THE
RUBBER RESEARCH INSTITUTE OF CEYLON

ANNUAL REVIEW FOR 1971

CONTENTS

NOTICE

SRI LANKA (CEYLON) RUBBER CONFERENCE 1973

A two-day conference on the recent developments in the production and processing of natural rubber, organised by the Rubber Research Institute of Sri Lanka (Ceylon), will be held in Colombo on 19th and 20th April 1973.

It is expected that, in addition to the members of the Institute staff, a number of eminent scientists from overseas will read papers at this conference.

Further communication will follow.

THE RUBBER RESEARCH INSTITUTE OF CEYLON

BOARD OF MANAGEMENT
(As at 31st December, 1971)

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The Director of Agriculture—Mr. P. T. Jinendradasa, B.Sc. (Lond.), C.A.S.

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The Rubber Controller—Mr. C. Chanmugam, B.Sc. (Cey.), A.R.I.C., C.A.S.

The Director, Rubber Research Institute of Ceylon—Dr. O. S. Peries, B.Ag. Sci. (Melb.), Ph.D. (Bristol), M.I. Biol. (*Vice-Chairman*)

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Mr. D. Jayasiri Perera

Member representing smallholders under the Rubber Research Ordinance

Mr. R. P. Amarasinghe

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Mr. H. G. R. de Mel
Mr. D. Jayasiri Perera
Mr. C. Chanmugam
Mr. C. A. Coorey
Dr. O. S. Peries

Estate Committee:

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Mr. H. G. R. de Mel
Mr. R. F. Poulier
Mr. D. Jayasiri Perera
Mr. Rajah Salgado (co-opted)
Dr. O. S. Peries
Mr. L. C. de Mel (co-opted)
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Mr. R. F. Poulier
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Mr. M. C. C. Fernando (co-opted)
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Mr. H. H. Peiris (co-opted)

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Mr. C. Chanmugam
Mr. H. G. R. de Mel
Mr. D. Jayasiri Perera
Dr. O. S. Peries
Heads of Scientific Departments (co-opted)
Mr. Douglas de Fonseka (co-opted)
Mr. L. H. T. de Mel (co-opted)
Mr. W. L. Bogtstra (co-opted)
Mr. A. H. B. Kalpagé (co-opted)
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Mr. R. F. Poulier
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Selection Committee:

Mr. D. B. Ellepola
Mr. C. Chanmugam
Mr. H. G. R. de Mel
Dr. O. S. Peries

Special Committee:

Mr. D. B. Ellepola
Mr. H. G. R. de Mel
Dr. O. S. Peries
Mr. M. Nadarajah (co-opted)
Mr. E. L. Straarup (co-opted)
Mr. P. I. Pieris (co-opted)
Mr. A. M. S. Perera (co-opted)

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Dr. O. S. Peries
Mr. A. B. Dissanayake
Mr. J. D. S. Wickremaratne
Mr. K. M. U. Jayanetty (Secretary)

Secretary to the Board

Mr. K. M. U. Jayanetty, B.A. (Lond.)

Lawyers

F. J. & G. de Saram,
Proctors, P. O. Box 212, Colombo.

Auditors

Wickremasinghe & Co.,
Chartered Accountants,
Mackinon Building, York Street, Colombo 1.

Bankers

Bank of Ceylon, York Street, Colombo 1.
People's Bank, Matugama.

Registered Office and Laboratories

Dartonfield, Agalawatta.

Smallholdings Department and Board Office

74, Davidson Road, Colombo 4.

THE RUBBER RESEARCH INSTITUTE OF CEYLON

STAFF

(As at 31st December, 1971)

Director .. O. S. Peries, B.Ag.Sci. (Melb.), Ph.D. (Bristol), M.I. Biol.

RESEARCH DEPARTMENTS

Botany

Head of Department .. L. B. Chandrasekera, B.Sc. (Cey.), Dip. Ag. Sci. (Cantab.)

Botanist .. R. Satchuthananthavale, B.Sc. (Madras), M.A. (Madras), Ph.D. (Sheffield)

Assistant Botanists .. *U. P. de S. Waidyanatha, B.Sc. (Cey.), M.Sc. (Cey.)
*Miss A. C. I. Yahampath, B.Sc. (Cey.)

Senior Technical Assistant .. W. G. V. Fernando

Technical Assistants .. I. Amarasinghe
J. G. de Mel
L. S. S. Pathiratne

Field Assistants .. D. A. Brahakmana
D. R. Colonne
R. B. Gunaratne
S. Kodikara
U. K. D. Lewis
W. T. Silva
S. Wilbert

Genetics & Plant Breeding

Head of Department .. D. M. Fernando, B.Sc. (Cey.), M.Sc. (McGill)

Assistant Geneticists .. *N. E. M. Jayasekera, B.Sc. Ag. (Cey.)
C. M. B. Ratnayake, B.Sc. (Cey.)

Technical Assistants .. M. S. C. de Silva
P. Samaranayake

Senior Field Assistant .. H. B. H. de Silva

Field Assistants .. D. S. Gamage
B. M. S. G. Peiris
A. K. M. S. Senaratne
W. A. C. Wijesinghe

Plant Pathology

Acting Head of Department	..	O. S. Peries, B.Ag.Sci.(Melb.),Ph.D.(Bristol), M.I. Biol.
Plant Pathologist	..	Mrs. V. Satchuthananthavale, B.A. (Madras), M.Sc. (Madras), Ph.D. (Sheffield)
Assistant Plant Pathologists	..	*A. de S. Liyanage, B.Sc. Ag. (Cey.) G. W. Liyanage, B.Sc. Ag. (Cey.)
Senior Technical Assistant	..	T. M. Fernando
Technical Assistants	..	D. M. Dantanarayana W. C. Dayaratne L. Halangoda Z. E. Irugalbandara S. S. Jayasuriya A. R. D. Sebastian

Soils Chemistry

Acting Head of Department	..	O. S. Peries, B.Ag.Sci. (Melb.),Ph.D.(Bristol), M.I. Biol.
Soils Chemists	..	R. S. John, B.Sc. Ag. (Cey.), Ph.D. (Aberdeen) C. G. Silva, B.Sc. (Cey.), M.S. (Hawaii)
Assistant Soils Chemist	..	N. Yogaratnam, B.Sc. Ag. (Alhabad)
Senior Technical Assistant	..	T. Kanthasamy
Technical Assistants	..	B. P. M. Arsecularatne G. N. de Silva A. M. A. Perera H. A. Seemon F. P. W. Silva L. J. Wickremasinghe
Field Assistants	..	W. M. Abeysinghe A. D. M. Karunaratne M. A. Mendis K. S. A. C. Peiris J. Wijenayake

Rubber Chemistry

Head of Department	..	M. Nadarajah, B.Sc. (Cey.), M.Sc. (Birm.), A.I.R.I.
Consultant in Polymer Science & Technology	..	Prof. Gerald Scott, M.Sc.
Rubber Chemist	..	S. W. Karunaratne, B.Sc. (Cey.), M.Sc. (Aston), A.R.I.C., A.N.C.R.T., A.I.R.I.

