment ($P=0.001$) as well as between insecticides ($P=0.001$). There was no significant difference in the larval mortality due to different levels of the insecticides, indicating that 6 g., a.i. was sufficient to kill the caterpillars in the crown. Among the insecticides, monocrotophos was the most effective followed by methamidophos (Table 4).

Table 4 *Mean larval mortality of Opisina arenosella in the palms treated with two concentrations of three different insecticides by root feeding at Madurankuliya.*

Treatments	Levels of insecticides (g of a.i.)	Mean percent mortality	
		Trans-formed	Detrans-formed
Monocrotophos	6.0	64.4	81.3
"	9.0	62.4	78.6
Methamidophos	6.0	56.6	69.6
"	9.0	58.0	72.0
Metasystox	6.0	23.4	15.7
"	9.0	25.0	17.9
Control		18.2	9.7
			LSD=15.9

In addition to the field assessment of larval mortality, a bioassay was carried out in the laboratory by feeding healthy field-collected caterpillars, with samples of leaflets collected from the experimental palms.

The results were analysed using arcsine transformation. There were significant differences in the caterpillar mortality between control and insecticide treatments ($P=0.05$) and between the three insecticides ($P=0.01$). However, there was no significant difference in the mortality caused by different levels of the insecticides.

The highest mean mortality was recorded when caterpillars were fed with leaves from palms treated with monocrotophos. Metasystox was the least effective insecticide (Table 5).

Table 5 *Mean mortality of caterpillars fed in the laboratory on leaves collected from palms treated with different levels of Monocrotophos, Methamidophos and Metasystox at Madurankuliya*

Treatment	Levels of insecticides (g of a.i.)	Mean percent mortality	
		Trans formed	Detrans formed
Monocrotophos	6.0	88.2	100.0
"	9.0	88.2	100.0
Methamidophos	6.0	61.0	76.5
"	9.0	83.2	98.5
Metasystox	6.0	41.5	43.9
"	9.0	46.1	51.9
Control		43.1	46.7
			LSD=27.9

P. Kanagaratnam and L. C. P. Fernando.

Experiment 9.1.6 : Studies on the distribution of the systemic insecticide in the crown of coconut palms; Bandirippuwa Estate (1986)

The aim of the experiment was to study the pattern of distribution of systemic insecticides, in the fronds, when applied to the palm by trunk injection.

One palm at Bandirippuwa estate, 5 m. in height was treated with 10 ml. of monocrotophos 60% by trunk injection. Ten alternate fronds starting from the thirteenth unfolded frond counted from the centre of the crown were labelled and samples of three leaflets were removed from the middle of each frond at hours 18, 40, 65 and 384 after treatment. Samples taken similarly from an adjacent untreated palm were used as the control. Twenty healthy third instar caterpillars of *Opisina arenosella* of uniform size were introduced into each sample and their mortality recorded on days, 4, 8 and 12 after introduction.

Analysis of variance was carried out using angular transformation. The larval mortalities among fronds of different ages ($P=0.001$) and between sampling dates ($P=0.001$ were significantly different. Mean larval mortality increased from 41.7% in the first ampling to 68.9% in the last. Table 6 and Fig. 1 show that mean percent mortality varied from frond to frond. There was no relationship between the point of injection on the stem and the concentrations of insecticides at different leaf positions.

Table 6 *Mean percent mortality of caterpillars of Opisina arenosella in fronds of different ages (Means of five samples)*

	Mean percent mortality	
Frond No.	*Transformed*	*Detransformed*
13	57.5	70.9
15	59.3	73.9
17	52.6	63.1
19	59.9	74.9
21	62.1	78.1
23	57.5	71.1
25	49.6	58.0
27	53.9	65.2
29	54.5	66.2
31	49.0	60.0

LSD = 5.6

The concentration of the insecticide was higher in the younger leaves, until 40 hours, after injection. Thereafter all the fronds had high concentration.

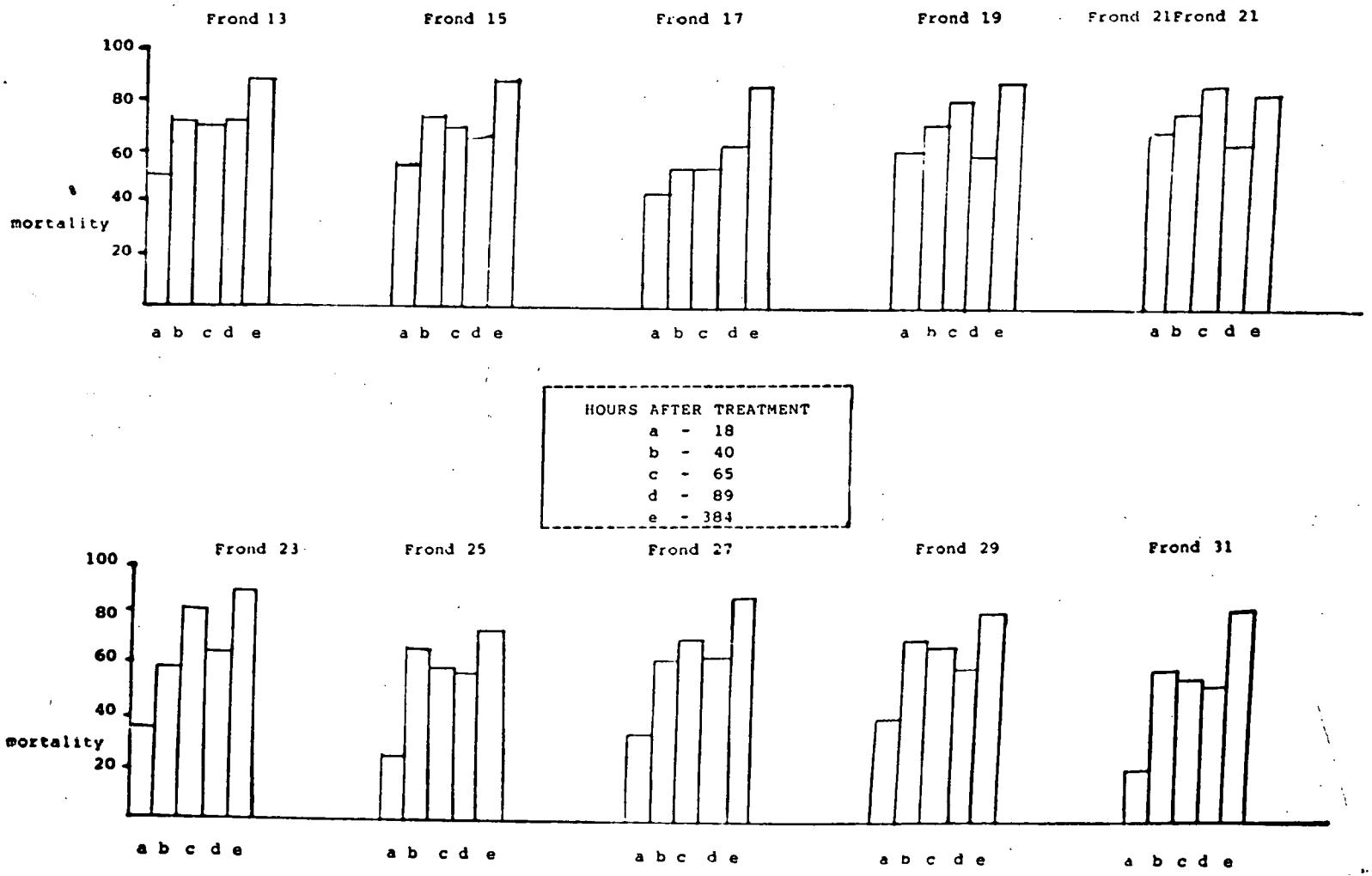
P. Kanagaratnam, L. C. P. Fernando and G. C. De S. Weerawardene

Experiment 9.1.7 : Studies on translocation of insecticides from the site of application to the crowns of palms of different heights; Bandirippuwa estate, (1986).

The aim of the experiment was to find the duration in which the systemic insecticides applied by trunk injection get translocated to the leaves in lethal quantities in palms of different heights.

The experiment was carried out in palms of three different height groups, 5–6.5 m. (group 1), 10–11.5 m. (group 2) and 14–15.5 m. (group 3). Five palms were selected from each group and treated with 6 ml. of 60% monocrotophos by trunk injection. Samples of leaflets were collected from frond 21 at hours 23, 47, 71 and 95 after treatment and fed to caterpillars in the laboratory. Twenty caterpillars were used for each replicate. There were three replicates in the control for which an untreated palm was used. The caterpillar mortalities were recorded on days 4, 8 and 12 after introduction.

Fig. 1 - Mean per cent mortality of caterpillars fed with leaflets taken from fronds of different ages on different sampling dates



Results were analysed for the different height groups using arcsine transformation. The difference in mortality for the different height groups of palms (P=0.05) and between periods of sampling (P=0.001) were highly significant. However, the mean percentage mortalities for groups 2 and 3 were not significantly different. In group 3, 66% mortality was recorded 23 h. after treatment (Table 7) indicating that the insecticide was translocated to the fronds of 14—15.5 m. tall palms within a day. The mortality gradually increased with time.

Table 7 *Mean percentage mortality of caterpillars fed with leaves from palms of different height groups at each period of observation after commencing treatment with 6 ml of 60% Monocrotophos.*

Height group	*Time after treatment (h)*			
	23	47	71	95
I (5.0– 6.5 m.)	89.0	94.0	92.0	94.0
II (10.0–11.5 m.)	70.0	84.0	81.0	85.0
III (14.0–15.5 m.)	66.0	83.0	84.0	85.0
Control	16.7	6.7	1.7	11.7

P. Kanagaratnam, L. C. P. Fernando and G. C. De S. Weerawardene.

Experiment 9.1.8 : Studies on the rate of absorption of insecticides through roots; Bandiripuwa estate (1986)

The aim of the experiment was to study the rate of absorption of insecticides, when fed through roots at different aqueous dilutions.

Twenty young palms; average height 4 m. were selected. The insecticides were diluted as follows :—

Monocrotophos 60% WSC	(*a*) 1 part with 1 part of water (T1)
	(*b*) 1 part with 2 parts of water (T2)
Methamidophos 60% LC	(*c*) 1 part with 1 part of water (T3)
	(*d*) 1 part with 2 parts of water (T4)

Five palms were used for each treatment. Two roots were selected in each palm one fed with lower concentration and the other with higher concentration of the same insecticide. The volume of the insecticide absorbed through each root was measured at 4 hourly intervals.

Table 8 : *Mean rate of absorption (ml./h.) of systemic insecticides at different intervals when fed through roots*

Treatment		*Duration after treatment (h)* 4	8	12
Monocrotophos	1.1 (T_1)	1.0	0.4	0.1
Monocrotophos	1.2 (T_2)	2.3	0.9	0.1
Methamidophos	1.1 (T_3)	0.8	0.3	0.1
Methamidophos	1.2 (T_4)	1.1	0.9	0.2

The results were analysed and given in Table 8. The rate of absorption of insecticides varied significantly ($P=0.001$) with period of observation after the treatments were commenced. The rates at which the two insecticides were absorbed were significantly different ($P=0.05$). Further, the rates of absorption between the levels of insecticides were also significantly different ($P=0.001$).

There was a decrease in the rate of absorption with time in all the treatments. The highest mean absorption was recorded in T_2 which was 1.1 ml./h. followed by T_4 which was 0.7 ml./h. The values for T_1 and T_3 were 0.5 ml./h. and 0.4 ml./h. respectively. The rate of absorption increased with dilution.

P. Kanagaratnam, L. C. P. Fernando and G. C. De S. Weerawardene.

Experiment 9.1.9 : Field evaluation of systemic insecticides against *Opisina arenosella* and *Promecotheca cumingi* by trunk injection (1986)

When parasitoids fail to control outbreaks of coconut caterpillar, in plantations with tall palms, alternative control measures had to be developed. Experiments carried out earlier on some caterpillar infested palms revealed that the caterpillar infestations in treated palms were brought under control by trunk injections with systemic insecticides (Kanagaratnam and Pinto, 1985 and experiment 9.1.1 in this report).

Therefore large-scale field evaluation was carried out in September in three estates using monocrotophos 60% and methamidophos 60% applied by trunk injection, using electric drills, at the rate of 7 ml. per palm in the undiluted form.

At Galkandegama estate, Nikadalupotha, 4480 palms and at Pallekotuwa estate, Wellawe, 550 palms were treated with monocrotophos. At Goluwapokuna estate, Katunayake, 750 palms were treated with methamidophos.

An assessment of the population of *O. arenosella* was made before and after treatment. At Nikadalupotha, observations taken one month after treatment revealed that the caterpillar mortality on five randomly selected treated palms was 100% while on the untreated palms there were no dead caterpillars though very large numbers of live caterpillars were present.

At Goluwapokuna estate, Katunayake, there were no live caterpillars in the samples collected from ten palms treated with methamidophos, for about four months, though live caterpillars were present on untreated palms.

At Palaicholai estate, Madurankuliya, about 1700 young palms treated with 6 ml. of 60% monocrotophos per palm, in October 1985 were free from caterpillar infestation throughout 1986. Further, the wounds caused by drilling holes for trunk injections had healed and the palms appeared healthy.

At Dummalasuriya too, the wounds on the trunks caused by drilling in July 1985 for trunk injection with monocrotophos to control *Promecotheca cumingi* had healed and the crowns of palms appeared healthy at the end of 1986. These results demonstrate the usefulness of trunk injection for the control of outbreaks of foliar pests of coconut.

P. Kanagaratnam, L. C. P. Fernando, M. S. Velu and D. M. Jayakody.

Experiment 9.2.1 : Evaluation of systemic insecticides for the control of *Oryctes rhinoceros* in coconut seedlings and young palms (1984)

The results of the experiments carried out at Kohombe estate A and Kongoda estate were analysed. The damages in the control and treated palms were not significantly different. This may be due to the appplication on insecticides only once in three months. The experiment at Kongoda estate was discontinued due to the low incidence of black beetle. The experiment was repeated at a new site at Bandirippuwa estate. The experiment at Kohombe estate A was continued. At both sites, the frequency of insecticide application was increased from once every 3 months to once every 2 months and the damage assessment was made at each application.

P. Kanagaratnam and L. C. P. Fernando and M. S. Velu

PROJECT 11 BIOLOGICAL CONTROL OF BLACK BEETLE

Experiment 11.1.4 : Effect of temperature on the growth of six strains of *Metarhizium anisopliae* in the laboratory (1986)

The aim of the experiment was to select a virulent strain of *Metarhizium anisopliae* that could grow well at temperatures prevailing in coconut plantations.

Five strains of *Metarhizium anisopliae* viz. 148 - 83, 170 - 83, 208 - 85, 172 - 83 137 - 82 obtained from England and a local strain were grown on Sabouraud Dextrose Agar (SDA) for four days at 25oC. Inoculum plugs, 1.2 cm in diameter, were cut from confluent growth of these cultures and placed on central cavity of equal size in SDA petri dishes 9 cm in diameter. These were incubated at temperatures 20o C, 25oC, 30oC and 35°C. At each temperature three petri dishes were used as replicates. Growth of each colony was recorded every four days by measuring the diameter of the colonies until the fungus grew up to the margin of the petri dish. The experiment was completed and the results are being analysed. It appears that the optimum temperature for growth of all six strains was 30°C. At 35°C there was no growth.

L. C. P. Fernando, P. Kanagaratnam and K. N. Narangoda

Experiment 11.1.5 : Evaluation of pathogenicity of different strains of *Metarhizium anisopliae* against larvae and adults of *Oryctes rhinoceros*. (1986)

The aim of the experiment was to evaluate the pathogenicity of several strains of *Metarhizium anisopliae*.

Larvae : The strains viz. 137 - 82, 148 - 83 and the local strain were tested against larvae of *O. rhinoceros*. Spores of the fungus cultured at 25°C on SDA for two weeks suspended in 0.05% Tween 80 in water. The larvae were dipped in a suspension with 10^7 spores/ml to wet them thoroughly removed immediately and transferred into small buckets with lids. For the control, larvae were dipped in 0.05% Tween 80 in water. Each treatment was replicated three times with 20 larvae per replicate. Then the larvae were incubated in a controlled temperature room at 27 - 28°C for one day to obtain maximum spore germination. On the second day the larvae were provided with adequate amount of rotten cowdung in each bucket. The larvae were observed every third day for symptoms of disease and mortality caused by fungal infection. The highest larval mortality was caused by the strain 148 - 83 and the lowest by the local strain. However the differences in mortality caused by the three strains were not statistically significant (Table 9).

Table 9—*Mean percentage mortality of larvae of Oryctes rhinoceros caused by three strains of Metarhizium anisopliae.*

	Days after inoculation				
Strain	4	7	10	13	17
Local strain	14.0 (21.9)	32.9 (35.0)	66.7 (54.8)	80.6 (63.9)	100.0 (88.2)
137 – 82	3.5 (10.8)	9.6 (18.0)	96.3 (78.9)	100.00 (88.2)	100.00 (88.2)
148 – 83	2.2 (8.5)	36.4 (37.1)	96.3 (78.9)	100.00 (88.2)	100.00 (88.2)

Figures in parenthesis are the means of angular transformation of three replicates.

Adults : As only a few adults were available, only two strains were evaluated against them.

Spore suspensions of strain 148 - 83 and the local strain were prepared as described in the previous experiment. Seven adult beetles were used for each treatment including the control. For the control the beetles were dipped on 0.05% Tween 80 in water and for the treatment they were dipped in spore suspension. The beetles were then transferred into separate containers for each treatment and incubated at 28oC. On the second day after treatment moist coir dust and sugar cane stem cuttings were provided to the beetles. The mortality of the beetles were recorded at regular intervals for two weeks.

Though both, strains caused 100% mortality within 13 days, the local strain caused 53.3% mortality on the eighth day in contrast to 34.4% by the strain 148.83 (Table 10).

Table 10 *Mean percentage mortality of adults of Oryctes rhinoceros caused by two strains of Metarhizium anisopliae*

	Days after inoculation				
Strain	8	10	12	14	16
Local strain	0.0	0.0	27.3 (31.5)	49.8 (44.9)	60.0 (50.8)
148 + 83	4.7 (12.6)	4.7 (12.6)	50.9 (45.5)	71.9 (57.9)	86.9 (68.8)

Figures in parenthesis are the means of angular transformations of three replicates

L. C. P. Fernando, P. Kanagaratnam and K. N. Narangoda.

Experiment 11.1.6 : Studies on the size of the fungal inoculum required for the control of *Oryctes rhinoceros* **(1986)**

The inoculum for this experiment was prepared by culturing *Metarhizium anisopliae* on maize grains at 25°C for two weeks. Clay pots 0.1 cubic metre in capacity were filled with moist coir dust and three difierent quantities of the inoculum on maize viz 50 g, 100 g and 150 g were sprinkled on the surface of the medium. Twenty larvae of *O. rhinoceros* were released into each pot. Each treatment was replicated four times. All the pots were covered with wire netting to protect the larvae from the predators. The medium in the pots were kept moist throughout the experiment by pouring equal amount of water. Observations on larval mortality caused by the fungus were made on days 9, 13 and 17 after inoculation. The difference in mortality at different durations after inoculation was highly significant (P = 0.001). From Table 11, it could be inferred that 50 g of fungal inoculum was adequate to kill 90% of larvae in the pot within 17 days after inoculation.

Table 11 *Percentage mortality of larvae of Oryctes rhinoceros at different durations after inoculation with different quantities of inoculum*

	Days after inoculation		
Quantity of inoculum	9	13	17
50 g	0.0	58.0	90.0
100 g	26.4	74.1	90.0
150 g	3.8	59.8	90.0
Control	0.0	0.0	0.0

L. C. P. Fernando and P. Kanagaratnam.

Experiment 11.1.7 : Studies on the natural dissemination of *Metarhizium anisopliae* at Bandirippuwa estate ((1986).

The aim of this experiment was to study the natural dissemination pattern of *Metarhizium anisopliae* from a release point.

Twenty four square-shaped impregnation boxes or infection foci were made, using 60 cm long coconut logs in two tiers. Twelve were filled with fibre dust while the rest were filled with goat dung.

These boxes were kept 10m, apart. Three boxes with each medium, selected at random, were used as control and the others were treated with *M. anisopliae.*

Twenty four larvae of *O. rhinoceros* inoculated with *M.anisopliae*, by placing them for about 10 minutes in a bucket containing spores cultured on maize grains were released into each box except the boxes used as controls. Later the used maize grains with the fungus were sprinkled uniformly into the treated boxes and covered. Contents of all the boxes were kept moist by adding water regularly.

The experiment is in progress. Observations on larval mortality, attraction of adult black beetles for egg laying and dissemination of the fungus to the untreated boxes and to other breeding grounds in the close vicinity to the treated boxes will be made.

P. Kanagaratnam, L. C. P. Fernando and K. Croos.

PROJECT 21 : BIOLOGY, BEHAVIOUR AND CONTROL OF RED WEEVIL

Experiment 21.1 : Mass rearing of red weevil on artificial diet (1985)

The experiment was carried out to find a suitable medium to rear large numbers of red weevils.

Batches of 15 - 20 first instar larvae were weighed and introduced into plastic tubes at the rate of one larva per tube. Each larva was provided during the first ten days with 10 g of diet and later with 30 g of fresh diet at 10 day intervals. The larva were weighed at 10 day intervals up to 40 days. At the end of 40 days autoclaved coir fibre were spread on the diet so as to enable the larva to spin cocoons. Later the cocoons were removed and kept in glass containers until adults emerged. The number of insects survived, adult weights and adult emergence were recorded. For the control, sugarcane stem pieces were used for rearing the red weevils.

The composition of 500 g of the diet is as follows :

1. Tap water	393 ml
2. Baggase	26.6 g
3. Coconut cake	30 g
4. Sugar	38.4 g
5. Salt mixture	0.83 g

6. Methyl parahydro-benzoate (5g in 40 ml of 90% ethyl alcohol)	5 ml
7. Sorbic acid (5 g in 40 ml of ethyl alcohol)	7.5 ml
8. Yeast	10 g
9. Agar	5 g

Salt Mixture

1. Calcium carbonate	21.00 g
2. Copper sulphate	0.039 g
3. Ferric citrate	1.5 g
4. Potassium phosphate	15.5 g
5. Manganous sulphate	0.020 g
6. Magnesium sulphate	9.0 g
7. Potassium aluminium sulphate	0.009 g

The results were analysed by analysis of variance using angular transformation. There was no significant difference in larval weight gain when reared on the two media (Table 12).

Table 12 : *Mean weight gain (g) of larvae reared on artificial diet and sugar cane stem cuttings*

Medium	*Duration (days) after eggs hatched*			
	10	20	30	40
Artificial diet	0.152	1.165	2.186	2.814
Sugarcane	0.028	0.950	2.049	3.111

Table 13 :*Cumulative mortality of larvae at different durations (days) and percentage of survival.*

Medium	*Duration (days)*					
	10	20	30	40	*At pupation*	*Percentage of survival*
Artificial diet	71	73	74	74	105	22.8
Sugarcane	80	102	107	110	117	19.9

The weights gained per day are 0.09 g and 0.1 g in artificial diet and sugar cane respectively. The cumulative mortality of the larvae reared in both media is given in Table 13. There is a highly significant difference in mortality of larvae reared on artificial diet and on sugarcane stem pieces (P=0.001).

A higher mortality was observed when reared on sugarcane than on artificial diet upto the 40th day and then during pupation, the mortality trend reversed (Table 13). The larval period in the artificial diet was significantly longer than that in sugarcane (P=0.05). This was due to the construction of pupal cocoons in a shorter period in sugarcane cuttings. However there was no significant difference in the pupal period in both media. There was no difference in adult emergence in both media but there was a significant difference in weight of adults reared in the two media (P=0.05). The mean weight of the adult emerged from sugarcane was higher than that from the artificial diet (Table 14).

Table 14 *Average larval period, pupal period and weight of adults in artificial diet and sugarcane stem cuttings*

Medium	*Larval period (days)*	*Pupal period days)*	*Weight of adults (g)*
Artificial diet	60.54	28.46	0.671
Sugar cane	49.63	29.69	0.873

These observations indicate that—

Artificial medium is more suitable for rearing initial larval stages up to 40 days and then the larvae should be transferred to sugarcane stem cuttings.

C. N. K. Rajapakse, P. Kanagaratnam and K. Croos.

Experiment 21.2 : Development of techniques for monitoring the field population of the red weevil (1985)

Investigations were made using 'Y' shaped glass Olfactometer to study the production by red weevils of sex pheromones and the age at which maximum production of pheromones occur. The following groups of adult weevils were used as baits in the Olfactometer test;—

1. Virgin females
2. Mated females
3. Virgin and mated females mixed together
4. Unmated males
5. Mated males
6. Mated and unmated males mixed together
7. Mating pairs of males and females
8. Unmated adults with sugarcane stem pieces
9. Red objects.

The observations did not indicate the production of sex pheromones.

C. N. K. Rajapakse, P. Kanagaratnam and K. Croos.

Experiment 21.3 : Laboratory studies on reproductive biology of the red weevil (1985)

21.3.1 : Effect of mating of different number of males with a single female on reproductive cycle when males and females were not separated

Four treatments were used in this experiment. In these treatments male : female ratios were 1 : 1, 1 : 2, 1 : 4, and 1 : 8. All the insects were of equal age. The matings in different combinations were carried out in duplicate at four different periods as replicates. This was done due to the difficulty of obtaining large numbers of insects at the same time. Number of eggs laid was recorded every other day and hatchings recorded daily. Longevity of the females were also recorded. This experiment is in progress.

C. N. K. Rajapakse

Experiment 21.3.2 : Effect of multiple matings on the fecundity and hatchability of the red weevil when males and females were separated immediately after mating (1985)

One day old pairs of male and female red weevils were caged separately with a piece of sugarcane. Males were removed immediately after the required number of matings, which were 1, 2, 3, 4, 5, 10, 15, 20, and 25. The above matings were replicated thrice. The eggs were counted every third day. The hatchability of eggs was recorded daily. Observations were taken to ascertain the longest duration of the egg laying by caging mated female separately. The experiment is in progress.

C. N. K. Rajapakse

3. MISCELLANEOUS

3.1 : INTRODUCTION OF THE OIL PALM POLLINATING WEEVIL, ELAEIDOBIUS KAMERUNICUS FAUST, TO SRI LANKA

At the request of the Sri Lanka State Plantations Corporation, assistance was provided to them for the introduction of the oil palm pollinating weevil, *Elaeidobius kamerunicus* Faust. (Col. Curculionidae) to Sri Lanka. A consignment of 750 pupae of the insect was imported to Sri Lanka through the Commonwealth Institute of Biological Control (CIBC). This consignment was hand-carried to Sri Lanka by an entomologist of the CIBC station in Malaysia on 18 November.

At the request of the Chief Plant Quarantine Officer of the Department of Agriculture, laboratory screening was carried out at the CRI. The consignment was used as follows :

(a)	Handed over to airport quarantine service	10 insects
(b)	Used for screening tests	200 insects
(c)	Used for breeding	210 insects
	Total	420

The balance 330 insects were found to be dead, deformed or moribund. The packing material together with the dead, deformed and moribund insects was burnt on 19 November. Adult weevils began to emerge on 19 November. No parasites or nematodes were encountered.

The insect has already been extensively screened in Malaysia against a range of monocotyledenous as well as dicotyledenous plants including coconut (Kang & Abdul Karim, 1982). Therefore, the quarantine screening was confined to varieties of coconut and arecanut palm, *Areca catechu*, with the concurrence of the Chief Plant Quarantine Officer.

In these screening tests, each test plant (anthesising male flower in spikelets) was exposed to 16 mated females (four replicates of four females) until all the adults were dead. During this period, mated females were also kept on oil palm spikelets for comparison of their survival and reproduction with that of the test plants. The results of the screening tests are given in Table 15. In general, these results are very much, similar to the published results of screening tests on coconut and arecanut carried out in Malaysia (Kang & Abdul Karim, 1982; Syed, 1979, 1981). A more detailed report on these activities will be published later.

Table 15 *Results of screening tests on male flowers Insect : Elaeidobius kamerunicus Faust*

	Test plant	*Feeding* *	*Oviposition*	*Progeny Nos.*
1.	*Elaeis guineensis*	C	Oviposited	14*** (per spikelet)
2.	*Areca catechu*	A	Nil	Nil
3.	*Cocos nucifera*			
	3.1 CRIC 65 (DGXT)	A**	Nil	Nil
	3.2 *nana pumilla*	B	Nil	Nil
	3.3 Porapol	B	Nil	Nil
	3.4 Nawasi	A	Nil	Nil
	3.5 San Ramon (bronze)	B	Nil	Nil
	3.6 San Ramon (green)	B	Nil	Nil
	3.7 *Aurantiaca*	A**	Nil	Nil
	3.8 *typica* (bronze)	B	Nil	Nil
	3.9 Ambakele Tall (typica special)	A	Nil	Nil

*A—no feeding
B—slight feeding
C—substantial feeding

**Slight feeding observed in one replicate

***Progeny numbers increased considerably during laboratory breeding. As much as 52 insects/spikelet have been recorded subsequently.

A total of 210 insects were used for laboratory breeding, which was carried out very successfully using freshly anthesising male flowers from oil palm collected from Walpita Estate, Kotadeniyawa. During the initial stages of breeding, fresh male spikelets were placed singly in pvc tubes (about 2.5 cm in diameter) and offered for egg laying. After 48 h, the adult insects were removed and the spikelets were left in the tubes in an air-conditioned room at about 26 - 29°C. A new generation of insects was obtained in 10 days. After the breeding techniques were perfected, mass breeding commenced in mid December. Entire male inflorescences with freshly anthesising flowers were offered in large cages for egg laying.

At the end of the year, nearly 4,000 adult insects were available for release.

The approval of the Chief Plant Quarantine Officer was received on 31 December for the release of this insect at Nakiyadeniya Oil Palm Plantation, Nakiyadeniya and at other oil palm plantations.

R. Mahindapala, M. S. Velu and D. M. Jayakody

3.2 : Biological control of the Nettle caterpillar, *Parasa lepida.*

An outbreak of nettle caterpillar, *Parasa lepida* (Lep. Limacodidae) occurred during the year at the Isolated Seed garden Ambakelle, Rajakadaluwa. Spraying of insecticides was confined to palms used for hand pollination to protect the pollination workers.

The outbreak was brought under control by the following parasitoids and predatory insects which occurred naturally;—

1. **Apanteles parasae** Rohwer
   Hymenoptera : Braconidae (A. K. Walker (CIE) determined)

2. **Chrysis** (=Praestochrysis) sp.
   Hymenoptera : Chrysididae. (A. Polaszek (CIE) det.),

3. **Kriechbaumerella ayyari** (gahar)
   Hymenoptera : Chalcididae (Z. Boucek (CIE) det),

4. **Eocanthecona furcellata** (Wolff) — **Cantheconidea furcellata** (Wolff)
   Heteroptera : Pentatomidae (M. S. K. Ghauri (CIE) det.).

Among the above four species *A. parasae* was recorded earlier in Sri Lanka and many other countries. *Chrysis shanghaiensis* was recorded earlier in Sri Lanka (Wickremasinghe, 1969), as a pupal parasitoid of *P. lepida.* The other insects were recorded for the first time from Sri Lanka.

Chrysis sp. parasitizes pupae of nettle caterpillars. Adult insect is bright a metallic greenish blue in colour. Only one parasitoid emerges from each pupal cocoon. *Chrysis sp.* is a well known pupal parasitoid of insects belonging to the family Limacodidae.

Kriechbaumerella ayyari is a pupal parasitoid. The adult insect is dark brown in colour and is about 8mm in length.

Eocanthecona furcellata is a predatory bug observed preying on nettle caterpillars in the field. The adult is brown in colour and is about 1.5 cm in length. Adult females kept in captivity in the laboratory in cages laid eggs on coconut leaves. Eggs were laid in clusters of about 50-60, and were greenish yellow in colour which turned golden yellow with time.

Eggs were cylindrical in shape with a diameter of about 0.5 mm. Incubation period was 7-9 days. The nymphs emerged were red in colour.

The eggs of *E. furcellata* were parasitized by *Trissolcus aloysiisabaudiae* (Foults) (=*Trissolcus artabazus* Nixon) (Hymenoptera : Scelionidae) (A. Polaszek (CIE) det.)

Literature survey revealed that *E. furcellata* was known as a predator of soft-bodied insects in India and Taiwan.

P. Kanagaratnam, L. C. P. Fernando, D. M. Jayakody and M. S. Velu

4. SERVICE AND EXTENSION ACTIVITIES

Assistance was provided to growers to control outbreaks of the black headed coconut caterpillar, nettle caterpillar, coconut scale and leaf miner.

Infestations of *O. arenosella* were widespread in Western, North Western, Southern, Central, North Central, Northern and Eastern Provinces.

About 10 ha at Dabarayaya Estate, Netolpitiya were sprayed with Gammalin (B.H.C.) in May to reduce the pest population, and parasitoids were released subsequently. However the observations taken a few months later indicated that the past populations in this estate and in an untreated adjoining estate were similar. The population appeared to have been reduced due to natural factors.

In all the other estates, parasitoids were released. The numbers of parasitoids released are given in Tabe 16.

Table 16: *Numbers of parasitoids released in different provinces for the control of Opisina arenosella in 1986*

Province	*Goniozus nephantidis*	*Bracon hebetor*	*Trichos-pilus pupivora*	*Eriborus trochan-teratus*	*Antroce phulas pandens*	*Brachyme-ria neph-antidis*	*Stoma-tomyia bezziane*	*Total*
Western	64,375	162,400	187,150	9,425	2,075	2,150	—	427,575
North Western	53,000	131,000	236,800	9,400	—	1,600	—	431,800
Southern	41,300	349,000	325,150	9,350	—	—	—	724,500
Central	6,500	19,000	25,200	2,000	—	—	—	52,700
North Central	9,000	50,000	41,200	4,200	—	250	—	104,650
Northern	5,000	10,000	—	—	—	—	—	15,000
Eastern	62,750	275,000	—	4,775	605	1,005	1,730	346,365
Total	241,625	996,900	815,500	39,150	2680	5,005	1,730	2,102,590

Arrangements are being made to introduce the parasitoids of *Opisina arenosella* viz. *Brachymeria nosatoi, Xanthopimpla nana nana* and *Elasmus nephantidis* from Central Plantation Crops Research Institute, Kayangulam, Kerala, India.

Resurgence of the leaf miner, *Promecotheca cumingi*

The infestation of the leaf miner at Dunkannawa, first reported during the latter part of 1985 was brought under complete control during this year, by the parasitoid *Pediobius parvulus*. No other control measures were adopted.

Coconut scale infestations were reported from some estates in the North Western Province. These were brought under control by the natural enemies.

5. VISITS

Mr. P. A. C. R. Perera visited the Imperial College of Science and Technology, University of London, England for consultations on the research project "Population Dynamics of Pest/Parasitoid complex of the coconut caterpillar" from 25 January to 1 March and again from 15 August for a duration of six months for completion of post-graduate research work.

Dr. P. Kanagaratnam undertook an academic visit to the Silwood Centre for Pest Management (SCPM) at the Imperial College of Science and Technology, University of London and to a number of other research institutions in the United Kingdom from 4 - 31 March, in connection with the collaborative research project between the SCPM and the CRI on "Integrated and Biological Control of the coconut caterpillar, *Opisina arenosella*".

The following scientists from the United Kingdom visited the division in connection with this collaborative project:—

Dr. David R. Hall	TDRI	February
Prof. M. P. Hassell	SCPM	March
Dr. C. Godfray	CIBC	March
Mr. M. Cammell	SCPM	March - April
Dr. J. D. Mumford	SCPM	March - July & October - November

Dr. P. Kanagaratnam also visited the research stations at Kayangulam, Kasaragod and Vittal of the Central Plantation Crops Research Institute, (CPCRI) Kerala, India from 25 November to 8 December to study the involvement of nematodes in diseases of coconut and intercrops.

6. LECTURES, WORKSHOPS, ETC.

Dr. P. Kanagaratnam, Mrs. L. C. P. Fernando and Mrs. C. N. K. Rajapakse were resource persons for the Diploma Course of the National Institute of Plantation Management.

Mrs. L. C. P. Fernando and Mrs. C. N. K. Rajapakse delivered several lectures in coconut pest control at meetings organized by the Coconut Cultivation Board.

Dr. P. Kanagaratnam delivered a lecture to the "Study Circle" comprising scientists at the Central Plantation Crops Research Institute, Kayangulam. Kerala, India on "CRI — Sri Lanka and its activities with special emphasis on Crop Protection" on 3 December.

Mrs. L. C. P. Fernando attended a worskhop on "Writing Scientific Papers' arranged by the Natural Resources Energy and Science Authority of Sri Lanka, on 3 and 4 April.

Papers presented at conferences.

(1) P. Kanagaratnam and L. C. P. Fernando—Insect Pathogens and Systemic Insecticides in Coconut Pest Control—Coconut Research Conference, 22 July, Colombo.