Assistant Rubber Chemists	..	*A. M. A. Amarapathy, B.Sc. (Cey.) *B. Boyd Cooray, B.Sc. (Cey.) *M. R. N. Fernando, M.Sc. (Moscow) *R. Tharmalingam, B.Sc. (Cey.) *G. Varathungarajan, B.Sc. (Cey.), M.Sc. (Aston) *P. A. J. Yapa, B.Sc. (Vidyodaya, Cey.)
Assistant Development Officers	..	*A. Coomaraswamy, B.Sc. (Cey.) D. S. Muthukuda
Assistant Specifications Officer	..	*L. M. K. Tillakeratne, B.Sc. (Cey.)
Senior Technical Assistant	..	Vacant
Technical Assistants	..	A. S. Dekumpitiya (covering duties of S.T.A.) K. P. N. de Silva W. D. Dharmasena L. S. Goonawardena P. P. Jayasinghe, L.I.R.I. S. Kasinathan J. Kirubakaran D. D. Medagama H. Narangoda K. A. Piyadasa
Specification Assistants	..	T. M. Ahamadeen M. D. C. Seneviratne W. A. S. Wijesekera

Rubber Processing Unit

Industrial Adviser (Rubber)	..	S. Hansen, M.Sc. (Chem. Eng.)
Adviser in Block Rubber	..	Ellis Findlay
Project Manager	..	M. T. Veerabangsa
Divisional Advisory Officer	..	M. B. Dissanayake
Assistant Development Officer	..	W. S. E. Fernando, B.Sc. (Cey.)
Senior Technical Assistants	..	*E. G. Mendis *S. K. Samaraweera
Technical Officers	..	S. H. Pandithasekera R. P. Dharmasena
Rubber Instructor	..	*K. Ekanayake
Field Officers	..	U. R. N. Bandaranayake M. R. Karunaratne Banda
Clerk	..	M. J. Abeysinghe

Statistical Section

Assistant Statistician	..	G. A. J. P. R. Gunasekera, B.Sc. (Cey.), Dip. Stat. (Vidyodaya, Cey.)
Technical Assistants	..	L. T. Peiris S. L. Weerasinghe

EXTENSION SERVICES

Estates Advisory Department

Head of Department	..	A. B. Dissanayake, B.Sc. Ag. (Cey.), B.A. (Cey.), M.Sc. (Cey.)
Assistant Advisory Officers	..	A. Dahanayake, B.Sc. Ag. (Cey.) H. T. Wickremasekera, B.Sc. Ag. (Cey.) R. A. Wijewansa, B.Sc. Ag. (Cey.)
Assistant Agricultural Economists	..	*G. R. Chandrasiri, B.Sc. Ag. (Cey.) *S. K. W. Jayasooriya, B.A. Econ. (Cey.)
Junior Clerk/Typist	..	H. B. de Silva

Smallholdings Department

Chief Advisory Officer (Smallholdings)	..	H. H. Peiris
Deputy Chief Advisory Officer (Smallholdings)	..	*R. P. M. de Zoysa, B.Sc. (Cey.), M.Sc. (Oregon)
Divisional Advisory Officers (Smallholdings)	..	W. S. Dassanayake (R.I. acting for D.A.O.S.) B. D. Pedrick D. R. Ranwala K. P. Siriwardene D. B. Weligodapola J. D. S. Wickremaratne L. A. Wijesinghe D. R. Wijesuriya (R.I. acting for D.A.O.S.)
Office Assistant	..	R. A. Somadasa
Chief Clerk	..	C. Jayasinghe
Accounts Clerk	..	K. J. L. Perera, F.S.A.A., A.C.B.I.
Clerk-Translators	..	W. A. A. Perera I. L. Sirisena
Artist Clerk	..	M. J. P. Lusena
Clerks	..	R. E. Perera A. Wijesinghe

Junior Clerk/Typists	..	Mrs. N. K. Ekanayake
		Miss M. A. P. P. Seneviratne
Rubber Instructors	..	W. D. Abeysena
		D. L. Abeysinghe
		M. D. Albert
		H. A. D. Ariyaratne
		K. I. Ariyaratne
		S. D. Athukorala
		P. W. David
		W. E. W. de Mel
		A. J. L. de Silva
		H. R. Dias
		J. M. E. Dissanayake
		P. I. N. Fernando
		R. Gunadasa
		W. W. Gunasekera
		U. D. V. Gunasinghe
		R. K. Gunatilake
		G. Gunawardene
		B. A. Gurusinghe
		G. P. G. S. Hapugoda
		R. B. Heendeniya
		T. B. Herath
		D. Hettiarachchi
		S. D. Hidellarachchi
		T. W. Jayalath
		A. K. Jayatissa
		W. D. Jayawardene
		L. S. Kasturiratne
		N. C. Katukurunda
		K. S. Kodikara
		D. D. Kotalawala
		E. N. Liyanage
		P. R. Nonis
		D. Palihakkara
		M. P. V. P. S. Perera
		U. L. C. Perera
		S. C. Rajasinghe
		R. M. B. Ranasinghe
		D. J. Ratnayake
		W. D. D. Rupasinghe
		M. C. Samarasekera
		G. Senarath
		R. G. Siripala
		U. S. Somapala
		J. H. Suaris
		J. Sumanasekera
		O. M. W. Tilekeratne
		C. Wickrematilake
		W. A. S. Wijesekera
		D. U. Wijesinghe
		V. Wijesinghe
		W. M. D. Wijesundera
		R. P. D. J. Wijewardena

Rubber Instructors (Publicity Unit)	..	A. Suriyaarachchi U. S. Wijeyapala
Mechanic	..	K. A. Siripala

Correspondence and Accounts Sections

Chief Administrative Officer and Secretary to the Board	..	K. M. U. Jayanetty, B.A. (Lond.)
Accountant	..	M. E. A. Peiris, Dip. Acc. (Cey.)
Assistant Administrative Officer	..	S. M. J. Neangoda, B.A. Econ. (Cey.)
Office Assistant	..	J. A. Attygalle
Accounting Assistant	..	E. P. D. Roberts, F.C.B.I. (Lond.)
Personal Assistant to the Director	..	P. Samarasinghe
Chief Clerk	..	W. D. Jayawansa
Establishment Clerk	..	D. G. Udawatta
Book-keeper	..	A. K. D. Amaradasa
Foreign Order Clerk	..	K. G. A. K. Dharmawardena
Clerk/Typists	..	J. D. Gunaratne G. P. A. I. G. Pathirana T. H. Wijesena
Junior Clerk/Typists	..	Miss A. P. A. Amarasinghe Miss D. T. Baranasuriya Miss M. M. B. R. J. Cooray Miss G. R. H. de Alwis Miss L. J. C. Ranasinghe Miss W. Sellamuttu Miss R. S. Seneviratne L. Andrew Silva Mrs. D. F. Thambawita
Accounts Clerks	..	L. W. S. C. de Silva N. de Silva A. L. Gunawardene K. D. D. Navaratne J. H. C. S. Perera A. L. Ratnayake B. H. Withanachchi
Junior Accounts Clerk	..	R. L. Fernando