(2) P. A. C. R. Perera — Sex Attractants and Natural enemies in Coconut Caterpillar Control — Coconut Research Conference, 22 July, Colombo.

(3) P. Kanagaratnam and L. C. P. Fernando—Evaluation of Systemic Insecticides for the Control of Foliar Pests of coconut.

Sri Lanka Association for the Advancement of Science, December 1986.

7. PUBLICATIONS

Kloft, W. J., Kloft, E.S, Kanagaratnam, P. & Pinto, J. L. J. G. (1986). Studies on the use of radioisotopes for the control of the red palm weevil, *Rhynchophorus ferrugineus F.* by the sterile insect technique. I. Preliminary investigations on the detection of radiolabelled weevils. *Cocos* 4, 11 - 17.

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Kang S. M. & Abdul Karim Z. (1982) Quarantine aspects of the introduction into Malaysia of an Oil Palm Insect Pollinator *Proceeding International Conference on Plant Protection in the tropics*, Kuala Lumpur; 615-625.

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9. ACKNOWLEDGEMENTS

We are grateful to Messrs D. T. Mathes and Sarath Peiris of the Biometry Unit for statistical analysis and to the Commonwealth Institute of Entomology, London for identifying the insect specimens.

We express our sincere thanks to the Commission of European Communities for sponsoring the collaborative project between the CRI, SCPM and TDRI.

REPORT OF THE BIOMETRY UNIT

Biometrician — D. T. Mathes B.Sc

1. GENERAL

Two microcomputers were commissioned and a statistical package (SAS) with a multiuser facility was installed.

Mr. D. T. Mathes participated in a 12-week residential course on 'Crop Experimentation in Developing Countries' from4 July to 26 September at University of Kent, England. In addition, he spent three weeks at the Rothamsted Experimental Station, Harpenden and two weeks at Agricultural Research Council Unit of Statistics, Edinburgh.

Messrs. D. T. Mathes and T. S. G. Peiris were promoted to Executive Grade, Class II with effect from 1 February 1980 and 2 September 1985 respectively. Mr. A. Wilson was promoted to Operative Grade, Class I with effect from 1 January 1984.

Three final year Agricultural students were assisted in their research projects.

2. BIOMETRICAL SERVICE

Assistance to the research staff was provided by way of statistical designs, selection of lands, layout of experimental ploto and interpretation of results. In all, 51 analyses of data were carried out.

3. RESEARCH PROJECTS

Project 19 : APPLICATION OF BIOMETRY IN COCONUT RESEARCH

Experiment 19.1 Calibration trial at Ratmalagara Estate (Intermediate Zone) — 1965

This experiment was discontinued in January.

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

The bimonthly recordings of vegetative and yield characters of the palms were carried out without interruption. Variation of five yield parameters between the six picks of 1985 and 1986 is given in Tables 1 and 2.

Number of bunches per palm showed an increase over 1985 for the first four picks, while difference was insignificant for the rest of the two picks. However there was an overall increase of 15.8 % compared with 1985.

Table 1 : *Calibration trial average yield components in* 1985 *and* 1986.

	1st pick		*2nd pick*		*3rd pick*		*4th pick*		*5th pick*		*6th pick*		*TOTAL*	
	1986	1985	1986	1985	1986	1985	1986	1985	1986	1985	1986	1985	1986	1985
No. of bunches/palm	2.5	2.0	2.3	1.7	2.5	2.0	2.6	2.0	2.0	2.1	2.0	2.2	13.9	12.0
No. of nuts/palm	13.2	16.2	17.2	19.9	25.7	31.5	26.3	23.1	12.5	18.0	10.1	14.5	105.0	123.2
No. of nuts/hectare	2080	2563	2725	3148	4070	4982	4156	3646	1974	2853	1597	2298	16602	19490
No. of nuts/bunch	5.2	8.1	7.6	11.7	10.3	15.5	10.1	11.7	6.1	8.5	5.0	6.7		

Table 2 — *Average weight of husked nut, copra outturn and copra yield in* 1986

Pick	*Wt. of husked nut (g)*		*copra outturn (nuts/candy)*		***Copra* (Kg/ha)**	
	1986	1985	1986	1985	1986	1985
1	661	722	1209	1099	416.02	591.88
2	715	589	1110	1348	600.95	585.54
3	653	585	1216	1356	746.60	931.62
4	620	504	1281	1574	764,33	586.17
5	667	566	1190	1402	375.82	514.65
6	747	601	1063	1321	352.64	440.59
Total/AVE	667	590	1191	1346	3256.36	3650.45

** Copra yield = Weight × 0.32

Number of nuts per palm decreased compared with 1985 for all the picks, except for the 4th, where an increase was observed. The overall decrease during the year compared with 1985 was 14.8 %.

Number of nuts per hectare showed a similar pattern as for the number of nuts per palm.

All the picks recorded a decrease in the number of nuts per bunch compared with 1985.

The husked nut weight and copra outturn for the year were 667 g and 1191 nuts respectively, showing an increased nut size compared with 1985. The comparative figures for 1985 were 590 g and 1346 nuts. The copra yield per hectare for 1986 was 3256 kg which is a decrease of 10.8 % compared with 1985.

4. YIELD RECORDING

The recording of yield data from experiments were maintained satisfactorily at the following estates.

1. Bandirippuwa
2. Ratmalagara
3. Heenmeliyagara
4. Kiniyama
5. Shanthil
6. Jacintha
7. Muthugala
8. Puwakwatte
9. Sirikandura

5. MISCELLANEOUS

(a) Lectures and symposia

(i) "Watering increases coconut production" presented at the Coconut Research Conference, Colombo, 22 July — T. S. G. Peiris.

(ii) Mr. T. S. G. Peiris delivered two lectures at the training course in Diploma in Plantation Management.

(b) General

Mr. T. S. G. Peiris served as the Chairman of the Coconut Research Institute seminar series during the year.

6. PUBLICATIONS AND COMMUNICATIONS

(i) Peiris, T. S. G. "Seasonal ARIMA Model for forecasting crop-wise coconut yield in a given estate" presented at the 42nd annual sessions of Sri Lanka Association for the Advancement of Science.

(ii) Thilakasiri, M. A., Peiris, T. S. G. and Gunasekera, T. G. L. G. "Some Socio-Economic Characteristics of Coconut-based farming systems".

Presented at the 42nd annual sessions of Sri Lanka Association for the Advancement of Science.

7. AGRI - METEOROLOGY

The three metorological stations at Bandirippuwa estate, Ratmalagara estate and Isolated Seed Garden were maintained satisfactorily. The recordings were taken daily throughout the year, morning and afternoon. The recordings taken at the above stations were rainfall, temperature (maximum and minimum), evaporation, humidity and soil temperature. The data from these stations were provided to the Department of Meteorology monthly and to a number of outside Institutions on request.

7.1 Bandirippuwa Estate

a. Rainfall

Although every month had some rains, the total rainfall for the year was 1190.9 mm which was the lowest rainfall during the last 10 years. A considerable reduction of the crop in 1987 is indicated.

The rainfall since 1976, the ten-year average and for 1986 are given in Table 3.

b. Temperature

The average monthly maximum temperature during the year ranged from 29.9 o 33.2°C. Temperatures over 32°C were recorded in February, March, April, May and December. The average for the year was 31.4°C (Table 4).

c. Evaporation

The evaporation ranged from 3.8 mm to 4.9 mm with November recording the maximum. The average for the year was 4.0 mm (Table 4)

d. Sunshine

The average sunshine recorded for the year was 6.8 h with a range of 5.7 h in September and 8.3 h in April (Table 4).

Soil temperature

Soil temperature was recorded daily, morning and afternoon at depths 5, 10, 20, 30, 60 and 120 cm. The average morning temperatures for the year at the above depths were 29.6, 29.3, 28.6, 30.7, 31.5, and 31.3°C respectively, while the respective values for the afternoon were 38.1, 35.5, 31.1, 32.4, 31.4, 31.2°C (Table 5).

Table 3 : *Rainfall (mm) for the last 10 years and in 1986 (Bandirippuwa Estate)*

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	76-85 *Ave.*	1986
January	8.1	0.0	0.0	0.5	0.0	50.8	0.0	0.0	197.9	13.0	27.0	61.7
February	0.0	99.8	3.0	146.8	0.0	66.0	0.0	0.0	106.9	189.0	61.2	35.0
March	143.2	146.0	204.2	17.5	68.8	16.5	144.2	0.0	145.5	228.9	111.5	62.0
April	119.6	131.6	145.8	70.9	206.0	100.6	125.2	219.7	425.2	103.9	164.8	60.2
May	56.9	700.0	590.0	174.5	54.2	333.5	232.9	322.1	297.7	275.3	303.7	284.7
June	60.2	130.6	64.0	231.4	308.1	107.4	328.4	138.4	115.1	291.3	177.5	44.7
July	51.8	14.2	1.3	22.4	21.8	38.6	152.1	79.7	111.0	14.5	50.7	33.5
August	84.8	66.6	20.8	20.1	78.2	41.4	188.9	120.6	0.5	139.9	76.2	77.2
September	80.8	74.7	84.1	194.8	182.3	124.2	185.2	242.1	129.3	168.4	146.6	94.7
October	310.4	656.1	260.3	203.2	364.4	298.4	235.7	50.0	121.9	195.6	269.6	224.3
November	522.5	322.3	455.9	364.5	184.9	297.2	244.6	159.0	239.8	306.3	309.7	149.4
December	166.9	12.4	169.7	162.3	102.3	12.9	57.7	141.0	83.0	63.7	97.2	63.5
TOTAL	1605.2	2354.3	1999.1	1609.9	1571.0	1487.5	1893.9	1472.6	1973.8	1989.8	1795.7	1190.9

Table 4. *Summary of meteorological observations in 1986 (Bandirippuwa Estate)*

	Temperature C°		*Evaporation (mm) per day*	*Relative Humidity %*		*Sunshine (h)*
	Max.	*Min.*		*a.m.*	*p.m.*	
January	30.3	21.9	3.8	83	70	6.1
February	32.7	21.4	4.4	75	64	7.9
March	32.3	22.8	4.0	78	66	7.0
April	33.2	24.0	4.6	76	67	8.3
May	32.1	24.6	3.8	81	73	7.0
June	31.2	24.1	3.8	80	75	5.9
July	30.3	24.8	3.7	79	74	6.2
August	30.2	23.3	3.9	80	73	6.4
September	30.2	24.0	3.9	80	73	5.7
October	29.9	23.8	3.1	80	76	6.7
November	31.7	21.7	4.9	77	67	8.1
December	32.4	22.7	4.2	78	63	7.6
Ave.	31.4	23.2	4.0	79	70	6.8

Table 5 : *Soil temperature at different depths*
(Bandirippuwa Estate)

	Morning						*Afternoon*					
	5 cm	*10 cm*	*20 cm*	*30 cm*	*60 cm*	*120 cm*	*5 cm*	*10 cm*	*20 cm*	*30 cm*	*60 cm*	*120 cm*
January	26.1	26.8	—	28.5	29.5	29.7	34.2	32.8	—	29.8	29.3	29.3
February	28.2	27.9	—	30.7	31.7	31.1	40.0	36.9	—	32.3	31.5	31.1
March	29.3	29.1	—	30.6	31.4	31.1	37.8	36.3	—	32.5	31.4	31.1
April	32.1	31.3	—	32.8	33.5	32.7	44.4	37.7	—	34.7	33.4	32.7
May	31.5	30.5	—	31.2	32.2	32.1	40.7	37.3	—	33.6	32.1	32.1
June	31.2	30.5	—	31.7	31.5	32.2	39.7	36.9	—	33.9	32.5	32.2
July	30.8	30.5	—	31.8	32.7	32.3	39.2	36.2	—	33.2	32.6	32.3
August	30.3	29.7	—	30.8	31.9	31.8	39.5	35.9	—	32.6	31.7	31.7
September	30.5	29.9	—	31.4	32.3	32.1	38.9	35.9	—	32.9	32.2	32.1
October	30.5	29.2	—	29.9	31.0	31.2	36.7	35.5	—	31.9	30.9	31.1
November	27.7	28.0	28.6	29.5	29.9	29.4	32.8	32.6	31.3	30.9	29.8	29.6
December	27.7	27.8	28.6	29.5	30.0	29.7	32.3	32.2	30.9	30.4	29.8	29.8
Ave.	29.6	29.3	28.6	30.7	31.5	31.3	38.1	35.5	31.1	32.4	31.4	31.2

Table 6 : *Rainfall (mm) for the last* 10 *years and in* 1986
(*Ratmalagara Estate*)

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	76-85 *Ave.*	1986
January	18.3	1.0	0.0	0.0	0.0	78.7	0.0	0.0	132.9	16.9	24.8	64.8
February	0.0	49.5	0.0	167.3	0.0	11.3	0.0	0.0	166.2	122.1	51.6	54.3
March	139.7	186.7	89.3	16.9	16.7	38.4	118.8	0.0	168.6	158.3	93.3	74.7
April	161.5	157.5	69.7	70.6	208.2	53.5	112.2	109.2	703.6	208.3	185.3	143.4
May	134.9	625.8	410.0	46.9	74.0	290.8	196.8	145.3	282.4	82.3	228.9	246.1
June	61.2	67.3	15.1	46.1	246.1	87.4	190.8	80.9	39.1	126.0	96.0	50.9
July	30.5	23.3	6.5	28'8	14.3	55.1	35.6	55.6	88.6	39.1	37.7	22.6
August	30.2	35.4	27.4	46.1	31.2	80.4	155.2	74.9	2.0	13.3	49.6	85.9
September	36.1	58.3	54.0	125.6	149.0	121.6	36.6	109.9	132.8	84.2	90.8	26.4
October	215.1	565.9	302.0	316.3	239.6	168.9	272.8	79.5	109.3	209.9	247.9	153.0
November	418.1	166.4	540.3	377.3	273.2	304.0	200.8	163.6	472.9	319.0	323.6	228.4
December	114.6	73.8	55.7	272.6	126.4	24.2	118.7	216.3	95.9	104.4	120.3	95.9
TOTAL	1360.2	2010.9	1570.1	1514.5	1378.7	1313.3	1438.3	1035.2	2394.2	1483.5	1549.8	1246.4

Table 7—*Rainfall (mm) for the last* 10 *years and in* 1986
(*Isolated Seed Garden*)

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	76-85 *Ave.*	1986
January	10.9	0.0	0.0	13.1	0.5	36.9	0.0	0.0	96.9	38.3	19.7	59.1
February	0.0	27.4	0.0	60.0	0.0	11.5	0.0	2.1	228.9	113.4	44.3	65.8
March	112.3	168.7	23.3	17.6	23.7	93.5	176.3	1.6	279.7	94.6	99.1	55.3
April	130.6	110.2	158.7	59.8	164.5	48.4	61.7	52.8	821.4	100.0	170.8	104.9
May	64.5	451.1	405.1	11.4	87.8	147.8	281.8	248.8	155.5	171.1	202.4	121.9
June	18.8	21.6	11.1	34.8	147.9	148.9	110.7	73.4	29.7	88.8	68.6	74.5
July	9.1	25.0	16.4	19.4	5.8	72.5	32.1	26.4	117.0	17.9	34.2	4.2
August	16.0	19.7	10.1	10.6	10.0	54.3	91.6	78.0	3.8	10.7	30.5	47.4
September	10.7	31.7	32.9	197.8	106.9	68.4	35.6	89.4	164.7	107.4	84.6	37.4
October	205.2	759.9	521.6	160.6	272.1	280.3	199.9	105.7	227.3	108.7	284.1	199.9
November	271.3	247.2	582.9	356.6	251.0	295.9	152.7	199.3	210.6	334.8	290.2	236.1
December	108.2	34.0	97.6	172.1	82.7	54.3	93.4	331.4	53.6	118.6	114.6	7.6
TOTAL	957.6	1896.5	1859.7	1113.8	1152.9	1312.7	1235.8	1208.9	2389.1	1304.6	1443.2	1014.1

REPORT OF THE COCONUT PROCESSING RESEARCH DIVISION

Officer-in-Charge — R. Mahindapala PhD

1. GENERAL

The Coconut Research Board, with the concurrence of the Coconut Development Authority (CDA) made the following policy decisions in regard to research activities on coconut processing:

(a) CDA enter into an agreement with the Ceylon Institute for Scientific and Industrial Research (CISIR) to conduct research on kernel products.

(b) energy problems to be handled jointly by CISIR and CDA as the latter is already engaged on research on waste heat recovery in the manufacture of desiccated coconut, and

(c) CRI to concentrate on research in fibre production and the on-farm (small-scale) processing of coconut products such as copra and shell charcoal.

The position was subsequently reviewed by the Board and it was agreed that the establishment of a research facility for processing of fibre is not feasible. The Ministry of Coconut Industries agreed with this and would take steps to arrange research on fibre and fibre products with other agencies. However, the CRI would continue the on going experiments on fibre to a completion.

Staff matters

Mr. P. A. N. Ratnayake, Officer-in-Charge and Research Assistant resigned his post on 27 March.

Mr. G. M. R. Karunasekera, Experimental Officer resumed duties with effect from 12 December.

Mr. G. C. Perera, Technical Assistant reverted to the division on 7 February.

The following officers were transferred to the divisions indicated :

W. H. Warnasiri (Technical Assistant)	20 June —	Soils and Plant Nutrition Division
A. Anula de Zoysa (Clerk)	23 June —	Crop Protection Division
R. A. Chandrasekera (Labourer)	11 June —	Establishment Unit
P. M. S. Tudor Fernando (–do–)	11 June —	Engineering Unit
W. M. F. Noel Fernando (–do–)	11 June —	Crop Protection Division
W. M. Gnanawathie (–do–)	11 June —	Soils and Plant Nutrition Division

Appointments

Dr. A. M. J. C. Wijesinghe was appointed Research Assistant with effect from 01 September.

Mr. T. K. G. Ranasinghe was appointed Consultant with effect from 15 May.

2. RESEARCH PROJECTS

PROJECT 22 : IMPROVEMENTS TO COPRA MANUFACTURING PROCESS WITH FUEL SAVING TECHNIQUES

Experiment 22.1 : Copra drying and improvements (Sri Lanka kiln) (1985)

It was proposed to determine thermodynamic factors in the existing method for copra making which has several firing and cooling cycles, turnings and shelling operations. etc.

At present, seven separate fires are recommended for the Sri Lanka copra kiln with a cooling period at the end of each fire. This experiment attempts to combine two fires into a single fire with the objective of reducing the total copra drying time, to save a portion of coconut shells used as fuel and to reduce the labour requirements (the new methods under experimentation have only three fires).

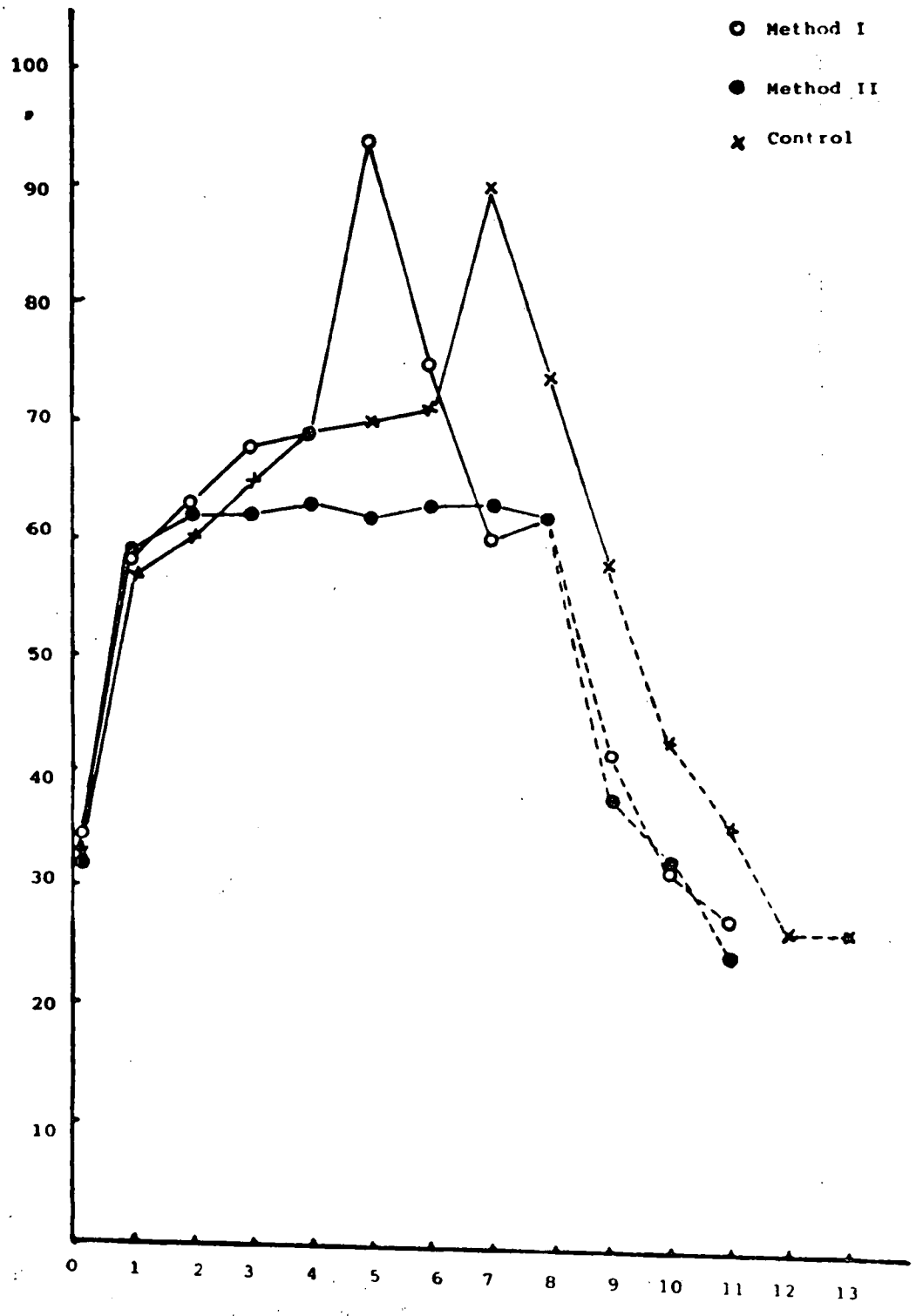
Preliminary trials were conducted in the kiln at Ratmalagara Estate with the new arrangement of rows of coconut shells using 60% and 70% of the number of shells used for two fires of the present method, with the aim to study the efficiency of drying and fire hazards.

In this trial the temperatures were recorded at two levels viz. inside the copra bed and just below the platform. These temperatures were taken at five points on the platform for the method under test and for the control, from the time the fires were commenced until the temperature returned to ambient level. After each fire, kernel samples were taken to estimate the moisture content by oven drying.

The results are given in Tables 1a, 1b, 1c and 2. Figs. 1 and 2 illustrate he temperatures below the copra bed and middle of the copra layer at the centre of the kiln. Although high temperatures were reached below the bed with the new system, the temperatures inside the copra layers appear to be comparable to the existing standard method.

This experiment is in progress.

T. K. G. Ranasinghe and A. M. J. C. Wijesinghe.


Method I
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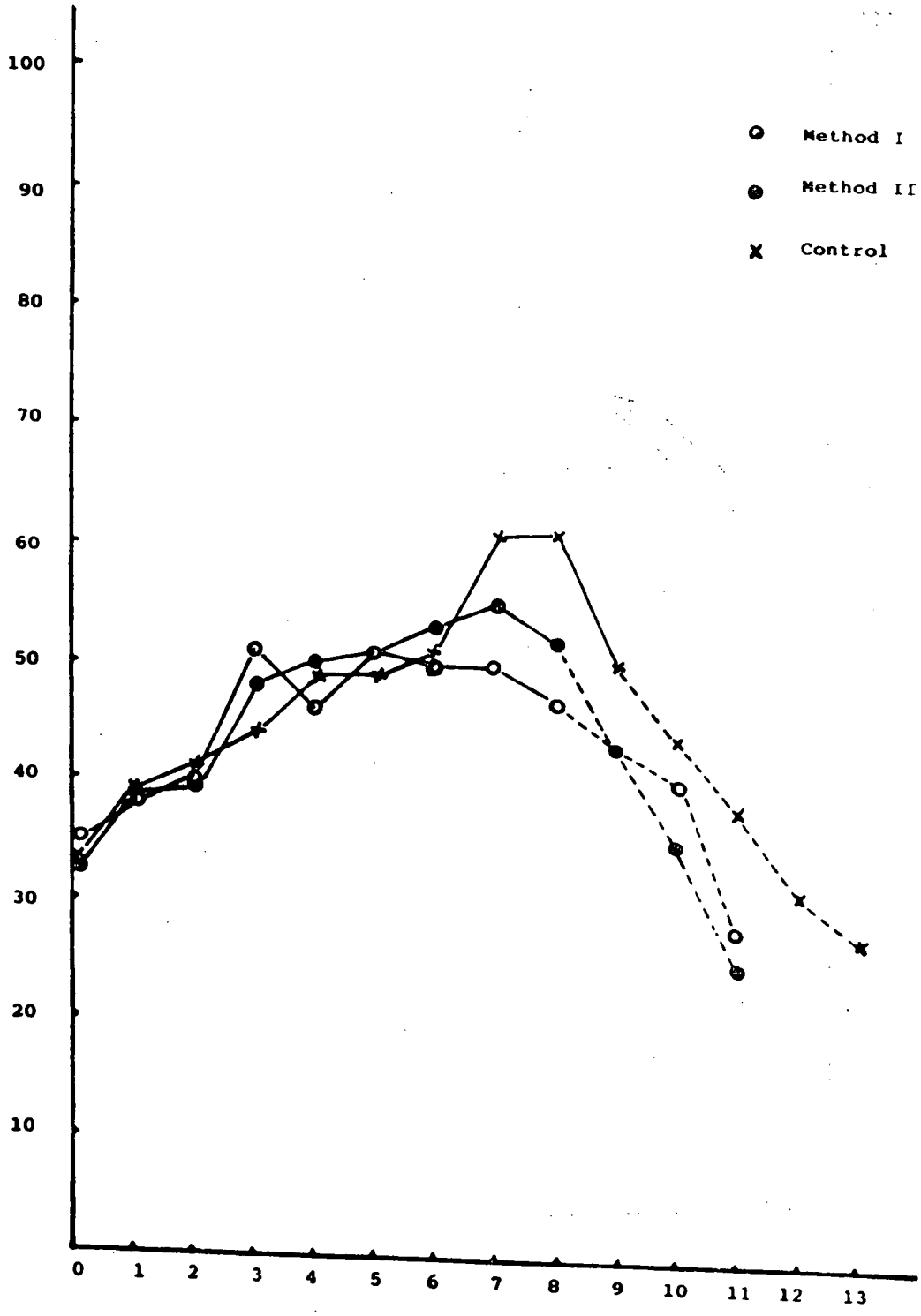
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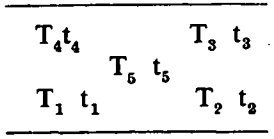
Method I
Method II
Control

Table 1(a) — *Variation in temperature (°C) jus below the copra bed (T_1– T_5) and within the copra layer (t_1– t_5) during the period of first firing and cooling*

1(a) — *60% of the number of shells used for two fires of the present method*
1(b) — *70% of the number of shells used for two fires of the present method*
1(c) — *Present method (Control)*

Temperature recording positions in the kiln



Time of the day		*Temperature (°C)*									
		T_1	T_2	T_3	T_4	T_5	t_1	t_2	t_3	t_4	t_5
Start	1600	Uniformly 34.5									
	1700	58	58	55	65	58	44	39	45	35	38
	1800	58	58	64	66	63	45	46	48	38	40
	1900	58	62	69	85	68	50	47	52	51	51
	2000	68	69	68	66	69	56	58	56	50	46
	2100	83	87	100	87	94	63	62	75	53	51
	2200	70	70	82	74	75	61	62	73	55	50
	2300	55	55	52	55	60	50	53	50	55	50
Finish	0000	50	66	52	53	62	65	54	50	49	47
	0100	50	46	41	41	42	49	48	48	43	43
	0200	31	33	33	32	32	33	31	34	40	40
	0300	Uniformly 28									

Table 1 (b)

Time of the day		*Temperature* (°C)									
		T_1	T_2	T_3	T_4	T_5	t_1	t_2	t_3	t_4	t_5
Start	1500	Uniformly 32.5									
	1600	54	57	56	54	57	44	48	39	38	39
	1700	57	60	65	65	60	50	55	45	43	41
	1800	64	64	70	74	65	56	58	48	54	44
	1900	66	64	73	82	69	58	60	56	70	49
	2000	72	80	70	69	70	65	78	52	59	49
	2100	69	70	65	67	71	62	65	51	51	51
	2200	85	89	96	85	90	69	85	70	65	61
	2300	74	78	89	78	74	64	75	73	70	61
Finish	0000	75	63	48	48	58	62	61	52	48	50
	0100	46	45	40	39	43	50	44	44	45	44
	0200	36	37	36	36	36	40	37	39	39	38
	0300	27	27	27	27	27	31	30	31	31	31
	0400	Uniformly 27									

Table 1 (c)

Time of the day		*Temperature* (°C)									
		T_1	T_2	T_3	T_4	T_5	t_1	t_2	t_3	t_4	t_5
Start	1500	Uniformly 32									
	1600	54	51	61	63	59	38	45	47	59	39
	1700	60	60	67	63	62	48	50	47	57	39
	1800	57	60	60	61	62	50	52	50	57	48
	1900	60	57	63	59	63	51	52	51	57	50
	2000	59	58	56	57	62	50	53	50	53	51
	2100	58	59	55	55	63	52	55	49	54	52
	2200	72	70	56	55	63	61	62	50	54	55
	2300	69	71	58	57	62	62	65	57	54	52
Finish	0000	39	38	37	36	38	46	45	42	40	43
	0100	34	34	33	31	33	37	35	34	34	35
	0200	Uniformly 25									

Experiment 22.2 : Improvements to copra drying through solar dryers.

The objectives of this experiment are improving copra quality, easy and cheap drying.

It is proposed to develop two models of solar dryers, one using natural ventilation and the other with a mechanical air draught. The design and the efficiency of the solar dryers already developed locally and abroad were studied to decide on a design to be, fabricated and tested. The dryer with natural ventilation will be designed to suit the requirements of the smallholder and the dryer with the mechanical air draught will be for the estate sector.

Literature survey on existing solar dryers developed in other countries, particularly for copra, was completed.

Some plans for solar dryers have been drawn. These are being evaluated and the best design will be selected for fabrication and further studies.

This experiment is in progress.

T. K. G. Ranasinghe and A. M. J. C. Wijesinghe

PROJECT : COCONUT FIBRE TECHNOLOGY

Experiment 23.1 : Compilation of standards for coir fibre (1985)

Collection of data and information on the international standards and grading of fibre was completed. Arrangements were made to install a fibre dust separating machine to examine samples of fibre for quality.

This experiment is in progress.

T. K. G. Ranasinghe and G. M. R. Karunasekera.

Experiment 23.2 : Mechanical pretreatment for soaking brown husks (1985)

Mechanical crushing of brown husks reduces the soaking and retting periods for fibre extraction with Sri Lankan drums. This experiment is aimed to identify the design features in husk crushers which will give the best effect. A survey of the existing techniques of husk crushing being used at various fibre mills was completed. The results are given in Table 3. Trials will be conducted at few fibre mills with husk crushers of different designs to study the efficiency of crushers by comparing the rate of retting of precrushed husk samples. On the results of this trial, the best design and the optimum settings of the husk crusher will be determined.

This experiment is in progress.

T. K. G. Ranasinghe and G. M. R. Karunasekera.

Table 3 — *Data collected from husk crushers used at various fibre mills.*

	Name of Mills and address	*Type of rollers*	*r.p.m.*	d_0	d_1	x	1	g	f	*Power supply*
1.	Nattandiya Co-op. Society Ltd.	grooves along generators	14	17.7	12.7	2.5	30	4.8	54.8	Electricity
2.	St. Joseph Fibre Mill, Kimbulagala	— do —	33	20.0	17.0	1.5	30	—	61.0	Industrial oil
3.	Borella Fibre Mill, Wennappuwa	— do —	24	19.0	14.0	2.5	30	3.0	100.3	Electricity
4.	Nasarath Fibre Mills, Koswatta	— do —	40	20.0	17.0	1.5	30	—	60.0	Industrial oil
5.	St. Raphayal Fibre Mill, Madurankuliya	— do —	27	21.0	18.0	1.5	30	20.0	—	— do —
6.	St. Odiliya Fibre Mill, Waikala	— do —	20	17.0	13.0	2.0	30	5.0	45.0	Electricity
7.	St. Anthony's Fibre Mills, Bathuluoya	— do —	40	16.0	11.0	2.5	30	5.0	28.0	Industrial oil
8.	St. Anthony's Fibre Mills, Wennappuwa	— do —	—	20.0	18.0	1.0	—	—	56.0	Kerosene oil
9.	St. Rita's Fibre Mills	— do —	—	20.3	17.3	1.5	30	3.2	28.2	Kerosene oil

r.p.m. — revolutions per minute

Roller dimemsions

d_0 — outside diameter
d_1 — internal diameter
x — height of hump
l — length of roller
g — gap between rollers (between internal diameters)
f — floor area used for husk crusher

Experiment 23.4 : Improvements to mattress fibre cleaning (1986)

In Sri Lanka mills, mattress fibre is traditionally cleaned using the conical sifters and sometimes further cleaned using paddle sifters. This experiment was designed in collaboration with the Export Development Board to resolve the techno-economic problems involved in cleaning mattress fibre in the mills, and was conducted at two mills in Kuliyapitiya, using the conical sifter, paddle sifter and turbo cleaner.

(a) The first set of experiments was to treat the mattress fibre coming out of the breaker drum and cleaner drum separately. Assessment of quality was made by reputed members of the Coir Fibre Exporters Association. The quality grading of coded sample ballots revealed an appreciable quality increase for the mattress fibre coming out from the cleaner drum (better colour and lesser dust) when compared with that from the breaker drum (darker and higher dust and husk pieces), irrespective of the subsequent treatment for cleaning.

(b) The second set of experiments was designed to assess the relative cleaning ability of the different machines available (Conical sifter, Paddle sifter and Turbo, cleaner both in the wet state and air-dry state. The results are presented in Tables 4a and 4b. The main conclusions were —

(i) When paddle sifter or Turbo cleaner is used after conical sifter, the dust content is satisfactorily removed, (ii) Dry state cleaning is more effective than wet state cleaning but the present design of cleaning equipment is not suitable and safe for dry state cleaning. (iii) Any secondary cleaning as above results in a loss of yield (due to dust removal) and additional expense of machine time and labour, which is not acceptable to the millers due to decreasing and uneconomic prices for fibre.

Arising from the above conclusions, the Sub Committee of the Export Development Board made the following recommendations :

(1) **Short-term**

Set up pilot projects at a few mills to process mattress from breaker and cleaner drums for about 6 to 12 months after tying up with a exporter to monitor the performance technically, economically and to test the logistics and acceptability of this change with the millers. Some of the mills should use the conical sifter only and some should use both the conical sifter and the paddle sifter.

(2) **Long-term**

To carry out research and development of a low cost simple cleaning machine, suitable for dry state cleaning at the fibre mills.

Table 4—*Moisture and Pith/Dust content of mill — fresh mattress fibre samples when cleaned with different types of machines*

4 (a) Wet State

Type of Machine used	*weight in (kg)*		*Moisture content %*
	Fibre	*Dust/Pith**	
1. Turbo cleaner	32.0	18.0	13.3
2. Paddle sifter	41.5	8.5	12.7

4 (b) Dry State

Type of Machine used	*weight in (kg)*		*Moisture content %*
	Fibre	*Dust/Pith**	
1. Turbo cleaner	28.0	22.0	3.0
2. Paddle sifter	40.0	10.0	1.5

Inclusive of Baby fibre

As an alternative, promote the use of cleaning machines now used by exporters to clean in the dry state by setting up such units for centralized cleaning.

T. K. G. Ranasinghe and G. M. R. Karunasekera.

Experiment 23.5 : Improvements to sundrying mattress fibre (1986)

The present methods of sundrying mattress fibre are not very efficient as fibre, millers experience difficulties in drying them during limited sunshine hours.

As the thermal capacity of the black surface is comparatively high, an artificial cemented black surface of 12'x12' was constructed to compare the physical characteristics of fibre drying with normal mill conditions. This experiment will be carried out using mattress fibre and bristle fibre.

This experiment is in progress.

T. K. G. Ranasinghe and G. M. R. Karunasekera,

3. LECTURES AND SYMPOSIA

Dr. R. Mahindapala and Mr. G. M. R. Karunasekera participated as resource personnel in the training course conducted for the Diploma in Plantation Management. Mr. Karunasekera delivered a lecture at the Fisheries Women Development Project. Kalpitiya, sponsored by the Assistant Government Agent, Kalpitiya.

4. ACKNOWLEDGEMENTS

The assistance of the Tilak Fibre Mills, Paragammana Fibre Mills, the Export Development Board and Mr. H. Tillakaratne, Director (Development) of the Coconut Development Authority in the conduct of the experiment No. 23.4 is gratefully acknowledged. The assistance of Tilak Fibre Mills, Kuliyapitiya is acknowledged in the conduct of other experiments.