Store-keeper	..	D. P. W. Goonesekera
Stores Assistant	..	M. H. C. Ariyaratne, L.C.I.A.
Cashier	..	D. C. A. D. B. de Silva
Clerk cum Steno/Typist (Board Office)	..	P. H. Seneviratne

Library

Librarian & Publications Officer	..	Vacant
Library Assistant	..	W. Ranasinghe
Library Clerk	..	D. C. Thambawita
Junior Clerk/Typist	..	Mrs. I. Swaris

Works Section

Works Engineer	..	P. C. J. F. Keerthisinghe
Electrical Foreman	..	K. C. L. Fernando
Mechanical Foreman	..	M. M. Anderson
Building Foreman	..	W. S. J. Benjamin
Transport/Stores Assistant	..	B. D. Ponnamperuma
Clerk/Typist	..	D. D. D. Adikaram
Junior Clerk/Typist	..	N. Jayasekera
Workshop Charge-hand	..	W. D. Dharmawardena

ESTATES

Dartonfield Group

Estate Superintendent	..	S. de S. Daluwatta
Assistant Estate Superintendent		M. R. T. Mendis
Office Assistant	..	A. C. Swaris
Chief Clerk	..	B. H. Rodrigo
Accounts Clerk	..	D. A. Rajapakse
Junior Assistant Clerks	..	G. S. Doolwela G. Kannangara
Senior Field Assistant	..	L. P. de Mel

Factory Assistant	..	O. de Alwis
Estate Medical Assistants	..	M. C. Peiris G. J. A. Silva
Field Assistant	..	H. A. Haramanis
Field Officer	..	A. Jayasena
Assistant Rubber Maker	..	S. Hettiarachchi
School Teachers	..	Mrs. K. P. Goonawardene D. L. W. Lionel S. Nadarajah
Asst. Nursery Manager	..	L. H. Samaranayake

Kuruwita Sub-station

Visiting Superintendent	..	S. M. Dias
Senior Field Assistant	..	M. C. Perera

Note: Names of officers of a single group under each department have been alphabetically listed.

* on study leave overseas.

THE RUBBER RESEARCH INSTITUTE OF CEYLON

DIRECTOR'S REVIEW FOR 1971

BY

O. S. PERIES

General

The adoption of uniform, international technical specifications for natural rubber (NR) will be a reality within a few years. Ceylon can justly be proud of the part it played in achieving this, as the decision to adopt uniform specifications in all NR producing countries was taken at the meeting of Chief Executives and Directors of Research of the International Rubber Research and Development Board, held in Colombo from 16 — 19 June 1971. The meeting also agreed that :

(*a*) multilateral and bilateral exchanges of *Hevea* clones be organised without restrictions ;

(*b*) co-operation on plant breeding be free and uninhibited ;

(*c*) periodic visits between plant breeders and selectionists of member institutes be encouraged ; and

(*d*) the Rubber Research Institute of Malaya be appointed the International Registration Authority for *Hevea* cultivars.

These were important decisions which will have far reaching effects on NR production, as the basis for a united NR front has now been established.

The problem of low rubber prices loomed large in the minds of all NR producers during 1971. The reasons for the low prices were many : the dock strikes in America — West coast docks were closed for over three months and those in the East for more than two months ; economic recessions in many countries ; and the return of Indonesia on a large scale into the NR market being some of them. It would appear that the price of NR will improve to a certain extent in the months to come; but the long term prospects for rubber lie in increased production at a competitive price range of 80 to 90 cents. The strategy for NR should be to gain a considerable proportion of the ever increasing consumption of all rubbers in the world market.

The proportion of NR consumed in 1960 as a percentage of the total rubber consumption was 50%; in 1970 this had dropped to 38% and in 1980 this is expected to drop further to 35%. However, it must be remembered that the total world consumption of rubber in 1970 was 7.4 million tons of which 2.9 million tons were NR. The total rubber consumption in 1980 is expected to be 13 million tons, of which 5 million tons can be NR, if the latter retains a proportionate share of the market. NR at competitive prices must be available when it is required ; if adequate supplies are not available, then synthetic rubbers (SR) will fill the gap in demand. Therefore, not only should the total production of NR be increased, but this should be achieved at lower cost, and there should be a continuous effort to improve the

technical qualities and consistency of NR to suit the demands of the manufacturing industries overseas.

The present inflationary tendencies in the world, are likely to affect SR manufacturers, with their high and constantly rising costs, more than plantations, where costs can be pruned with increased efficiency and the higher yields made possible by improved varieties and stimulants. Europe's biggest SR producer has recently recorded a 10% increase in the cost of raw material, which accounts for 70% of the company's total costs. Mr. Ralph Lamberson, Head of the International Institute of Synthetic Rubber Producers has written : " One of the keys to unlocking the future of synthetic rubber will be the development of a capability to make isoprene monomer, the feedstock for polyisoprene, cheaper so that polyisoprene can move in more strongly on natural rubber, with which it competes directly in many applications ". However, producing the isoprene monomer more cheaply, when world oil supplies are diminishing rapidly will be no easy matter. Two major American SR producers have admitted losses during the year and the Shell Chemical Company has closed its SBR plant in the U.S.A. Polymer Corporation of Canada has curtailed SBR production, and so have some German and Japanese producers. Several companies have reported the replacement of SBR and of cis-polyisoprene by NR on the basis of price. Therefore, the temporary low prices for NR may be beneficial in the long term and help stabilize the industry.

In this price war there is no doubt that the rate of replanting in high yielding clones of rubber must be stepped up in Ceylon. Here we come up against the disincentive of reigning low prices for the product — nevertheless, in the long term, the stability of the industry lies in replanting. The 1971 figure of below 10,000 acres replanted, compares very unfavourably with the early years of the Rubber Replanting Subsidy Scheme, when more than 20,000 acres were replanted per year. If the present trend in replanting continues, by 1985, when all the old rubber was scheduled to be replanted, there will still be about 200,000 acres to be replanted. The Government must take cognizance of this fact and take remedial action.

Research

General: A general specification laboratory for raw NR will be built in Colombo, and the Government has agreed to allocate a suitable area of land, at a site near the Ceylon Institute of Scientific & Industrial Research (CISIR), for this purpose. The sections of the Rubber Chemistry Department, dealing with the chemistry and technology of the product, too will be shifted to Colombo, in order to enable the fullest use of the valuable equipment which the Overseas Development Administration (ODA) of the British Government has agreed in principle to gift to the RRIC. The universities, the CISIR and the Tyre Corporation will be able to share the use of this equipment, when the shift is effected.

Botany : Experiments on clone PB 86, with a 10% solution of Ethrel in coconut oil, have given a 100% increase in yield, with no ill-effects in the first year. This material has also given very encouraging results in combination with low tapping intensities. The wider use of this stimulant, with the appropriate cultural practices, on areas being tapped on panels C and D should be considered by all estates.

There have been no adverse effects either on growth or yield during eight years of tapping of clones Nab 12 and PB 86, without the usual winter rest. These observations are applicable particularly to conditions that prevail in the wet low country districts. Daily tapping on a half spiral cut has given lower yields and DRCs in comparison with the usual S/2,d/2, 100% system on clones RRIC 7, 45, 52 and PB 86. Tapping with the Jebong knife has given yields comparable with those of the Michie-Golledge knife on clone RRIC 52.