Table 2— *Moisture content of copra dried by Method I* (60% *of the shells*), *Method II* (70% *of the shells*) *and present Method* (*control*) — *Results of the preliminary trial.*

Drying time	*Moisture content* (% *by weight*)		
	Method I	*Method II*	*Control*
After sundrying	57.80	59.00	56.12
After 1st fire	24.34	33.36	—

After 2nd fire	17.68	16.24	13.34
After 3rd fire	8.05	7.72	9.45
After 4th fire			7.60
After 5th five			6.47
After 6th fire			5.64
After 7th fire			5.54

REPORT OF THE TISSUE CULTURE UNIT

Officer-in-Charge. S. M. Karunaratne, M. Sc.

1. GENERAL

Miss L. K. Periyapperuma was appointed Research Assistant on 1 October.

2. RESEARCH PROJECTS

PROJECT 18 — Studies on the Vegetative propagation of Coconut.

Experiment 18.1 : *In vitro* culture of embryos of local varieties of coconut (1983).

Methods for the culture of embryos excised frpm *typica* (open pollinated) and *Diriki* coconuts (a non-germinating variety) were perfected. The seedlings thus raised from these two types have been successfully transplanted into soil.

S. M. Karunaratne, K. D. Cecily, C. K. Gamage and N. Jayatissa.

Experiment 18.2 : Investigations on development of vegetative propagules in coconut inflorescences, *in vivo* (1983).

Since the original treatments showed no effect on the normal pattern of development of floral primodia, the experiment was modified to incorporate combinations of hormones. The following combinations (C1 - C4) of Indole Butyric acid and Benzyl amino purine were applied to the experimental palms through leaf blade, rachis and tender inflorescence. Water was injected to the control. Number of replicates has been increased to 4.

Hormones	**Treatment combinations**				
	C1	C2	C3	C4	C0
Indole Butyric acid (ug)	200	200	600	600	Control (Water)
Benzyl amino purine (ug)	200	600	200	600	

The experiment is in progress.

S. M. Karunaratne and N. Jayatisse.

Experiment 18.3 : Culture of leaf and shoot apical meristem explants of coconut *in vitro* (1983)

About 30% of the coconut leaf explants cultured *in vitro* produced embryoids. Adventitious roots developed from the proximal end of the embryoids on transferring to low-auxin liquid media. Four embryoids sprouted in culture but complete plants were not formed. Further investigations are in progress to enhance germination of the embryoids.

The cultured apical meristems continued to grow in culture to produce plants but shoot multiplication was not possible. Rooting was induced by transferring to a fresh medium supplemented with naphthalene acetic acid.

These experiments are in progress.

This experiment is partly supported by a grant from USAID.

S. M. Karunaratne and C. K. Gamage.

Experiment 18.4 : Culture of coconut floral meristem explants (1986).

Flower meristem explants obtained from 20-30 cm long inflorescences were subjected to various culture conditions. In most of the media tested, the explants were observed to follow the normal developmental pattern of the flowers. However, callus initiation occurred when flowers subjected to a cold pre-treatment (4°C for 24-48 hours) were cultured in the medium formulated by Tuyen & de Guzman (1983).

L. K. Periyapperuma.

Experiment 18.5 : Application of the embryo culture technology to select drought tolerant coconuts in a population (1986).

The possibility of using the embryo culture technique (Karunaratne *et al*, 1985) for selecting drought tolerant coconuts in a population was investigated. The stress condition was induced in cultures by incorporating sodium chloride and polyethylene glycol, separately into the culture medium. Seedlings having capacity to grow in high salt and polyethylene glycol (400mM and 20% respectively) have already been obtained by this method.

The experiment is in progress.

S. M. Karunaratne and K. D. Cecily.

3. REFERENCES

1. Nguyen T. Thanh-Tuyen & Emerita V. De Guzman (1983). Formation of pollen embryos in cultured anthers of coconut (*Cocos nucifera* L). *Plant Sci. Lett.* 29 81 - 88.

2. S. M. Karunaratne, C. Kurukula Arachchi & C. K. S. Gamage (1985). A report on the culture of embryos of dwarf coconut, *Cocos nucifera L var. nana in vitro. Cocos*, 3, 1 - 8.

REPORT OF THE PLANT PHYSIOLOGY UNIT

Officer-in-Charge, C. Jayasekera, B.Sc.

1. GENERAL

The Plant Physiology Unit was established in July with the following officers.

Mrs. C. Jayasekera	—	Officer in charge
Mr. P. D. N. Premasiri	—	Technical Assistant

The following officers were transferred to the unit in September.

Mr. A. Jayatilake	—	Field Assistant
Mr. W. Sirisena	—	Lab/Field Attendant

Miss S. P. Suriyapperuma was appointed Research Assistant with effect from 01 October.

Mrs. C. Jayasekera returned to the island after 4 years overseas study leave. She carried out post graduate studies at the University of Queensland on "*Ecophysiology of palms in relation to Photosynthesis and Partitioning of Assimilates*". The training was sponsored by the Australian Government.

2. RESEARCH PROJECTS

Project No. 16 : STUDIES ON THE PHYSIOLOGY OF DROUGHT TOLERANCE IN THE COCONUT PALM.

Experiment 16.3 : Identification of physiological and biochemical characters of putative drought tolerant tall (Ambakele Special) palms 1986)

The objective of this study is to determine the physiological and biochemical characters of putative drought tolerant and high yielding superior adult palms and their seedlings and compare them with those of tall×tall (CRIC 60) adult palms and seedlings.

Ten palms from each group were selected randomly from field Nos. 1 and 2 at the Isolated Seed Garden. The leaf water potential, stomatal diffusive resistance and the rate of transpiration from the leaflets of 9th fully expanded leaf from the apex were recorded during last 3 months. Similar measurements were carried out for last open mature leaf of seedlings raised from seednuts of these selected palms. Leaf samples were collected at bimonthly intervals for quantitative estimation of the total soluble sugars, starch and amino acids.

The soils moisture content in Field Nos. 1 and 2 was studied monthly.

All these measurements will be continued until the end of 1987. The number of stomata per unit area of the abaxial leaf surface was studied in all the experimental palms. No significant difference was observed between the two groups.

C. Jayasekera and S. P. Suriyapperuma

Project 25 : STUDIES ON ESTABLISHMENT AND GROWTH OF AMPUTATED SEEDLINGS IN POLY-BAGS (SEEDLINGS SEPARATED FROM THE SEEDNUT)

Experiment 25.1 : Effect of time of separation of seedlings on their establishment (1986).

Germinated seedlings were amputated at 4, 6, 8, 10 weeks after germination and planted in 4" polybags. This experiment is in progress.

C. Jayasekera and N. Premasiri.

Project 17 : STUDIES ON PREMATURE DECLINE OF VIGOUR OF COCONUT PALM

Experiment 17.1 : Survey of Leaf Scorch Decline (1986).

The survey of Leaf Scorch Decline (LSD) at CRI substations was completed by the end of December. Depending on the severity of symptoms, palms were grouped into 3 categories as incipient, moderate and advance stage of disease.

Selection Category		Criteria of LSD Visual Symptoms
Incipient	:	Three to five mature leaves of the crown has leaflets with scorching. No differences in crown size, number of leaves and nut yield between healthy and affected palms.
Moderate	:	Six or more mature leaves of the crown has scorching symptoms. Scorching has spread towards the middle region of the leaflets. Curling of the scorched area is visible at this stage. No difference in crown size, number of leaves and nut yield between healthy and affected palms.
Severe	:	The number of leaves in the crown is considerably reduced and hence upto six scorched leaves are found. Leaves are smaller in size and the nut yields reduced, together with subsequent tapering of the trunk.

The number of affected palms at each location is given in Tables 1 and 2 as a percentage of the total number of palms. The results indicate that Leaf Scorch Decline is mainly confined to ordinary tall, tall × tall and reciprocal crosses of tall × dwarf hybrids. The incidence of leaf scorch was heardly evident in the three colour forms of the dwarf variety. The data also indicate that the symptoms of leaf scorch are more conspicuous in areas where fertility and physical properties of the soil are poor. Comparision of yield data of affected and healthy palms for the last 15 years did not reveal an acceptable relationship between the leaf scorch and previous yield. It is important to note that the observed high incidence of Leaf Scorch may be due to the difficulty in identifying the palms affected only by moisture deficit.

C. Jayasekera and S. P. Suriyapperuma.

Table 1 : *Survey of Leaf Scorch Decline.*

*Location**	*Field No.*	*Variety****	*Total no. of palms*	*No. affected*	*% LSD*
BE	8	Progeny of high yielding palms (Tall)	1083	114	10.5
	9**				
	10	T×D, D×T, T×T	166	62	37.0
	11	T×D	96	46	48.0
	13	D×SR, SR×D	172	6	3.5
	14	T×D, D×T	473	38	8.0
ISG	1	T	330	19	6.0
	2	T	416	10	2.0
	3	T	341	16	5.0
	4	T	2562	123	5.0
	8	T	1555	47	3.0
PRS	1	T×T	213	29	13.6
	2	T×T	263	26	8.0
	3	T×D, T(OP)	168	19	11.3
	4	T×T, T(OP)	130	15	12.0
	5	T×D, T×T, T(OP)	427	45	10.5
	6	T×T, D×T	293	50	17.0
	7	T×D, D×T, SR	346	31	9.0
	8	T	362	30	8.0
	10	TxD, DxT	225	18	8.0
	11 A×B	T×T	2329	142	6.0
	12	T(OP)	1598	85	5.0
RE	1	T	1281	0	0.0
	2	T	332	1	0.3
	3	T	563	2	0.4
	4	T	1344	1	0.0
	5	T, D	1002	5	0.5
	7	T	753	16	2.0
WE	Block A&B	T	2204	132	6.0

***BE** — Bandirippuwa Estate; ISG — Isolated Seed Garden; **PRS** — Poththukulama Research Station; **RE** — Rathmalagara Estate; **WE** — Walpita Estate.

****Please see Table 2 for details.**

*****T** — tall; **D** — Dwarf; **SR** — San Ramon; **T(OP)** — tall (open pollinated)

Table 2 : *Survey of Leaf Scorch Decline in Field No. 9 at Bandirippuwa Estate.*

Variety	*Total no. of palms*	*No. affected*	*% LSD*
Tall × Dwarf	9	6	
Typica (tall)	10	4	
Gon Thambili	3	1	
Ran Thambili green	5	1	
Porapol	4	2	
Navasi	4	3	
Kamandala	2	—	
San Ramon	7	—	
Bodiri	3	—	
African Tall	4	—	
Tall green	5	2	
Ran Thambili-Red Form	7	3	
Nawasi Thambili	4	2	
King Coconut	3	1	
Dwarf Green	1	—	
Dwarf Red	4	—	
Dwarf Yellow	3	1	
TOTAL	78	26	33.3%

REPORT OF THE INFORMATION SERVICES UNIT

Officer-in-Charge — P. A. Henry N. Appuhamy, B.Sc Agric.

1. GENERAL

Staff Matters

Mr. D. B. Hettiarachchi, Senior Technical Asssistant (Photography) resigned his post on 30 June.

Mr. J. H. P. Chandradasa, Lab and Field Attendant (Photography) reported for duty on 01 October, after completing two years' no-pay leave abroad.

Mr. T. W. R. Weralupitiya was appointed Technical Assistant (Photography) with effect from 07 November.

2. PUBLICATIONS

2.1 Technical Publications

Volume No. 3 of *Cocos* was published.

Annual Report of the Institute for 1984 was published.

2.2 Extension Publications

The following publications were issued during the year.

Pol Puwath: Volume 8, No. 2 and Volume 9, Nos. 1 and 2;
Coconut Bulletin: Volume 2 No. 2 and Volume 3, Nos. 1.

2.3 Other Publications

A booklet titled 'Guide to Coconut Research Institute' was published.

Advisory Circulars

The following Advisory Circulars in the new series were issued:

1. Fertilizer Recommendations for coconut (No. A 4)
2. Bud Rot Disease (No. B9)
3. Stem Bleeding Disease and its Control (No. B 10)
4. Leaf Blight Disease and its control (No. B 11)
5. Leaf Scorch Decline (No. B 12)

3. TRAINING PROGRAMMES/STUDY TOURS

3.1 Training Programmes

The following programmes were conducted during the year:

i. Attachment training for three batches of students from the National Apprenticeship Board from 1 January to 30 April, 1 May to 31 August and 1 September to 31 December.

ii. A short familiarization programme for Mr. Hans-Joachim Fuchs from the Department of Geography, Mainz University, West Germany from 29 January to 31 January.

iii. An attachment training for Mr. Roughua Gao from China from 5 February to 2 June.

iv. Familiarization programme for Extension Agents of member countries of the Asian & Pacific Coconut Community from 14 May to 26 May.

v. Short Programme for Mr. Pham Van — FAO Fellow, from 12 May to 30 May.

vi. Short Programme for two Vietnamese officials, from 4 June to 10 June.

vii. Short Programme for Coconut Instructors from Indonesia, from 16 June to 11 July.

viii. CRI Component of the Diploma Course of the National Institute of Plantation Management from 7 July to 18 July.

ix. An attachment training for a trainee from the Technical College, Kuliyapitiya from 21 August to 20 November.

3.2 Study Tours

The following study tours were organized for the persons indicated:

i. Tanzanian officials on 21 February.

ii. Agriculture Students from Aquinas College on 28 July.

iii. Officials from the Kurunegala District and Kachcheri on 29 July.

iv. Three study tours for trainees from the Coconut Development Training Centre on 03 April, 26 September and 28 November.

v. Group of students from the Technical College, Kuliyapitiya on 04 August.

vi. Maldivian Extension officers on 16 October.

4. VISITORS

A large number of persons visited the Institute during the year, including 1861 students from 27 schools.

5. FIELD DAYS, ETC.

Two Field Days were held by the Institute to introduce the new recommendations to coconut growers.

A Field Day was organized on 27 March at Bandirippuwa Estate for smallholders in the Kurunegala region and the extension personnel of the Coconut Cultivation Board in the region. The other Field Day was organized at both Walpita and Bandirippuwa Estates for farmers attached to Coconut Development Project at Rambukkana on 28 October.

The Institute conducted three seminars in the Quarterly Seminar series for the officials and plantation managers of the Coconut Cultivation Board, National Livestock Development Board and the Janatha Estates Development Board.

6. EXHIBITIONS

The Institute participated in the Mahapola Sixth Anniversary Exhibition at Pannala, Fisheries Exhibition organized by the Ministry of Fisheries to mark the World Food Day in October, the Science Exhibition at the Joseph Vaz College, Wennappuwa and the 133rd Mahapola Exhibition at Nattandiya.

7. PHOTOGRAPHY

Transparancies and photographs required for technical divisions were prepared.

8. MUSEUM AND GRAPHIC WORK

The Museum was maintained satisfactorily. Line drawings and other graphic work required for publications and divisions were prepared.

REPORT OF THE COCONUT INFORMATION CENTRE

Project Leader — M. J. C. Perera, ALA

1. GENERAL

The Coconut Information Centre continued its activities during the year with further financial support from the International Development Research Centre (IDRC), Canada, supplemented with local funds. Greater emphasis was laid on the publications programme collection of missing literature and microfiching of retrospective literature from 1965 for depositing in four regions viz. African, S.E. Asian, Carribean and Pacific of the world to provide easy access for coconut literature as envisaged in the project under phase II.

1.1. Staff

The staff position as at 31 December 1986 remained as Project Leader (1), Documentation Officer (1), Documentation Assistant (1), Library Assistants (2) and, Clerical Assistant (1). In addition, the services of one Library Assistant, one Machine Operator and Four Supporting Staff were provided by the Institute. Further, one casual typist was engaged to cover the additional typing involved, in order to expedite the publications programme.

1.2. Training

Miss P. A. S. F. Caldera, Documentation Officer and Miss D. I. Piyasiri, Library Assistant attended a one day seminar on Cataloguing of Library Material according to the Anglo American Cataloguing Rules of Second Edition (AACR2) conducted by the Sri Lanka Library Association on 10 October.

Mr. M. J. C. Perera, Project Leader, Miss T. I. I. Peiris and Miss P. D. U. C. Dharmapala, Library Assistants attended the workshop on micro-computer Data Base Management System using CDS/ISIS Software from 3-7 November organized by the UNESCO in collaboration with the Natural Resources, Energy and Science Authority (NARESA).

2. VISITS, SYMPOSIA & VISITORS

Mr. M. J. C. Perera, Project Leader attended the Regional and the National Seminar on Science and Technology Information Policy held in Colombo from 20 to 25, October organized by the UNESCO in collaboration with the NARESA, Sri Lanka.

The Coconut Information Centre organized a one day user seminar at the Institute on 20 November. Twenty participants drawn from agricultural libraries, crop research institutes, university libraries and departments involved in coconut-based research activities participated at this seminar. The objective of this seminar was to familiarise the participants on the work of the Coconut Information Centre and the facilities provided by the Centre in promoting information relevant to coconut.

Visitors

In addition to students from Universities who visited the Centre to gather information for their research projects, the following foreign visitors were received during the year.

Mr. Alan Green, formerly of the World Bank
Mr. H. L. Barkey, from Tanzania
Mr. M. E. Cammel, from the Imperial College, London
Dr. Duong-Tan-Thuoc, from Vietnam
Mr. Firoz, from Pakistan
Mr. Hans-Joachim Fuchs, from West Germany
Mr. P. G. Punchihewa, Executive Director, Asian & Pacific Coconut Community
Mr. Peter Ooi, from CIBC Malaysia
Mr. Ronghua Gao, from China

The following groups of visitors were also received :

Coconut Instructors from APCC member countries
Board members from Coconut Development Authority, Sri Lanka
Delegates from the World Bank
Hon. Gamini Jayawickrama Perera, District Minister for Kurunegala accompanied by a team of officials from Kurunegala District

Delegates from India, Indonesia, Japan, Korea New Zealand, China, Malaysia, Philippines, Sri Lanka and Thailand who attended the Regional Seminar on Scientific and Technology Information Policy were hosted by the Centre for a full day programme at the Institute. They studied in detail the activities of the Centre.

Prof. A. Neelameghan from the Division of the General Information Programme, UNESCO visited the centre accompanied by Miss Delia E. Torrijos, Regional Advisor, Division of the General Information Programme, UNESCO and Mr. S. C. J. Vickers from the International Federation of Library Association and Institutes (IFLA). Their visit was to familiarize themselves with the activities of the CIC in connection with a proposal submitted by the CIC for establishing a Coconut Information Network for Asian and Pacific Region under the UNESCO Programme for the exchange of Information and experiences in Science and Technology in Asia and Pacific (ASTINFO).

A party from the Philippines Coconut Authority led by Mr. Oscar Santos, Chairman, also visited the Centre.

Consultancy

Mr. Clive Wing, Programme Officer, IDRC from the Regional Office in India visited the Centre on 29 October to review the progress of the Centre.

3. EQUIPMENT

Following items were purchased during the year.

Wang PC micro-computer
KROY 80E Lettering Machine
Paper Collating Machine and Paper Trimmer.

4. ACKNOWLEDGEMENT

I wish to record my appreciation for the support received from the UNESCO and the NARESA of Sri Lanka in providing basic training for the staff in using CDS/ISIS software. Cooperation received from various institutions in collecting retrospective literature missing from the Centre's collection and the encouragement extended by the IDRC Programme officer, Mr. Clive Wing and the Board of Management and the Directorate of the Coconut Research Institute is recorded with due acknowledgement.

5. SERVICES

Information Collection and Storage

During the period under review 236 items covering literature on coconut cultivation, processing and technology were collected, processed and stored in the information storage and retrieval system. These included articles from Journals, Symposia proceedings, Patents and Reports. In addition 24 theses submitted to various Universities were added to the theses collection bringing the total number available at the Centre to 109.

Requests for literature

Of the 120 items of current literature requested from outside sources 46% have been responded and of the 155 requests for retrospective literature only 31% could be responded.

Retrospective literature collection for microfiching

During the year the Centre staff had to spend much of their time in preparing articles for microfiching. 2025 items from retrospective bibliographical series covering the period 1967-1978 were checked and 1222 availabe articles from the library collection and those received from outside sources were photocopied and processed by key wording for microfiching and also for storing in Centre's information storage system. In order to obtain the missing items several requests were made to various organizations in the world.

Supply of information

Requests received for literature searches on various subjects, from the Centre's database were attended to by supplying the relevant literature. Where necessary lists of references were also provided.

The Centre presently maintains 29 Selective Dissemination of Information (SDI) profiles and alerting services carried out as it became necessary.

6. PUBLICATIONS

Annotated Bibliographical Series :

Nos. 16 & 17 combined volume of this series covering literature for the years 1983 and 1984 are in the press and will be issued shortly. Preliminary work for publishing another combined series for 1985-1986 was in progress.

Retrospective Bibliographial Series :

No. 3 of this series covering the period 1900-1965 on Diseases & Disease Control was published during this year. This series covered 710 titles with bibliographic details.

Retrospective Bibliography on Theses :

Work on this publication is almost complete. It will be published shortly. This publication covers 168 theses on coconut with abstracts, submitted to various universities in the world.

"COCONIS" Newsletter

Four issues were published on schedule and circulated among 640 clients.

In addition to above publications, the Centre undertook a considerable amount of printing for the Institute on miscellaneous items.

REPORT OF THE LIBRARY

Librarian—M. J. C. Perera, ALA

GENERAL

The Library was separated from the Publications and Publicity Unit and began to function with the Coconut Information Centre from July 1985.

ACQUISITIONS

During the year, 54 journals were obtained on subscriptions and 145 journals on exchange. Thirty books were added to the collection bringing the total number in the collection to 4424. In addition, 53 missing items of coconut literature, some dating back to early 20th century were received from the Library of Congress and the National Agricultural Library of the U.S. This was possible through the cooperation received from Dr. Dennis V. Johnson of the U.S.

SERVICES

Inter Library Loan Service : 75 items were received from the libraries and 96 items were loaned to other libraries.

Alert Service : Staff of the Institute were alerted for 72 items from journals received in the library. on their subject interests based on the research projects of Divisions.

AGRINET Services : Selective Dissemination Contents Pages Service (SDCP). One hundred and twenty-three items were received from member libraries of the **AGRINET** group of libraries to meet the requirements of our staff and 101 items were provided to other libraries.

In order to meet the requirements of the staff from resources available outside the country, 34 items were requested and supplied from the British Library Document Supply Centre (BLDSC), U.K.

Visitors

Sixty-nine visitors used the library during the year. Majority of these visitors were from the Universities.

REPORT OF THE ESTATE MANAGEMENT DIVISION

Manager (Estates) — P. S. Liyanagama B.Sc (Agric)

1. GENERAL

1.1. Staff matters

Appointments

Mr. G. Vithanage	—	Superintendent	on 17 July
Mr. M. S. Perera	—	Supervisor	on 01 February
Mr. K. P. C. Fernando	—	Supervisor	on 01 May

Transfers

Mr. M. R. S. Fernando (Superintendent) from Minneriya Research and Demonstration Farm to Head Office on 18 November.

Mr. D. M. Pathirage (Superintendent) from Rathmalagara Estate to the Isolated Seed Garden on 01 March.

Mr. M. R. L. A. Perera (Superintendent) from Poththukulama Research Station to Rathmalagara Estate on 01 August.

Mr. N. Gamage (Field Officer) from Walpita Estate to Poththukulama Research Station on 07 March.

Mr. J. I. Jayalath (Supervisor) was transferred from Bandirippuwa Estate to Makandura Seed Garden as Officer-in-Charge on 5 May.

Mr. M. P. W. Fernando (Supervisor) was transferred from Bandirippuwa Estate to Minneriya Research & Demonstration Farm as Officer-in-Charge on 06 November.

Mr. B. A. L. Mendis (Field Assistant) from Poththukulama Research Station to Bandirippuwa Estate on 03 January.

Mr. P. P. Jayasundera (Field Assistant) from Makandura Seed Garden to Head Office on 05 May.

Mr. E. W. A. G. Gunasinghe (Field Assistant) from Bandirippuwa Estate to Rathmalagara Estate on 16 May.

Mr. A. Jayatillake (Field Assistant) from Minneriya Research and Demonstration Farm to Plant Physiology Unit on 15 September.

Mr. H. M. Kirihamy (Driver) from Maduru Oya Seed Garden to Head Office on 12 May.

Mr. H. M. Nimalaratne (Tractor Driver) from Bandirippuwa Estate to Poththukulama Research Station on 06 November.

Mr. H. M. Tikiribanda (Tractor Driver) from Poththukulama Research Station to Bandirippuwa Estate on 06 November.

1.2. Activities

The following estates, seed gardens and other sub-stations were administered by the Division*

1. Bandirippuwa Estate, Lunuwila
2. Rathmalagara Estate, Madampe
3. Poththukulama Research Station, Pallama
4. Walpita Estate, Walpita
5. Kirimetiyana Estate, Lunuwila
6. Makandura Seed Garden, Gonawila
7. Maduru Oya Seed Garden, Bogaswewa, Dimbulagala
8. Minneriya Research and Demonstration Farm, Minneriya
9. Passekudah Research and Demonstration Farm, Kalkudah.

These properties with a total extent of 1585 ac were maintained in good order. The recommended cultural practices were carried out. Noxious weeds were kept well under control. Soil and moisture conservation measures such as contour drains and establishment of cover crops were practised and a programme of husk burying was undertaken by utilizing the entire quantity of husks available on the estates.

New field road systems were introduced in all the estates to facilitate field supervision and transport.

Office records as well as field records and periodical statements of the estates were revised so that there was effective control of field operations and financial activities.

The General performance of the estates is given in the Table 1.1.

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*Report on the Isolated Seed Garden, Ambakelle appears under the Genetics and Plant Breeding Division.

Table 1.1 :—*General Performance of the estates, etc.* — 1986

	BE	*RE*	*PRS*	*WE*	*KE*	*MK*	*MO*	*MIN*	*PAS*	*TOTAL*
Total extent (ac)	365	273	212	44	95	144	210	125	117	1,585
Planted extent (ac)	333	240	147	40	40	133	60	22	87	1,102
Bearing extent (ac)	185	183	109	34	20	—	—	—	—	531
Yield in 1986 (nuts)	464,637	874,843	483,031	188,995	22,577	—	—	—	—	2,034,083
Yield/palm (nuts)	39.3	74.8	69.2	87.6	17.6	—	—	—	—	59.9
Yield/acre (nuts)	2513	4786	4428	5608	1129	—	—	—	—	3831
Yield in 1985 (nuts)	593,806	918,658	806,593	213,923	22,683	—	—	—	—	3,555,663
Percent difference over 1985	(–) 21.8	(–) 4.8	(–) 40.1	(–) 14.7	(–) 0.5	—	—	—	—	(–) 20.4
Av. yield 1981–1985	522,348	754,664	548,172	154,909	—	—	—	—	—	—
Percent difference over 5 yr average	(–) 11.0	(+) 16.0	(–) 14.9	(+) 22.0	—	—	—	—	—	—
C.O.P. (Rs.)	2551.94	849.74	1373.76	47.50		—	—	—	—	—
Replanting (ac)	39	22	—	—	7	—	—	—	—	68
New planting (ac)	—	—	—	—	—	2	60	12	—	74

BE — Bandirippuwa Estate
RE — Ratmalagara Estate
PRS — Poththukulama Research Station
WE — Walpita Estate
KE — Kirimetiyana Estate

MK — Makandura Seed Garden
MO — Maduru Oya Seed Garden
MIN — Minneriya Farm
PAS — Passekudah Farm
COP — Cost of production/1000 nuts.

Rainfall in general had been far below the normal. This will reduce the yield in 1987.

2. Bandirippuwa Estate — (Superintedent Mr. A. N. Eknaligoda)

District — Puttalam

Electorate — Wennappuwa

Agroclimatic Zone — Semi-wet Intermediate Zone

The major part of the estate is under young plantations and only 185 ac of the planted area are in production.

Table 2.1—*Area Statement, Bandirippuwa Estate.*

	Hectares	*A*	*R*	*P*
Coconut	134.81	333	0	17
Roads & Buildings	12.95	32	0	00
Waste land	0.34	0	3	14
Total	148.10	365	3	31

Table 2.2—*Census of Palms, Bandirippuwa Estate.*

Bearing palms	11,833
Seedlings	10,842
Dud palms	137
Vacancies	184
Total	22,986

Rainfall during the year had been very poor (Table 2.3.). This affected the a envisaged replanting programme of the estate.

Table 2.3—*Rainfall 1985 – 1986—Bandirippuwa Estate*

Month	1985		1986	
	mm	*Wet days*	*mm*	*Wet days*
January	130.0	3	61.7	10
February	189.0	6	35.0	77
March	228.9	11	62.0	88
April	103.9	8	60.2	11
May	275.3	12	284.7	16
June	291.3	22	44.7	11
July	14.5	7	33.5	8
August	139.9	7	77.2	8
September	168.4	15	94.7	15
October	195.6	20	224.3	15
November	306.3	13	149.4	7
December	63.7	4	63.5	6
Total	1989.8	128	1190.9	122

The total nut yield for the year (464,637) was 21.8% less than the 1985 yield and 11.00% less than that of the previous five years' average. In addition to the dry weather conditions prevailed in 1985, progressive removal of the old plantation under the replanting programme reduced the yield considerably. An analysis of yield data for the last five years is given in Table 2.4.

Table 2.4 :—*Analysis of Yield Data 1981 to 1986 — Bandirippuwa Estate*

Pick	*1981*	*1982*	*1983*	*1984*	*1985*	*Five years' average*	*Percent*	*1986*
1.	69,654	63,330	75,157	31,107	81,496	64,149	12.3	81,180
2.	139,433	86,138	126,571	57,418	105,327	102,977	19.7	112,322
3.	139,805	117,120	141,571	96,823	122,662	123,596	23.7	82,023
4.	105,157	109,202	100,693	112,174	114,394	108,324	20.7	90,490
5.	73,577	63,571	56,482	62,678	93,811	70,024	13.4	56,088
6.	64,675	53,853	33,878	37,766	76,116	53,268	10.2	37,534
	592,301	493,214	534,352	397,966	593,806	522,348	100.0	464,637
No. of Bearing palms	14,237	14,751	14,076	13,289	13,289	13,928	—	11,834
Yield/Palm	41.6	33.4	38.0	30.0	44.7	37.5	—	39.3
Yield/acre	2663	2140	2430	1917	2860	2400	—	2513
Yield/ha	6581	5289	6005	4737	7068	5930	—	6211

Table 2.5 — *Disposal of Crop — Bandirippuwa Estate*

Sold to dealers	309,822
Converted into copra	43,655
Issues to resident staff	34,618
Issues to C.C.B.	194
King coconuts	222
Balance for disposal	65,911
Total	464,637

Field Operations

(i) Manuring : The bearing palms were fertilized as recommended with the Adult Palm Mixture. The Young Palm Mixture was applied at 1½ times the recommended dosage in four split doses. In addition, kieserite was applied in the entire estate at 1 kg per palm.

(ii) Weed Control : Ground condition of the estate was quite satisfactory and the weeds were kept well under control. Noxious weeds such as 'Illuk' and 'mana' had virtually been eradicated. A tractor driven weed slasher (Rotaslasher) was successfully used in controlling weeds, thereby reducing the cost of weeding to about Rs. 120/— per acre per year.

(iii) Soil and moisture conservation : New contour drains were opened in 13 ac and all existing drains were reconditioned. Manure circles were mulched with fallen fronds at regular intervals and the seedlings were mulched with coconut fibre dust with very satisfactory results. Establishment of cover crops in new areas was hampered due to dry weather conditions but the established cover crop was well maintained. All available husks were buried in the estate. Twenty acres in field No. 1 (Kotakanda) and the nursery block were earmarked for soil regeneration. Accordingly, a 6" layer of coir dust was applied on the soil surface and incorporated into the soil by ploughing. Ipil-ipi and sunhemp were planted afterwards as a further measure of soil reconditioning. This land will be planted to coconut only after keeping for two years under ipil-ipil.

(iv)) Fences : In spite of frequent wilful damage, the perimeter fence was well maintained. The old fence with wooden posts in field No. 8 (50 acre block) was replaced with concrete posts and a new security fence with crancked concrete posts was erected round the estate office enclosing nut heaps.

(v) Roads and paths : The main estate roads and field roads were well maintained. New field roads were introduced in field Nos. 3, 6, 7 and 8.

(vi) Replanting : Replanting was done in 39 ac. Of these, 10 ac in field No. 2 were planted with CRIC-60 at a spacing of 24 ft quilateral triangular system. Another 15 ac in field No. 7 were planted with "Ambakelle Special" in 21 ft × 28 ft rectangular system. Two more acres in the same field were planted with seedlings of several crosses supplied by the Genetics and Plant Breeding Division. Twelve acres in field No. 8 (50 ac block) were planted by Genetics & Plant Breeding Division for experiments. The young plantation previously established (30 ac) was maintained well. Pests and diseases were controlled effectively.

(vii) Buildings; machinery : Vehicles and equipment were satisfactorily maintained. One Massey Ferguson — 240 tractor and a trailer and a water bowser (800 gal capacity) were received during the year. In addition a single bullock cart was purchased for estate use.

(viii) Cost of Production : The cost of production for 1986 was Rs. 2551.94 per 1000 nuts produced. The higher cost of production is due to a variety of reasons such as unusually large area of non-bearing plantations, poor yields due to field experimentations, higher general charges and overheads due to the presence of CRI headquarters in Bandirippuwa Estate.

3. **Rathmalagara Estate, Madampe** — (Superintendent, Mr. M. R. L. A. Perera)

District	—	Puttalam
Electorate	—	Chilaw
Agro-climatic Zone	—	Semi-dry Intermediate Zone

Excepting for a jungle block of about 8 acres the rest of the plantable land in the estate is under coconut.

Table 3.1—*Area Statement, Rathmalagara Estate.*

	Hectares	*A.*	*R.*	*P.*
Coconut	97.13	240	0	00
Roads and Buildings	2.02	5	0	00
Jungle	3.24	8	0	00
Wasteland	8.09	20	0	00
Total	110.48	273	0	00

Census of palms : Census of palms in relation to field blocks is given in table 3.2. Accordingly the area in bearing is 183 acres.

Table 3.2 — *Census of Palms, Rathmalagara Estate.*

Field No.	1	2	3	4	5	6	7	8	9	*Total*
Bearing palms	1281	372	56	1363	1002	3071	2925	475	579	11630
Seedlings	2335	523	975	1974	560	—	—	—	—	6307
Vacancies	—	—	—	—	178	492	188	23	146	1027
Dud palms	18	2	3	5	3	37	18	3	10	89
Total	3634	898	1539	3342	1683	3590	3131	501	735	19053
Extent (AC)	28	7	9	52	29	51	57	20	20	273

Rainfall : The rainfall during the year was 15.2% less than that in 1985 (Table 3.3.) There were only 124 wet days. The north east monsoon failed and the 1987 yields are expected to drop.

Table 3.3—*Rainfall* 1985/1986, *Rathmalagara Estate.*

	1985		*1986*	
Month	*mm*	*days*	*mm*	*days*
January	16.6	2	64.8	9
February	122.1	4	54.3	5
March	158.3	11	74.7	7
April	208.3	8	143.4	11
May	82.3	7	236.1	14
June	126.0	17	50.9	13
July	38.1	6	22.6	6
August	2.6	2	85.9	7
September	74.8	11	26.4	13
October	206.9	18	153.7	25
November	319.0	14	228.1	8
December	104.0	10	95.9	6
Total	1459.0	110	1236.8	124

Analysis of yield data : Although the yield is 4.8% less than 1985 yield, it is still 16.0% more than the average yield for the previous five years. Compared with the other stations this is very satisfactory (Table 3.4.)

Table 3.4 — *Analysis of Yield Data* 1981–1986—*Rathmalagara Estate*

Pick	*1981*	*1982*	*1983*	*1984*	*1985*	*Five years' Average*	*Percent*	*1986*
1.	92,803	97,487	60,175	43,324	109,226	80,579	10.7	133,639
2.	122,889	143,151	133,010	80,520	109,455	117,805	15.6	157,982
3.	148,786	143,880	169,948	138,295	159,840	152,150	20.2	203,283
4.	153,030	154,895	196,896	119,035	187,083	162,188	21.4	160,857
5.	140,566	142,485	108,141	121,802	220,001	146,600	19.5	127,404
6.	121,302	77,401	72,455	72,417	133,047	95,324	12.6	91,678
Total	779,376	759,270	740,625	575,393	918,658	754,664	100.0	874,843
No. of bearing palms	11,411	11,435	11,434	11,409	11,398	11,417	—	11,700
yiled/palm	68.3	66.4	64.8	50.4	80.6	66.1	—	74.8
yield/acre	4371	4250	4147	3226	5158	4230	—	4787
yield/ha.	10,804	10,503	10,250	7972	12,749	10,456	—	11,832

Table 3.5 : *Disposal of Crop, Rathmalagara Estate*

Sold to dealers		672,849
Converted into copra		76,114
Issues to resident staff		11,711
Issues to Research Divisions		2,564
Rejections		31,909
Balance undisposed		79,696
	Total	874,845

Field Operations :

(i) Manuring : The old stand in the underplanted area in field Nos. 1, 2, 3 and 4 was not manured as they are to be uprooted soon. Rest of the adult palms were manured with the Adult Palm Mixture at 3 kg per palm. Dolomite was applied at 1½ kg per palm for the entire estate. The Young Palm Mixture was applied at 1½ the recommended dose to all young palms. The failure of the monsoon may have reduced the efficiency of fertilizer in some fields that were fertilized later during the season.