Small scale trials carried out with a rainguard designed by the Botanist have given promising results. Experiments have indicated the feasibility of using dried bacterial cultures for field coagulation of latex. Callus cultures developed from anthers of *Hevea* flowers have been grown successfully on solid agar media.

Genetics & Plant Breeding : Large scale plots of RRIC 101 and RRIC 103 were brought into tapping at five years of age and showed very satisfactory yields and percentage of trees that could be tapped at a younger age than normal. A few seedlings were obtained with a combined source of SALB resistance. RRIC 102 yielded satisfactorily at Matale at an elevation of 1,400 ft. An inhibitor was isolated from rubber seed oil. A population of 3,000 seedlings from 31 different clonal sources was tested individually and 330 seedlings selected for further study.

Plant Pathology : The incidence of *Oidium* leaf disease was very heavy during the refoliating season, but those of *Phytophthora* and *Gloeosporium* leaf diseases were negligible during the S. W. monsoon season.

The results of field experiments on *Fomes* control have shown that the use of small quantities of sulphur in the planting holes, is not likely to have any retarding effect on growth of young trees. The indications are that the timber from the old stand can be kept back in replanted areas, where the incidence of *Fomes* in the old stand was low, as long as certain precautions are taken.

Two more effective species of bacteria were isolated from cup coagula for the coagulation of latex. Bacterial cultures, dried over silica gel and stored in polythene vials for varying periods of time, have been found to be effective for latex coagulation.

Soils Chemistry : A detailed soil survey of the Panadura - Horana one inch to a mile topographic map was started and more than half the area has been mapped. The studies on volatalization of urea showed that it was controlled by the moisture status and the texture of the surface soil.

Field experiments have indicated that variation in fertilizer practices in the mature phase does not affect yields. In two experiments high levels of fertilizer have given significant responses over the control. Two separate experiments have shown that potassium has a significant effect on yield and girth increment and a third that phosphorus has a linear effect on yield.

Studies on cover crops have shown that rubber plants grow better in areas planted with leguminous covers than those where volunteer plants are allowed to grow. Nursery experiments have confirmed that the current policy of applying a complete NPK+Mg mixture to young seedlings is correct and that the normal soil application of fertilizers is generally better than foliar applications.

Rubber Chemistry : A number of development projects to increase the uses of rubber and improve its technological properties have been undertaken and promising results have been obtained in the production of easy processing RSS by the addition of mineral oil to undiluted latex. Oxalic acid and sodium bisulphite have been shown to increase storage hardening of pale crepe, while RPA No. 3 reduces it. A suitable method for the manufacture of soluble chlorinated rubber from field latex has been devised. This material can be used for adhesives in paints and in printing inks. A form of crumb rubber, made by mixing field latex with paraffin wax, has been found to be suitable for mixing with bitumen for use in roads. Fresh field latex can be used to prepare rubber hydrochloride, but creamed latex has given

a faster reaction. Cyclised rubber masterbatch 90 : 10, which is a powder, was found to be suitable for use in injection moulding : the results were improved by substituting methyl methacrylate-grafted latex for NR latex when preparing the masterbatch. Oil-extended NR latex has been used to line irrigation channels to prevent seepage and for checking soil erosion, and shows promise for both purposes.

Rubber can be compounded with graphite as a lubricating agent, for improving the rheological properties of the compound in the uncured state. One promising application is in the preparation of stereos for flexographic printing.

Coagulation of latex by hydrochloric acid is feasible, but there are safety limits to be adhered to ; excessive degradation takes place if acid concentration exceeds 0·2%, based on dry rubber. This method is cheaper, however, than oxalic, formic or acetic acid coagulation, and does not alter the molecular characteristics or the technological properties of the rubber.

Rubber rainguards, based on the design of the rigiform rainguards currently used in Malaysia, were supplied by the CISIR and tested on eight rubber estates. The preliminary results of these experiments show promise.

Extension : The extension departments of the Institute, the Estates Advisory Department and the Smallholdings Department, continued to provide the middle class owners and smallholders with the necessary advice and practical assistance to improve their planting and manufacturing processes. The Estates Advisory Department in addition to its other duties carried out a number of surveys in different rubber growing areas to establish the feasibility of erecting factories to produce pale crepe in such areas. It also carried out a survey of all large and medium sized estates in the Kalutara and Kegalla Districts to assess the rate of replanting and establish the reasons for the increasing lack of interest in replanting. The Smallholdings Department paid special attention to the erection of Group Processing Centres (GPCs) to improve the quality of smallholders' rubber. The Department has done the preliminary work to build twenty GPCs in 1972.

Staff

The Director, the Heads of Departments and all the Senior and Intermediate Staff officers were on duty throughout the year, except Dr. R. S. John, who was away from office during the period 30-4-1971 — 28-8-1971.

In addition to his duties the Director overlooked the work of the Soils Chemistry and the Plant Pathology Departments from 1 May 1971.

The following officers were appointed to the Intermediate Staff Grade during the year :

Mr. A. M. A. Amarapathy, Assistant Rubber Chemist — 1 April
Mr. B. B. Cooray, Assistant Rubber Chemist — 1 April
Mr. L. M. K. Tillakeratne, Assistant Specifications Officer — 1 April
Mr. N. Scott, Assistant Development Officer — 1 June
Mr. W. S. E. Fernando, Assistant Development Officer — 15 September
Mr. S. K. W. Jayasooriya, Assistant Agricultural Economist — 2 October.

The following officers resigned from the services of the Institute during the year :—

Mr. D. E. F. Suraweera, Assistant Advisory Officer — 7 July
Miss S. M. Fernando, Librarian & Publications Officer — 31 March
Mr. N. Scott, Assistant Development Officer — 15 September
Dr. (Mrs.) M. Rajasingam, Rubber Chemist — 2 November.

The following officers proceeded abroad on scholarships during the year :—

Mr. N. E. M. Jayasekera, Assistant Geneticist — to U.K. on 15th September for post-graduate studies in Plant Genetics, at the University of Birmingham;

Mr. M. R. N. Fernando, Assistant Rubber Chemist — to U.K. on 21st September for a course of study and training in Polymer Chemistry, at the University of Aston;

Mr. B. B. Cooray, Assistant Rubber Chemist — to U.K. on 21st September for a course of study and training in Polymer Chemistry, at the Univeristy of Aston;

Mr. A. M. A. Amarapathy, Assistant Rubber Chemist — to U.K. on 21st September for a course of study and training in Polymer Chmistry, at the University of Aston;

Mr. G. R. Chandrasiri, Assistant Agricultural Economist — to U.K. on 1st October, for post-graduate training in Agricultural Economics, at the Wye College, University of London;

Mr. L. M. K. Tillakeratne, Assistant Specifications Officer — to Malaysia on 31st October, for a course or study and training in technical specification of natural rubber, at the Rubber Research Institute of Malaya;

Mr. R. M. P. de Zoysa, Deputy Chief Advisory Officer (Smallholdings) — to Malaysia on 31st October for a course of training in field operations for the upliftment of the rubber smallholders, at the Rubber Research Institute of Malaya;

Mr. E. G. Mendis, Senior Technical Assistant — to Malaysia on 31st October to follow the Processing Instructors' Diploma course, conducted by the Rubber Research Institute of Malaya;

Mr. S. K. Samaraweera, Senior Technical Assistant — to Malaysia on 31st October to follow the Processing Instructors' Diploma course, conducted by the Rubber Research Institute of Malaya;

Mr. K. Ekanayake, Rubber Instructor — to Malaysia on 31st October for a course of training in the collection of smallholders' latex at the Rubber Research Institute of Malaya.