(ii) Weed control : Weeds were kept under control and ground conditions were satisfactory. The 'Rotaslasher' available on the estate had been very useful in the control of weeds and reducing weed control cost.

(iii) Soil and moisture conservation : Husk burying programme was successfully completed and all available husks were buried in the estate in 6622 pits of 4'×4'×3' in field Nos. 1, 4, 5, 7 and 8. With this, one circle of husk burying in the entire estate was completed and a fresh cycle will be commenced in the following year. Cover crops were established on husk pits and contour bunds in field Nos. 4 and 7 and the earlier established cover crops spread satisfactorily.

All young palms were mulched with husks. Adult palms in the gravelly areas were given a husk mulch while the rest were mulched at regular intervals with fallen fronds and weed trash. In field No. 8, Ipil Ipil loppings were used as a mulch.

Contour drains (7156 meters) in the entire estate were desilted, reconditioned and maintained in good order.

(iv) Fences : Perimeter fence was maintained well. 2944 meters of fence had been repaired and strengthened where necessary.

(v) Roads : Estate roads and paths were improved and maintained well. They were weeded and reconditioned three times during the year. A new field road was opened along the boundary of fields 3/4. Roads in field No. 1 were resurfaced with gravel.

(vi) Replanting : Twenty-two acres in field Nos. 2 and 3 were replanted. Of these 3 ac were established as a trial by the Division of Genetics and Plant Breeding. Earlier plantations were well maintained and irrigated during dry spells. Ninety-one seedlings were rogued in the trial plantation established with high density (field No. 4) to bring down the plant density to 90 palms per acre. Due to unfavourable weather conditions further replanting in field No. 8 could not be undertaken.

(vii) Buildings, machinery etc. : A Land Rover jeep (28 Sri 3039) was transferred from the Head Office to Rathmalagara Estate. A four-wheel tractor was also obtained increasing the number of tractors to two. A bowser was received as well as a new motor cycle (HONDA/CD-200). A typewriter (Sinhala) was received for the office and several items of furniture and a refrigerator were supplied to the Circuit Bungalow. All vehicles, machinery and equipment were maintained in good order.

(viii) Cost of Production : The Cost of Production had been Rs. 849/74 per 1000 nuts.

4. Pothukulama Research Station, Pallama — (Superintendent, Mr. G. Vithanage)

District	—	Puttalam
Electorate	—	Anamaduwa
Agroclimatic Zone	—	Semi-dry Intermediate Zone

About 65 ac of the estate still remain as uncleared jungle. Of the planted extent of 147 ac only 109 ac are in bearing.

Table 4.1 *Area Statement, Poththukulama Research Station.*

	Hectares	*A.*	*R*	*P*
Coconut	57.81	142	3	17
Paddy	1.80	4	1	31
Jungle etc.	26.22	64	3	06
Total	85.83	212	0	14

Table 4.2 : *Census of Palms.*

Bearing palms	6,982
Young palms	274
Seedlings	1,666
Vacancies	555
Total	9,477

Rainfall : The total rainfall in 1986 indicates a decrease of 135.8 mm over that of 1985 (Table 4.3). The distribution of rainfall was not satisfactory. Failure of rains during December interrupted most of the field operations.

Table 4.3—*Rainfall* 1985 – 1986, *Poththukulama Research Station.*

	1985		*1986*	
Month	*mm*	*days*	*mm*	*days*
January	49.5	6	44.2	7
February	110.5	3	124.0	6
March	72.9	8	35.6	13
April	98.8	4	214.6	12
May	97.5	6	165.6	6
June	63.0	7	34.3	2
July	23.6	3	3.6	1
August	7.9	1	33.3	2
September	97.3	8	33.8	7
October	175.0	10	288.0	15
November	335.5	11	242.0	7
December	223.3	9	0.0	0
Total	1354.8	76	1219.0	78

Analysis of yield data : The total crop in 1986 was about 40% less thatn that of 1985 and 11.9% less over the previous five years' average (Table 4.4). Comparative yield figures are given in Table 1.1.

Table 4.4 : *Analysis of nut yield data* 1981 *to* 1986

Pick	1981	1982	1983	1984	1985	*Five years' average*	*Percent*	1986
1.	76,127	22,480	55,206	22,959	92,480	53,851	10	79,934
2.	104,609	102,292	82,762	23,519	128,213	88,299	16	75,245
3.	88,790	128,741	200,907	40,842	211,778	134,212	24	100,534
4.	96,614	133,618	113,825	61,673	135,320	108,210	20	81,132
5.	82,909	89,778	81,727	56,197	147,100	91,542	17	71,424
6.	92,874	68,013	46,547	61,156	91,702	72,058	13	74,762
Total	541,923	594,922	581,074	266,346	806,593	548,172	100	483,031
No. of bearing palms	7187	7218	7201	7045	7071	7144	—	6982
Yield/palm/year	75.4	82.4	80.7	37.8	114.1	76.7	—	69.2
Yield/acre/year	4826	5274	5164	2420	7300	4909	—	4428
Yield/ha/year	11,927	13,034	12,764	5980	18,044	12,134	—	$10,94_3$

Disposal of crop : Crop was disposed mainly as fresh nuts through brokers and the breakdown of disposal is given in Table 4.5.

Table 4.5—*Disposal of Crop, Poththukulama Research Station.*

Sold to dealers	386,115
Converted into copra	1,300
Issues to resident staff	4,774
Rejections	16,692
Balance undisposed	74,150
Total	483,031

Field operations and maintenance

(i) Manuring : The last round of fertilizer application could not be completed due to unprecedented drought conditions prevailed during the latter part of the year.

(ii) Weed control : Weeds were kept under control and ground conditions were satisfactory excepting for several 'Illuk' patches. A considerable effort was taken in controlling this weed. Manual removal after harrowing was found to be satisfactory but was expensive. Establishment of cover crop on such fields reduced the recurrence of Illuk. This was effectively demonstrated in field No. 9.

(iii) Soil and Moisture conservation : All available husks were buried in 1534 pits of 8'×4'×3' and 822 pits of 4'×4'×3' in field Nos. 5,11A, 12 and 13. 1534 fathoms of new contour drains were opened in field Nos. 5, 6 and 8. 2485 fathoms of existing contour drains were cleaned and reconditioned. Some unnecessary drainage canals were closed and 623 fathoms of new ones were opened in the lower reaches of the estate The entire estate was mulched with fallen fronds for three rounds during the year. Cover crops were planted in 47 ac of the estate.

(iv) Fences : Perimeter fence of the estate was maintained in good order. 2569 fathoms of fence were cleaned and 1076 fathoms were renovated. New fencing with concrete posts was done in 1483 fathoms of the northern and southern perimeter.

(v) Roads : All estate roads and paths were maintained in good order. 3094 fathoms of roads were cleaned and another 1526 fathoms were renovated. Resurfacing was done using 121 3/4 cubes of gravel.

(vi) Removal of dud palms : A total of 313 unproductive and dead palms were uprooted during the year. Planting holes were prepared to supply vacancies. Trunks of the uprooted tender palms were cut into small logs and were buried in the bottom of husk pits.

(vii) Improvements : Three hundred and fifty CRIC - 60 seedlings were planted in vacant areas of the estate and another 350 planting holes were prepared for planting but the drought conditions did not permit them being planted.

The abandoned paddy field in the middle of the estate which was harbouring noxious weeds was re-cultivated during Maha season.

(viii) Buildings, machinery etc. : The old labour restroom was renovated and put into use. The rest room near the office is now used as muster shed. The office and two watcher's quarters were renovated. The well in field No. 7 was cleaned and reconditioned. The tractor garage was improved.

Machinery and equipment on the estate were maintained in good order. A typewriter (Sinhalese) and a diesel water pump (2)" were s upplied during the year. A bullock cart and a bull were transferred to Poththukulama for estate use.

(ix) Cost of production : The cost of production was Rs. 1373.76 per 1000 nuts.

5. Walpita Estate, Walpita. (Officer-in-Charge, Mr. M. S. Perera)

District	— Gampaha
Electorate	— Divulapitiya
Agro-climatic zone	— Wet zone

This is a small property of 44 acres in extent established in 1948 as a Progeny Trial. The area under coconut is 40 acres of which the effective area in bearing is 34 acres (Table 1.1 and 5.1). Most of the Intercropping trials and demonstrations of Agronomy Division are conducted here.

Table 5.1—*Area Statement, Walpita Estate*

	Hectare	*A.*	*R.*	*P.*
Coconut	16.19	40	0	00
Buildings, etc.	1.62	4	0	00
Total	17.81	44	0	00

Census of palms : According to the census, 83% of the plantation is in bearing (Table 5.2).

Table 5.2—*Census of Palms*

Bearing palms	2,127
Young palms	394
Dud palms	30
Total	2,551

Rainfall — The total rainfall for the year was 1801.7 mm with 135 wet days. This is 673 mm less than that of the 1985 (Table 5.3).

Table 5.3—*Rainfall* 1985 – 1986, *Walpita Estate.*

	1985		1986	
Month	*mm*	*days*	*mm*	*days*
January	49.8	5	113.4	9
February	183.7	4	58.3	5
March	83.4	11	80.1	8
April	230.3	7	220.7	11
May	588.5	17	242.0	15
June	381.1	23	97.7	15
July	43.3	7	36.6	11
August	187.9	6	98.1	7
September	161.8	15	154.5	20
October	390.6	22	300.3	19
November	327.6	14	325.4	9
December	72.8	6	74.6	7
Total	2700.8	137	1801.7	126

Analysis of Yield data : The crop in 1986 was 11.7% less than that of 1985. However, it is still 22% more than the average for the previous five years (Tables 1.1 and 5.4).

Table 5.4 : *Analysis of nut yield data* 1981 *to* 1986 — *Walpita Estate*

Pick	1981	1982	1983	1984	1985	*Five years' average*	*Percent*	1986
1.	6,145	16,139	9,809	5,408	17,926	11,085	7.1	20,843
2.	14,658	33,757	28,955	11,032	24,116	22,504	14,5	24,741
3.	39,887	41,421	36,024	24,040	58,925	40,063	25.8	43,911
4.	45,887	42,655	30,775	33,704	43,722	39,489	25.4	48,049
5.	22,632	31,349	17,887	25,854	40,291	27,603	17.8	33,114
6.	16,756	11,964	7,627	8,623	28,943	14,783	9.4	18,337
Total	145,955	177,285	131,067	108,661	213,923	155,527	100.0	188,955
No. of bearing palms	2157	2157	2157	2157	2157	2157	—	2157
Yield/palm/year	67.7	82.2	60.8	50.4	99.2	72.1	—	87.6
Yield/acre/year	4331	5260	3889	3224	6347	4614	—	5607
Yield/ha/year	10,703	13,001	9,612	7969	15,688	11,405	—	13,857

Disposal of crop : Crop was disposed mainly as fresh nuts through brokers and only the buyers' rejections were converted into copra resulting a poor out-turn i.e. 1448 nuts per candy (table 5.5).

Table 5.5—*Disposal of Crop, Walpita Estate.*

Sold to dealers		122,891
Issues 'o resident staff		2,912
Converted into copra		10,760
Rejections		3,114
Balance undisposed		4,318
	Total	188,995

Field Operations

(i) Manuring : As recommended the adult palms were fertilized with APM at 4½ kg per palm and the seedlings were fertilized with YPM as applicable.

(ii) Weed control : Ground conditions remained satisfactory with the weeds well under control. Three rounds of weeding by uprooting and slashing had been done during the year.

(iii) Soil and moisture conservation : All the contour drains were reconditioned and a small reservoir was built at the lower reaches of the estate to collect drainage water thereby improving the moisture availability. All available husks were buried in 261 pits. Establishment of cover crops was affected by the drought conditions and only four acres had been successfully established. The established cover crops spread out satisfactorily. Adult palms were mulched regularly with fallen fronds and the seedlings were mulched with husks.

(iv) Fences: The boundary fence was maintained in good order. Ipil ipil seedlings were planted along the boundary fence bordering the public road.

(v) Roads : All field roads were rotovated with hand tractor and reconditioned Roads in block 'A' (150 fathoms) were resurfaced with gravel and a new field road of 300 fathoms was opened in the same block.

(vi) Filling vacancies : All vacancies in the plantation were filled with 30 seedling of CRIC – 60.

(vii) Buildings, machinery etc. : A temporary structure was put up by the estates as a fertilizer store. Existing buildings were renovated and maintained in good order The estate cart which was lying in a disused condition was reconditioned and put into use once again. Two hand tractors and the motor Cycle in tne estate were maintained in good order.

(viii) Cost of production : The cost of production was Rs. 847.50 per 1000 nust produced.

6. Kirimetiyana Estate, Lunuwila—(Officer-in-Charge, Mr. K. P. C. Fernando)

District	—	Puttalam
Electorate	—	Wennappuwa
Agro-climatic Zone	—	Semi-wet zone

This is a propertyowned by the Land Reforms Commission and managed by the CRI on a lease basis. No development work had been done due to the uncertainty of ownership. Consequently, a major part of the estate is in a neglected state with a senile plantation. Only 30 acres had been planted with CRIC - 65 as a trial (Tale 6.1).

Table 6.1 —*Area statement, Kirimetiyana Estate*

	Hectares	*A.*	*R.*	*P.*
Coconut	16.19	40	0	00
Buildings, bare land, etc.	22.26	55	0	00
Total	38.45	95	0	0

Census of palms : No proper census of palms had been taken for the year, but the number of bearing palms is 1283.

Rainfall : Rainfall figures are the same as those of Bandirippuwa Estate (Table 2.3)

Analysis of yield data : The crop in 1986 is almost the same as in 1985 and is 23.5% more than the average yield in previous four years. However, the yield per palm remains at a very low level due to the neglected condition of the estate (Table 6.2).

Table 6.2 : *Analysis of Yield Data 1982 — 1986 Kirimetiyana Estate*

Pick	1982	1983	1984	1985	*Four years' Average*	*Percent*	1986
1.	1,856	3,914	1,751	2,940	2,615	14.3	2,698
2.	2,971	5,720	3,318	3,989	4,000	21.9	5,040
3.	2,430	4,866	4,240	4,183	3,230	17.7	5,068
4.	2,792	3,693	3,514	3,732	3,445	18.8	4,750
5.	2,156	3,227	1,861	3,859	2,776	15.1	3,017
6.	1,744	1,364	1,854	3,930	2,223	12.2	2,00
Total	13,949	22,784	16,538	22,683	18,289	100.0	22,577
No. of bearing palms	649	649	773	1196	817	—	1283
Yield/palm	21.5	35.1	21.4	19.0	22.4	—	17.6
Yield/acre	1376	2246	1370	1216	1434	—	1126
Yield/ha.	3399	5548	3384	3004	3542	—	2781

Crop disposal :

Table 6.3 : *Crop disposal, Kirimetiyana Estate*

Sold to dealers	15,775
Issues to resident staff	2,940
Rejections	1,858
Balance Undisposed	2,004
Total	22,577

Field operations : Only the minimum maintenance operations had been done to keep the plantation tidy.

7. Makandura Seed Garden — (Officer in Charge, Mr. J. I. Jayalath)

District — Kurunegala
Electorate — Katugampola
Agro-climatic zone — Semi-wet Intermediate Zone

This Seed Garden was established with the financial assistance of the Coconut Development Project (funded by the Asian Development Bank and the International Fund for Agricultural Development).

The entire plantable area in the Seed Garden is now put under coconut (Table 7.1)

Table 7.1—*Area statement, Makandura Seed Garden*

	Hectares	*A.*	*R.*	*P.*
Coconut	53.83	113	0	00
Roads and Buildings	2.02	5	0	00
Wasteland/reservoir	2.43	6	0	00
Total	58.28	144	0	00

The Seed Garden is planted to CRIC−60 and Ambakelle Special. Planting, details are given in Table 7.2.

Table 7.2 : *Planting details; Makandura Seed Garden*

Field	*Extent (Ac)*	*No. of Seedlings*	*Spacing (m) and System*	*Material*	*Planted in*
1.	17.1	1270	8.0 equilateral triangular	CRIC 60	September, 1984
1.	15.0	1068	— do —	— do —	June, 1985
2.	23.4	1735	— do —	— do —	November, 1984
2.	18.8	1392	— do —	— do —	May, 1985
3.	13.2	1057	7.6 equilateral triangular	"Ambakele Speical	May, 1984
3.	3.5	280	— do —	CRIC 60	May, 1985
3.	11.0	884	— do —	— do —	May, 1984
4.	25.9	2073	— do —	— do —	July, 1984
4.	5.1	408	— do —	— do —	May, 1985
Unplanted	11.0	—			
Total	144.0	10,167			

Rainfall : Total rainfall for 1986 was below normal but the distribution was quite satisfactory (Table 7.3).

Table 7.3—*Rainfall – 1986 Makandura Seed Garden*

Month	*Rainfall (mm)*	*Wet days*
January	86.1	9
February	34.1	4
March	32.1	6
April	83.4	10
May	271.1	13
June	46.3	9
July	29.9	6
August	115.9	8
September	113.8	17
October	264.7	20
November	354.3	8
December	80.4	4
Total	1512.1	114

Field operations :

(i) Manuring : YPM was applied at 1½ times the recommended dose in four split applications. An additional dose of organic manure (20 kg goat dung/seedling) was applied to 754 seedlings in field Nos. 2 and 4 heavy clay areas.

(ii) Weed Control : Weeds are kept well under control. Cover crops had been a contributory factor for the control of weeds. Rest of the area was manually slashed three times and the cheddies were uprooted in three rounds. In addition the "Rotaslasher" was used at regular intervals.

(iii) Soil and moisture conservation : 2387 fathoms of new contour drains were opened and 17,642 fathoms of existing drains were desilted and reconditioned. Cover crops were planted on the bunds of these drains. Manure circles of the entire plantation were mulched twice with coir dust and weed trash.

(iv) Fences : 913 fathoms of new perimeter fence was erected and the old fence was maintained in good order.

(v) **Roads and paths :** Field roads and paths were improved and well maintained Roads were clean weeded four times and reconditioned where necessary. Roadside drains of the main field roads were desilted and the road surface was improved with gravel.