All officers sent abroad for post-graduate studies and training received assistance under the Technical Co-operation Scheme of the Colombo Plan.

The following officers who were sent abroad earlier under the Colombo Plan scholarships continued their post-graduate studies :—

Mr. A. Coomaraswamy, Assistant Rubber Chemist, at the University of Aston;
Mr. A. de S. Liyanage, Assistant Plant Pathologist, at Wye College, University of London;
Mr. U. P. de S. Waidyanatha, Assistant Botanist, at the Imperial College, University of London;

Mr. G. Varathungarajan, Assistant Rubber Chemist, at the University of Aston;
Mr. P. A. J. Yapa, Assistant Rubber Chemist, at Bedford College, University of London;
Miss A. C. I. Yahampath, Assistant Botanist, at Wye College, University of London.
Mr. R. Tharmalingam, Assistant Rubber Chemist, at the University of Aston;
Mr. H. L. Munasinghe, Senior Technical Assistant, at the University of Exeter. This officer resigned from his post with effect from 10 November.

The salaried staff of the Institute as at the end of the year was as follows :

Officers in Grades I & II	..	15
,, ,, III	..	26
,, ,, IV to IX	..	189
,, ,, X to XIII	..	114
Total	..	344*

*includes the Institute staff seconded for service at New Rubber Processing Unit at Mawanella.

Visitors

The overseas visitors to the Institute included :—

Dr. G. F. Pegg, Wye College, University of London
Professor R. K. S. Wood, Imperial College, London
Minister of Foreign Trade of the People's Republic of China and Head of the Chinese Government Trade Delegation
Ambassador of the People's Republic of China and party
Dr. Chee Kheng Hoy, Rubber Reserach Institute of Malaya
Mr. Lim Tow Ming, Rubber Research Institute of Malaya
Dr. J. F. Dekker, Holland
Dr. D. L. Page, Anchem, U.S.A.
Dr. D. Van Dyck, Anchem, U.S.A.
Dr. Walter Zwick, Agricultural Experimental Station, BAST, Germany
Dr. A. S. Ghag, ' Monsanto ' Bombay, India
Mr. Louis C. Wheeler, Department of Biological Sciences, University of Southern California, Los Angeles, Calif., U.S.A.
Dr. George Varghese, Plant Pathologist, Malaysia
Dr. R. Kurose, Japan
Mr. T. Yoshimura, Japan
Mr. T. Okamoto, Japan
Mr. John Collins, C/o, United Nations Development Programme, Colombo
Mr. P. Compagnon, Institut de Recherches sur le Caoutchouc en Afrique, Ivory Coast
Dr. H. W. Greensmith, Natural Rubber Producers' Research Association, England
Dr D. J. Graham, Rubber Research Institute of Malaya
Mr. Richard Locke, Du Pont, Australia
Mr. K. Bridge, Anchem Products Inc., U.S.A.
Mr. R. Suryanarayan Rao, General Manager, Agromore Ltd., Bangalore, India
Mr. S. Kumarasamy, Agromore Ltd., Bangalore, India
Mr. M. H. Mellor, Harrisons & Crossfield Ltd., Kuala Lumpur, Malaysia
Trade Delegation from G.D.R.
Mr. Valdimir Chesuokov, Moscow, U.S.S.R.
Madame Valentina V. Lumbomoudrova, Moscow, U.S.S.R.
Mr. Y. S. Schukin, U.S.S.R. Embassy, First Secretary, Colombo
Mr. V. S. Ivanilov, U.S.S.R. Embassy, Colombo.

Visits

Mr. M. Nadarajah, Head of Rubber Chemistry Department attended the Fifth Technical Session of the Indian Rubber Manufacturers' Research Association held in Bombay, in January 1971.

Mr. L. B. Chandrasekera, Head of Botany Department, and Mr. S. W. Karunaratne, Rubber Chemist, attended the 1971 Planters' Conference organised by the Rubber Research Institute of Malaya, and held at Kuala lumpur from 12 — 16 July 1971. Dr. (Mrs.) V. Satchuthananthavale, Plant Pathologist, attended the FAO. Plant Protection Conference held at Djakarta, Indonesia, from 4 — 11 October 1971.

The Director attended the following conferences and seminars :—

Annual Sessions of the Ceylon Association for the Advancement of Science (CAAS),
General Research Council of the CAAS,
Research Planning Committee of the Ceylon Institute of Scientific & Industrial Research,
Steering Committee on Crop Diversification
General Committee meetings of the Planters' Association of Ceylon,
District Planters' Associations,
Committee meetings of the Institute of the Rubber Industry,
Seminars organised by the CAAS,
Rubber Replanting Advisory Board,
Standing Committee meetings on agrochemicals and fertilizers,
Ad hoc meetings of the Ministry of Plantation Industries,
Ad hoc meetings of the Ministry of Industries & Scientific Affairs,
Standing Committee on coconut pest control,
Committee on land capability studies.

Research scholars

Mr. L. Weerakoon, who worked under the supervision of Dr. O. S. Peries, Director, and had completed his studies in 1970, could not write his thesis for a major part of 1971, due to illness and other personal problems. His study period has been extended by Vidyodaya University, and he is now working on his thesis.

Mr. K. J. Wanasinghe, whose work on pineapple fertilization is being supervised by Dr. O. S. Peries, Director, completed his studies as expected, in September 1971 and is now writing up his thesis. He has been appointed Research Assistant of the Plywood Corporation.

Mr. S. D. Wimalaratne, who is working under the supervision of Mr. L. B. Chandrasekera, Head of Botany Department, will be completing his studies for the M.Sc. degree, on the optimum tapping system for *Hevea*, in September 1972.

Messrs. W. G. Karunasena, M. N. R. Cooray and W. M. M. Weerakkody, final year Engineering students, and Messrs. E. G. Somapala, D. Wahalatantiri and R. C. Wijesundara, final year Chemistry special students worked for four months in the Rubber Chemistry Department.

Workers from overseas

Professor Gerald Scott, of the University of Aston in Birmingham, U.K., who is our consultant in polymer science and technology, visited the Institute for two short periods, in January and July to assist the Rubber Chemistry Department.

Dr. Colin Barlow, Australian National University (ANU), worked for four weeks with the Agricultural Economics Unit in August — September. The results of his studies are being analysed at present. Dr. Barlow assisted the Institute in obtaining a scholarship for the recently appointed Assistant Agricultural Economist to read for the M.Sc. degree in Agricultural Development Economics at the ANU. He also took a keen interest in the development of the GPC scheme in Ceylon and has arranged, with an Australian Community Aid Society, to finance the building of one GPC. More aid has been promised, when the first GPC is proved a success.

Mr. S. Hansen, was appointed advisor on rubber by the FAO and continued to be in charge of the organisation of the New Rubber Processing Unit at Mawanella.

Mr. E. Bellis, formerly Head of Soils Division, RRIM, arrived in Ceylon on 19 October 1971 and worked with the staff of the Soils Chemistry Department, formulating a suitable research programme for the Department.

Mr. Ellis Findlay arrived in Ceylon in November as FAO Advisor on block rubbers.

Lectures

Dr. O. S. Peries Director, delivered the Presidential Address of the National Agricultural Society of Ceylon, at the Hotel Suisse, Kandy, on 7th November. He also read a paper entitled " A new look at the rubber planting industry — subsidiary products of economic importance from the rubber tree ", at a Symposium on Subsidiary Industrial Products of Agriculture and Forestry, organised by the CAAS.

Mr. M. Nadarajah, Head of Rubber Chemistry Department, continued his lectures and practical classes to the L.I.R.I. students at the Technological University, Katubedde.

Visiting officers

It is a pleasure to record our thanks to Mr. V. Abeywardena, Biometrician, Coconut Research Institute, who continued to visit the RRIC to help us with biometrical studies. The assistance given to us by the CRI in this connexion is greatly appreciated.

Publications

Dr. O. S. Peries, Director, prepared the following papers for publication during the year :—

PERIES, O. S. Environmental factors affecting plant disease. *Tea Quart.* **43** (in press).

PERIES, O. S. AND IRUGALBANDARA, Z. E. Histology of *Hevea* roots infected by *Fomes lignosus*. *Ann. appl. Biol.* (in press).

PERIES, O. S. Subsidiary products of economic importance from the rubber tree. *Industrial Ceylon* **2**, 19 - 32.

PERIES, O. S. The effect of weather on plant disease incidence. *J. Ceylon. Met. Soc.* (in press).

PERIES, O. S. Research for the future of the rubber industry. *Times of Ceylon*, Agriculture Supplement.

WANASINGHE, K. J. AND PERIES, O. S. Changes in the yield and fruit quality of pineapple associated with nitrogen fertilization. *Proc. Cey. Asso. Adv. Sc.* 27th Annual Sessions, p. 38, (Abs).

Institute publications

General :

Annual Review for 1970 (English)
Annual Report of the Rubber Research Board for 1969 (trilingual) Part II (in press)
Annual Report of the Rubber Research Board for 1970 (trilingual) Part I (in press)
Quarterly Journal Vol. 47, Parts 1 - 2
— do — ,, 47, ,, 3 - 4
— do — ,, 48, ,, 1 - 2 (Conference Proceedings)
— do — ,, 48, ,, 3 - 4 (Conference Proceedings) (in press)
R.R.I.C. Bulletin (New Series) Vol. 6, Nos. 1 & 2
— do — ,, 6, ,, 3 & 4 (in press)
" Rubber News " — Sinhala Bullctin Vol. 2, No. 1
— do — ,, 2, No. 2 (in press)

Papers :

CHANDRASEKERA, L. B. Developments in *Hevea* planting material in Ceylon. *Q. Jl. Rubb. Res. Inst. Ceylon* **48**, 7-18.

COCKBAIN, E. G. NR latex applications and developments. *Q. Jl. Rubb. Res. Inst. Ceylon* **48**, Parts 3 — 4 (in press).

DAYARATNE, W. C. AND MUNASINGHE, H. L. Mould contamination of rubber. *Q. Jl. Rubb. Res. Inst. Ceylon* **48**, 136 — 146.

DISSANAYAKE, A. B. An analysis of the economic prospects of the rubber industry. *Q. Jl. Rubb. Res. Inst. Ceylon* **48**, Parts 3 — 4 (in press).

DU PLESSIX, C. J., GENNER, P. AND COMBE J. Gl. Contribution of the IRCA to the improvement of propagation, by budding, of *Hevea*. *Q. Jl. Rubb. Res. Inst. Ceylon* **48**, 31.

FERNANDO, D. M. The yields and secondary characters of clone RRIC 102. *Q. Jl. Rubb. Res. Inst. Ceylon* **48**, 56 — 65.

FERNANDO, D. M. AND DE SILVA, M. S. C. A new basis for the selection fo *Hevea* seedlings. *Q. Jl. Rubb. Res. Inst. Ceylon* **48**, 19 — 30.

FERNANDO, D. M., TAMBIAH, M. S., ABEYWARDENA, V. AND SAMARANAYAKE, P. A study of the heritability of oil content in cotyledons of *Hevea* seedlings. *Q. Jl. Rubb. Res. Inst. Ceylon* **47**, 70 — 72.

FERNANDO, M. R. N. Manufacture of dark factice from rubber seed oil. *Q. Jl. Rubb. Res. Inst. Ceylon* **47**, 59 — 64.

FERNANDO, T. M. *Oidium* leaf disease — the effect of environment and control measures on incidence of disease and atmospheric spore concentration. *Q. Jl. Rubb. Res. Inst. Ceylon* **48**, 100 — 111.

GUHA, M. M., SINGH, M.M. AND CHAN, H. Y. Use of appropriate fertiliser for rubber based on soil and leaf nutrient survey. *Q. Jl. Rubb. Res. Inst. Ceylon* **48**, Parts 3 — 4 (in press).

JAYASEKERA, N. E. M. AND SENANAYAKE, Y. D. A. A study of growth parameters in a population of nursery rootstock seedlings of *Hevea brasiliensis* cv. Tjir 1. *Q. Jl. Rubb. Res. Inst. Ceylon* **48**, 66 — 81.

KARUNARATNE, S. W. Preparation of Heveacrumb from first fraction coagulum. *Q. Jl. Rubb. Res. Inst. Ceylon* **48**, Parts 3 — 4 (in press).

KARUNARATNE, S. W., GOONEWARDENA, L. AND MEDAGAMA, D. D. Evaluation of locally available raw material in the natural rubber industry. Part I — graphite. *Q. Jl. Rubb. Res. Inst. Ceylon* **47**, 65 — 69.

KARUNARATNE, S. W., JOHN, R. S. AND PIYADASA, K. A. Use of natural rubber latex to improve seepage resistance of soils. *Q. Jl. Rubb. Res. Inst. Ceylon* **47**, 51 — 58.

KASINATHAN, S., NADARAJAH, M. AND TIRIMANNE, A. S. L. A study of the free amino acids in the latex of natural rubber. *RRIC Bull.* (New Series) **6**, 28 — 32.

LEVEQUE, J. Experience of the French speaking institutes in the field of processing and technical grading of natural rubber. *Q. Jl. Rubb. Res. Inst. Ceylon* **48**, Parts 3 — 4 (in press).

LIYANAGE, A. DE S., PERIES, O. S. AND SEBASTIAN, R. D. Assessment of the incidence of *Oidium* leaf fall and economics of its control in the smallholdings. *Q. Jl. Rubb. Res. Inst. Ceylon* **48**, 112 — 124.