(vii) **Others :** All vacancies were filled. One hundred and eighty-four seedlings were newly planted. Sign boards giving planting details were erected in every field. Seedlings in the Progeny trial (field No. 3) were numbered with metal tags. About 100 mahogany seedlings were planted along the main roads. Seed garden was irrigated as required during the dry periods.

(viii) **Machinery :** The motor cycle was reconditioned. Both tractors and their implements were maintained in good order.

7. **Maduru Oya Seed Garden, Bogaswewa, Dimbulagala** — Superintendent (Mr. S. M. Wijeratne Banda)

District	—	Polonnaruwa
Electorate	—	Polonnaruwa
Agroclimatic Zone	—	Dry Zone

This seed garden was established under the East Coast Rehabilitation Project of the Coconut Development Authority financed by the European Economic Community, and will produce CRIC–60.

Work on the seed garden commenced in the latter part of 1985. Sixty acres were planted with CRIC-60 by end of 1986.

Table —8.1 *Area Statement, Maduru Oya Seed Garden.*

	Hectares	*A.*	*R.*	*P.*
Coconut	24.28	60	0	00
Unplanted	38.45	95	0	00
Jungle	18.21	45	0	00
Buildings, roads etc.	4.05	10	0	00
	84.99	210	0	00

Rainfall records are not available for 1986. However, the seed garden received an average rainfall.

Activities :

(i) New Planting : Planting out commenced at the beginning of the year with seedlings raised out of CRIC - 60 seednuts from Ambakelle Seed Garden. Planting was done on 7.6 m equilateral triangular system. 4320 seedlings, covering a land area of 60 acres, had been planted by end of the year.

(ii) Manuring : YPM was applied at 1½ times the recommended dose (750 g/seedling) to all the seedlings after six months of planting. 1300 seedlings received their second dose of fertilizer at 900 g YPM.

(iii) Weed control : Weeds were kept under control in planted areas. A well established cover crop had been very helpful in the control of weeds.

(iv) Soil and moisture conservation : Contour drains were opened in 40 acres (2394 fathoms). About 500 fathoms of natural drains were cleared and maintained. Seedlings were mulched with salvinia collected from the nearby reservoir. Completed planting 50 acres of cover crops.

(v) Fences : Boundary fence was maintained in good order. 1245 fathoms of concrete fence had to be shifted due to the change of boundaries.

(vi) Roads : A roadway system was marked. The roads coming in the planted area were improved. 425 fathoms of main estate road was surfaced with gravel and consolidated up to a width of 20 ft.

(vii) Pests and diseases : Recommended preventive measures were taken. No incidence of pests and diseases was reecorded.

(viii) Nursery : A nursery was established to raise seedlings for future planting 5000 CRIC - 60 seednuts were laid of which 2000 sprouted nuts were transferred into polybags.

(ix) Elephant damage : Regular and frequent visitations of wild elephants continued. Strict vigilance and timely action had prevented any damages of serious nature. Uncleared jungle was underbrushed as wild elephants were using it as a hiding ground. However, towards the latter part of the year the paddy fields surrounding the seed garden were cultivated and this had helped in minimising the elephant damage.

(x) Vehicle, machinery etc.: A major repair was done to the jeep. Other machinery and equipment were maintained in good order. A tractor driven grass cutter ("Rotaslasher") was received. An iron safe, filing cabinet, steel cupboard, wall clock and a calculator were received for the office.

(xi) Buildings : Building programme could not be completed as the contractor had abandoned the work and deserted the site. Only two of the grade II quarters were completed.

8. Minneriya Research and Demonstration Farm, Minneriya

(Officer-in-Charge, Mr. M. P. W. Fernando)

District	—	Polonnaruwa
Electorate	—	Polonnaruwa
Agroclimatic zone	—	Dry zone

Table 9.1 — *Area Statement.*

	Hectares	*Acres*
Planted	8.90	22
Cleared area	12.55	31
Uncleared area	29.14	72
	50.59	125

Table 9.2 — *Census of palms.*

	Field No. I	*Field No. II*	*Total*
Ordinary Tall	24	—	24
Tall x Tall	241	1000	1241
Dwarf x Tall	239	—	239
Tall (Moorock)	224	—	224
Dwarf Red	15	—	15
Total	743	1000	1743

Plantation in field No. 1 is about 4 years old. Five of the dwarf × tall seedlings have come into flowering. Seven dwarf reds are in bearing. Field No. 2 was planted this year.

Rainfall records are not available. However the farm received an average rainfall during the year.

Activities

(i) **New Planting :** 25 ac in field No. 2 were prepared for planting and 12 ac were planted with 1000, Tall × Tall seedlings in 7.6 m triangular system.

(ii) **Manuring :** Flowering palms were fertilized with APM at 1 1/2 kg each season. Rest of the old seedlings not in flower were fertilized with YPM at 900 g per season.Dolomite was applied at 3 kg for all the seedlings completing four years. Seedlings below four years were fertilized with YPM according to their age.

(iii) **Weed control :** Planted area was weeded three rounds during the year.

(iv) **Soil and moisture conservation :** Contour drains were opened in 25 ac prepared for planting in field No. 2. Seedlings were mulched with available material such as paddy straw, weed trash. Cover crop (*Pueraria phaseoloides*) seeds were planted in about 10 ac of new planted area in field No. 2.

(v) **Watering :** Seedlings were irrigated during the dry season at about 201 seedling once in four days.

(vi) **Fences :** Boundary fence was frequently damaged by wild elephants. However, it was regularly repaired and kept in good order.

(vii) **Roads :** Farm has about 3 km of roadways. These were cleaned thrice and maintained satisfactorily.

(viii) **Pests and diseases :** Recommended preventive measures were taken. Incidences of pests and diseases were not recorded.

(ix) **Wind barrier :** Arrangements were made to establish rows of Eucalyptus plants one in every ten rows of coconuts. Work on this was started late and 2000 Eucalyptus seedlings were planted in 1.5 m triangular system (double row).

(x) **Elephant damage :** Wild elephants continued to visit and damage young palms. However, the damages were comparatively less during this year.

(xi) **Vehicles, machinery, etc. :** Jeep, tractor, hand tractors and other implements were maintained in good order.

(xii) **Buildings :** Buildings were well maintained. Grade II quarters occupied by the Coconut Development Authority was vacated and handed over to CRI.

8. Passekudah Research and Demonstration Farm, Kalkudah

Assistant Farm Manager — Mr. A. Thavaratnarajah

District	—	Batticaloa
Electorate	—	Kalkudah
Agroclimatic zone	—	Dry zone

Table 10.1 — *Area Statement*

	Hectares	*A*	*R*	*P*
Evaluation of cultivars	2.43	6	0	00
Irrigation trial	1.82	4	2	00
Shade cropping and mulching trial	0.91	2	1	00
Drought tolerance trial	2.02	5	0	00
Coconut varieties	0.46	1	0	25
Coconut (non experimental)	24.69	61	0	00
Horticultutal crops	0.81	2	0	00
Mango plantation	0.81	2	0	00
Cashew plantation	1.27	3	0	00
Buildings	2.02	5	0	00
Rocks	1.29	3	1	29
Roadways	1.66	4	0	17
Uncultivated	7.11	17	2	11
Total	47.40	117	0	19

Table 10.2 — *Census of Palms*

	Field A	*Field B*	*Field C*	*Field D*	*Total*
Bearing	—	8	28	179	215
Young palms	358	1642	563	956	3519
Vacancies	344	456	294	230	1324
Total	702	2106	885	1365	5058

Table 10.3 : *Rainfall*

	1985		1986	
	mm	*wet days*	*mm*	*wet days*
January	113	10	442	14
February	66	5	154	8
March	86	4	266	13
April	55	3	22	2
May	0	0	26	3
June	0	0	0	0
July	130	6	58	4
August	12	3	6	3
September	50	4	28	6
October	103	8	123	15
November	258	11	242	13
December	148	10	377	22
Total	1021	64	1744	103

A long period of drought accompanied by strong dry winds was experienced from April to September.

Yield particulars

Out of the 215 palms that came into bearing, 126 mature nuts were harvested in two picks out of 25 palms, all from the Genetics trial in field D.

Rejection percentage — 25.5.

Activities

Farm could not be visited by officers from the Head Office due to terrorist activities in the region. Progress of activities could not be reviewed physically.

Field operations were kept at their minimum just enough to maintain the plantation. Farm was weeded two rounds during the year. Perimeter fence was cleaned and maintained. Only the main roads were weeded in two rounds. Fertilizer was applied as recommended in two split doses.

Samples and necessary data on experiments were collected by the officer in charge and sent to the Head Office.

One two-wheel tractor was robbed by the terrorists Rest of the valuable machinery and equipment were transferred to Head Office

REPORT OF THE ADMINISTRATION DIVISION

Deputy Director (Adm. / Finance) — D. N. B. Perera B.Sc.

1. GENERAL

Mr. J. M. D. Jayaweera, Deputy Director (Adm. & Fin.) left the services of the Institute on 26 August.

Mr. D. N. B. Perera, Additional Deputy Director (Adm. & Fin.) was appointed Deputy Director (Adm. & Fin.) on 27 August.

The following appointments were made :

Mr. D. N. B. Perera	—	Additional Deputy Director (Adm. & Fin.) on 05 February.
Mr. T. H. G. A. G. Perera	—	Accounting Assistant, 01 August.
Miss U. I. Gunasekara	—	Clerk/Typist, on 03 February.
Mrs. M. Rodrigo	—	Clerk/Typist, on 03 February.
Mr. M. Chandrasoma	—	Supervisor, on 01 October.
Mr. M. J. J. A. Mirando	—	Tractor Driver, on 15 May.
Mr. Neil Luxman	—	Tractor Driver, on 15 May.
Mr. G. Witanage	—	Superintendent, on 15 July.
Mr. P. B. A. Wijesekera	—	Field Officer, on 15 July.
Mr. R. A. J. R. Perera	—	Research Assistant, on 01 September.
Dr. A. M. J. C. Wijesinghe	—	Research Assistant, on 01 September.
Miss M. G. F. S. Ferdinandis	—	Research Assistant, on 01 September.
Mr. A. A. K. Amarasinghe	—	Carpenter, on 01 September.
Mr. M. Dhanapala	—	Mason, on 01 September.
Mr. K. B. Dasanayake	—	Research Assistnat, on 02 September.
Miss I. J. S. Kondasinghe	—	Research Assistant, on 02 September.
Mr. W. G. A. Ratnasiri	—	Research Assistant, on 02 September.
Mr. L. P. Vidhana Arachchi	—	Research Assistant, on 08 September.
Miss S. P. Suriyapperuma	—	Research Assistant, on 01 October.
Miss L. K. Periyapperuma	—	Research Assistant, on 01 October.
Mr. T. R. W. Weralupitiya	—	Technical Assistant, (Photography), on 07 November.

The vehicles, their management and maintenance were centralized with the establishment of a Transport Section in the Establishment Unit in January.

Cadre

The staff position of the Coconut Research Institute at the end of December, 1986 was as follows :

Grade	*Class*					*Ungraded*	*Total*
	Sp	*I*	*II*	*III*	*IV*		
Executive	02	04	11	28	09	—	54
Technical	09	10	45	—	—	—	64
Intermediate	01	01	05	—	—	—	07
Clerical & Allied	07	07	43	—	—	—	57
Operative	04	12	51	—	—	—	67
Minor	28	61	74	—	—	—	163
Unclassified							
Drivers	02	07	33	—	—	—	42
Watchers	—	—	—	—	—	25	25
Total	53	102	262	28	09	25	479

2. PROMOTIONS & NEW APPOINTMENTS

Internal Promotions

Mrs. M. J. Ariyadasa, Stenographer (English), from Intermediate Grade Class I to Special Class, with effect from 01 January, 1984.

Mr. J. D. Ratnasekera, Clerk/Typist, from Clerical & Allied Grade Class I to Special Class, with effect from 01 January, 1984.

Mr. K. V. W. de Silva, Field Assistant, from Operative Grade Class I to Special Class, with effect from 01, January, 1984.

Mr D. M. Jayakody. Field Assistant, from Operative Grade Class I to Special Class, with effect from 01 January, 1984.

Mr. S. A. Cyril Appuhamy, Driver, from Drivers Grade Class I to Special Class, with effect from 01 January, 1984.

The following officers were promoted from Minor Grade; Class I to Special Class with effect from 01 January, 1984,

Mr. J. M. C. E. Appuhamy
Mr. M. Somapala
Mr. K. G. Dhanapala
Mr. K. S. A. J. Fernando
Mr. M. A. Perera
Mr. W. W. S. A. Fernando
Mr. D. E. P. R. Wijetunga
Mr. W. F. Tissera
Mr. W. R. O. Fernando.

Mrs. N. H. R. M. de Silva, Technical Assistant, from Technical Grade, Class II, to Class I with effect from 01 January 1984.

Miss W. P. K. K. Croos, Technical Assistant, from Technical, Grade Class II, to Class I with effect from 01 January 1984.

Mr. R. P. Victor, Clerk, from Clerical & Allied Grade, Class II, to Class I with effect from 01 January 1984.

The following officers were promoted from Operative Grade, Class II, to Class I with effect from 01 January 1984.

Mr. A. M. Ranasinghe Banda
Mr. R. M. Dayaratne
Mr. A. Wilson

Mrs. T. M. Alice Silva, Gardener, from Minor Grade, Class II, to Class I with effect from 01 January 1984.

Mrs. A. P. Elizabeth Pinto, Gardener, from Minor Grade, Class II, to Class I with effect from 01 January, 1984.

Internal Appointments

Mr. P. A. H. N. Appuhamy, Assistant Publications/Publicity Officer, to Executive Grade, Class III, as Assistant Information Officer, with effect from 01 January.

Mr. M. Sisira Perera, Field Assistant, to Operative Grade, Class II, as Supervisor (Estates Management) with effect from 01 February.

Mr. D. G. Manamudali, Assistant Accountant, to Executive Grade, Class II, as Internal Auditor with effect from 17 March.

Mr. K. P. C. Fernando, Field Assistant to Operative Grade, Class I, as Supervisor (Estates Management) with effect from 02 May.

Mr. R. M. Dayaratne, Foreman (Building) to Technical Grade, Class II, as Foreman (Building) with effect from 01 July.

3. RETIREMENTS, RESIGNATIONS AND DEATHS

Retirements

Mr. R. A. Nawatheris Appuhamy, Office Attendant, Establishment Unit, with effect from 13 March.

Mr. W. K. J. Fernando, Gardener, Estates Management Division, with effect from 28 April.

Mrs. T. M. Alice Silva, Gardener, Estates Management Division, with effect from 25 July.

Mrs. A. P. Elizabeth Pinto, Gardener, Estates Management Division, with effect from 08 August.

Mr. J. H. Amarasekera, Watcher, Establishment Unit, with effect from 20 September.

Mr. W. M. Francis Fernando, Driver, Establishment Unit, with effect from 20 September.

Mrs. K. A. Engaltinahamy, Gardener, Estates Management Division, with effect from 30 November.

Vacation of Post

Mr. W. C. C. Fernando, Lab & Field Attendant, Genetics & Plant Breeding Division, with effect from 19 February.

Resignations

Mr. A. E. M. Karunaratne, Pollination Labourer, Genetics & Plant Breeding, Division, with effect from 01 February.

Mr. M. T. Siridasa, Lab & Field Attendant, Genetics & Plant Breeding Division, with effect from 11 March.

Mr. P. A. N. Ratnayake, Research Assistant, Coconut Processing Research Division with effect from 23 March.

Mr. M. H. Karunadasa, Lab & Field Assistant, Genetics & Plant Breeding Division, with effect from 02 April.

Mr. S. M. H. Samarasinghe, Clerk, Estates Management Division, with effect from 30 April.

Mr. D. B. Hettiarachchi, Technical Assistant (Photography), Information Unit with effect from 30 June.

Mr. W. M. George Jayapala, Office Attendant, Accounts Unit, with effect from 31 July.

Miss N. W. V. Kumudini, Clerk/Typist, Engineering Unit, with effect from 29 September.

Mr. H. M. Dharmasena, Clerk, Accounts Unit, with effect from 31 October.

Mr. B. J. A. F. Mendis, Senior Technical Assistant, Soils & Plant Nutrition Division, with effect from 01 December.

Mr. M. R. S. Fernando, Superintendent, Estates Management Division, with effect from 31 December.

Deaths

Mr. D. M. W. Mendis, Conservancy Labourer, on 13 July.

4. WELFARE

(a) The Coconut Research Institute Recreation Club, Art Circle, Death Donation Society and Catholic Association continued to make satisfactory progress during the year.

The Coconut Research Institute Multipurpose Co-operative Society Ltd. expanded its activities in granting financial assistance to the members.

(b) Financial Aid

(1) Provident Fund

The loans from the Provident Fund to employees amounted to Rs. 3,183,193.00

(2) Distress Loans

Distress loans to employees amounted to Rs. 570,396.00.

(3) Transport Loans

Transport loans to employees amounted to Rs. 58,075.00.

5. OTHER ACTIVITIES OF THE ADMINISTRATION DIVISION

Transport Section

The Transport Section administered the drivers and upkeep of vehicles. The vehicle fleet at the end of the year was as follows:

Cars	06
Buses	02
Jeeps	21
Lorries/Double Cabs	08
Vans	02
Total	39

During the year, two new double cabs were purchased.

Accounts Unit

The Accounts Unit continued to service the Institute in the usual manner. The total expenditure during the year was Rs. 27.6 million. The capital assets at the end of the year was Rs. 35.1 million.

In 1986, two Public Auctions were held to dispose of the unwanted and condemned articles. An accounting firm was contacted to carry out a survey of capital items of the Institute, inventorize them and to update the fixed assets register.

M/s. Management Services Ltd. continued to handle the staff salaries in their computers.

Engineering Unit

The Engineering Unit continued to provide maintenance services for the Institute's buildings and other amenities. Civil works amounting to about Rs. 2 million were undertaken during the year. Civil/Electrical works costing more than Rs. 100,000 are as follows:

- Construction of access road, security fence and guard room.
- Electrical installation/service connections to buildings at Bandirippuwa Estate.
- Colour washing of CRI buildings at Bandirippuwa Estate.
- Construction of a road in front of the main building.
- Refurbishing of Soils Laboratory.
- Construction of houses and other buildings at Maduruoya and Makandura Seed Garden.
- Supply of laboratory furniture.
- Construction of Engineering Office Complex at Bandirippuwa Estate.
- Water supply scheme at the Isolated Seed Garden.
- Electrification at Makandura Seed Garden, Walpita Estate and Ratmalagara Estate.