MENDIS, E. G. AND NADARAJAH, M. The use of rubber in Ceylon roads. *RRIC Bull.* (New Series) **6**, 12 — 17

MENDIS, E. G. AND NADARAJAH, M. The use of coconut shells as latex collection cups in Ceylon. *RRIC Bull.* (New Series) **6**, 23 — 27.

MUNASINGHE, H. L. Black Root disease of *Hevea* caused by *Xylaria thwaitesii*. *Q. Jl. Rubb. Res. Inst. Ceylon* **48**, 92 — 99

MUTHUKUDA, D. S. AND NADARAJAH, M. Latex coagulating tanks. *RRIC Bull.* (New Series) **6**, Nos. 3 & 4 (in press).

NADARAJAH, M., BARTHOLOMEUSZ, P. A. AND MUTHUKUDA, D. S. Proposals to improve and increase quality production of pale crepe in Ceylon. *RRIC Bull.* (New Series) **6**, Nos. 3 & 4 (in press).

NADARAJAH, M., NARANGODA, H. AND COORAY, B. Specifications in relation to production methods in some conventional grades of raw rubber. *RRIC Bull.* (New Series) **6**, Nos. 3 & 4 (in press).

NADARAJAH, M., RAJASINGHAM, M., MUTHUKUDA, D. S. AND JAYASINGHE, P. P. Some suggested improvements in the grading of pale crepe. *Q. Jl. Rubb. Res. Inst. Ceylon* **47**, 20 — 29.

NADARAJAH, M., TIRIMANNE, A. S. L., COOMARASWAMY, A. AND KASINATHAN, S. Some naturally occurring antioxidants in *Hevea brasiliensis* latex. *Q. Jl. Rubb. Res. Inst. Ceylon* **48**, Parts 3 — 4 (in press).

PIYADASA, K. A. AND KARUNARATNE, S. W. A quick method for the determination of ammonia content in natural rubber latex — a modification of the B. S. method. *RRIC Bull.* (New Series) **6**, 18 — 22.

SATCHUTHANANTHAVALE, R. AND SATCHUTHANANTHAVALE, V. Bacterial coagulation of latex. *Q. Jl. Rubb. Res. Inst. Ceylon* **48**, Parts 3 — 4 (in press).

SATCHUTHANANTHAVALE, R., SATCHUTHANANTHAVALE, V., NADARAJAH, M. AND AMARASINGHE, I. Possibilities of bacterial coagulation in raw rubber manufacture. *Q. Jl. Rubb. Res. Inst. Ceylon* **48,** Parts 3 — 4 (in press).

SATCHUTHANANTHAVALE, V. Black Stripe or Bark Rot of *Hevea*. *Q. Jl. Rubb. Res. Inst. Ceylon* **48,** 125 — 135.

SATCHUTHANANTHAVALE, V. AND HALANGODA, L. Sulphur in the control of White Root disease. *Q. Jl. Rubb. Res. Inst. Ceylon* **48,** 82 — 91.

SCOTT, G. Pro-oxidant and antioxidant mechanisms in polymer technology. *Q. Jl. Rubb. Res. Inst. Ceylon* **47,** 1 — 19.

SCOTT, G. AND VARATHUNGARAJAN, G. A "new look" for Ceylon's pale crepe. *RRIC Bull.* (New Series) **6,** Nos. 3 & 4 (in press).

SEKHAR, B. C. New presentation processess — an essential feature of modernisation of the natural rubber industry. *Q. Jl. Rubb. Res. Inst. Ceylon* **48,** Parts 3 — 4 (in press).

SILVA, C. G. An evaluation of the nutrient status of the rubber soils of Ceylon. *Q. Jl. Rubb. Res. Inst. Ceylon* **48,** Parts 3 — 4 (in press).

SILVA, C. G. AND DE SILVA, M. U. J. A survey of wind damage in rubber plantations. *RRIC Bull.* (New Series) **6,** 1 — 11.

SILVA, C. G. AND PERERA, A. M. A. A study of the urease activity in the rubber soils of Ceylon. *Q. Jl. Rubb. Res. Inst. Ceylon* **47,** 30 — 36.

SINGH, M. M. Assessment of the cation nutrient status of acid soils. *RRIC Bull.* (New Series) **6,** Nos. 3 & 4 (in press).

TANG HONG TONG AND SELBY, D. New super high tapping technique. *Q. Jl. Rubb. Res. Inst. Ceylon* **48,** 32 — 46.

VEERABANGSA, M. T. AND NADARAJAH, M. Suggested improvements in the manufacture of Ceylon natural rubber. *Q. Jl. Rubb. Res. Inst. Ceylon* **48,** Parts 3 — 4 (in press).

WAIDYANATHA, U. P. DE S. AND PATHIRATNE, L. S. S. Studies on latex flow patterns and plugging indices of clones. *Q. Jl. Rubb. Res. Inst. Ceylon* **48,** 47 — 56.

WEERARATNE, A. AND NADARAJAH, M. Road performance studies and an investigation of some problems associated with rubberised bitumen road construction. *Q. Jl. Rubb. Res. Inst. Ceylon* **47,** 37 — 49.

YOGARATNAM, N. Weed control under *Hevea* in Ceylon with herbicide mixtures based on MSMA. *Q. Jl. Rubb. Res. Inst. Ceylon* **48,** Parts 3 — 4 (in press).

Social and sports activities

Cricket : We entered two teams for the Kalutara District Cricket Tournament and our 'A' team was runners-up. At the Government Services Cricket Tournament ('D' Division) we lost in the first round.

In the annual encounter against the Tea Research Institute Sports Club we annexed the 'Gun Trophy' once again.

Badminton : Our Badminton Team was placed 3rd in the 'B' Group of the 'C' Division in the All Island Inter-Club Badminton Tournament, conducted by the Ceylon Badminton Association.

Annual club tournament : The annual tournament of our club was conducted successfully. The prize distribution and the year ending party was held on 21 December 1971 and our chief guest was the Hon. Dr. Colvin R. de Silva, Minister of Plantation Industries.

REVIEW OF THE BOTANY DEPARTMENT

BY

L. B. CHANDRASEKERA

SUMMARY

Coconut oil has been found to be a good substitute for palm oil in formulating mixtures of the yield stimulant Ethrel. Experiments carried out using a 10 per cent solution of Ethrel in coconut oil have indicated a doubling of yields in clone PB 86, during the first year. No adverse effects have been noted so far. In one trial a 5 per cent solution of Ethrel in coconut oil has given equally good results as a 10 per cent solution. Ethrel stimulation at 67 per cent tapping intensity on clone PB 86 has given higher yields per tapper as well as per acre as compared with tapping at 100 per cent intensity without stimulation. In another trial which has been carried out for two months, tapping on alternate daily half spiral system, with Ethrel stimulation, has given higher average yields per tapper as compared with tapping alternate daily of a half spiral and a quarter spiral cut at 150 per cent intensity. The higher yields per tapper in this instance is largely due to the greater number of trees tapped on the S/2, d/2, 100% system. The average yields recorded per acre for the two systems remained the same.

There have been no adverse effects either on growth or yield during eight years of tapping clones Nab 12 and PB 86 without the usual rest during the wintering period. These observations are applicable particularly to conditions that prevail in the wet low country districts.

Daily tapping on a half spiral cut of clones RRIC 7, 45, 52 and PB 86 has given lower yields per tapping as well as lower DRC values as compared with alternate daily tapping. A high incidence of Brown Bast is recorded for daily tapping of clones RRIC 7 and 45. Tapping on the 2S/2,d/4,100% system has given slightly more than double the yields per tapping when compared with the S/2, d/2, 100% system for clones RRIC 7, 45 and PB 86, during the first year of the experiment. The clone PB 86 has given the highest yields per tree per tapping on the S/1, d/4, 100% system as compared with S/1, d/3; 2S/2, d/4 and 2S/2, d/3 tapping systems during the first year. The average yield response per tapping of clones RRIC 7, 45, 52 and PB 86 to third daily tapping on full spiral and two half spiral cuts has been lower than for fourth daily tapping of full spiral and two half spiral cuts. The two clones RRIC 7 and 45 have responded better to 2S/2, d/4 tapping than to S/1, d/4 tapping.

Tapping of clone PB 28/59 has given higher yields per tapping as well as per acre on the S/2, d/3, 67% system as compared with the S/2, d/2, 100% system, during the first year of the experiment. With clone RRIC 89, the yields per tapping on the S/2, d/3, 67% system have been higher but the yields per acre have been less than what is recorded for the S/2, d/2, 100% system. On the S/2, d/2, 100% tapping system, the clone RRIC 89 has yielded better than clone PB 28/59 in the fourth year of tapping.

Tapping of clone RRIC 52 with the Jebong knife has given yields comparable with those of the Michie-Golledge knife in terms of yield and the rate of bark consumption during the first year of the experiment.

The clone RRIC 45 has shown a high degree of resistance to *Phytophthora* leaf and panel diseases. However, it has now become apparent that under conditions which are exceptionally favourable for the development of *Oidium* leaf disease, such as light showers of rain during the refoliation period, sulphur dusting as a preventive measure would be necessary. This clone is expected to be replaced eventually by clones with higher yield potentials such as RRIC 13, 48, 50 and 89, which also possess high degrees of resistance to diseases. The white latex of clones PB 86 and RRIC 36 have been found to be particularly suitable for the manufacture of crepe.

The following new clone selections have continued to maintain satisfactory yields and freedom from diseases :—

RRIC 13, 48, 50, 89, AVROS 1734, PR 252, IRCI 2, 7, 9.

The clones RRIC 13, 48, 50, IRCI 7, 9 and PR 252, in view of their high yield potential have been rather sensitive to Brown Bast on 100 per cent tapping intensity. They may therefore have to be planted at maximum initial stands of 180 points per acre in order to allow for a 10 — 15 per cent incidence of Brown Bast with S/2, d/2, 100% tapping.

In the dry districts, particularly those with an average annual rainfall of around 80 in. recorded mainly during the North East monsoon season, the growth of budgrafts has been unsatisfactory. Under such conditions, only 7 per cent of trees of clone RRIC 45 reached a tappable girth of over 20 in. at the end of seven years from planting.

Dieback of trees at five years of age has been recorded for clone RRIM 701.

Buddings of clones RRIC 45 and PB 86 made on seedling stocks of clones RRIC 7, 36, 41, 52, 86, 88, 89, RRIM 623, Wagga 6278, Gl 1, PB 86, AVROS 427, TR 1406, WR 101 and Tjir 1 have not shown significant growth differences during the immature phase. The unusual growth vigour of RRIC 52 seedlings does not appear to have influenced the growth rate of RRIC 45 and PB 86 scions.

At the end of six years from planting, the growth rate as well as yield of clones RRIC 41, 45 and 52 appear to be similar for the two spacings of 8′ × 30′ and 12′ × 20′.

Results of small scale trials carried out with a rubber rainguard appear to be promising. Experiments have indicated the feasibility of using dried bacterial cultures for field coagulation of latex. Callus cultures from anthers of *Hevea brasiliensis* — cultivars KH 440 and RRIC 52 — have been grown successfully on a solid agar medium.

DETAILED REVIEW

Staff

Mr. L. B. Chandrasekera, Head of Botany Department and Dr. R. Satchuthananthavale, Botanist, were on duty throughout the year. Miss A. C. I. Yahampath and Mr. U. P. de S. Waidyanatha, Assistant Botanists, were on overseas study leave. Mr. S. D. Wimalaratne, research student, continued his studies on tapping of *Hevea*.

Visits

The technical staff of the Department paid advisory visits to estates and routine visits to experimental areas.

Publications

1. Annual Review of the Botany Department for 1971.

2. Developments in *Hevea* planting material in Ceylon.
   L. B. Chandrasekera. *Q. Jl. Rubb. Res. Inst. Ceylon* **48,** 7 — 18.

3. Bacterial coagulation of latex.
   R. Satchuthananthavale and V. Satchuthananthavale. *Q. Jl. Rubb. Res. Inst. Ceylon* **48,** parts 3 — 4.

4. Possibilities of bacterial coagulation in raw rubber manufacture.
   R. Satchuthananthavale, V. Satchuthananthavale, M. Nadarajah and I. Amarasinghe. *Q. Jl. Rubb. Res. Inst. Ceylon* **48,** parts 3—4.

5. Studies on latex flow patterns and plugging indices of clones.
   U. P. de S. Waidyanatha and L. S. S. Pathiratne. *Q. Jl. Rubb. Res. Inst. Ceylon* **48,** 47 — 56.

Meetings, conferences, etc.

The Head of the Department attended the following meetings :—

1. The meeting of the IRRDB held in Colombo on 19th June 1971.

2. The Planters' Conference held in Kuala Lumpur from 12th — 14th July 1971.

Yield stimulation experiments

All experiments during the period under review were confined to the use of Ethrel as a yield stimulant. As the first 50 cc sample of Ethrel obtained in January 1971 was insufficient for large scale trials, a preliminary small scale trial involving a few trees of clones PB 86, GT 1 and *Hevea benthamiana* was set down at Dartonfield, mainly to test the efficiency of a 10 per cent solution of Ethrel in coconut oil. The stimulant was applied to a $1\frac{1}{2}$ in. strip of scraped bark below the tapping cut once every two months. The trees were tapped on the S/2, d/2, 100% system. The yields recorded are given in Table 1.

TABLE 1

YIELD IN GRAMS DRY RUBBER PER TREE PER TAPPING

Clone	No. of applications	Tapping panel	Trees per treatment	Yield	
				Ethrel	Control
PB 86	4	C	2	66·0	24·7
GT 1	4	B	5	52·7	26·6
H. benthamiana	2	A	1	35·6	2·3

Field experiment No. 58 — Ethrel stimulation experiment, Malaboda Estate (L. B. Chandrasekera & D. A. Brahakmana)

A 10% solution of Ethrel in coconut oil is applied to a 1½ in. strip of scraped bark below the tapping cut once in two months on panel C of clone PB 86 planted in 1946. Two tappers' tasks were stimulated while two tasks served as the controls. Each task consists of approximately 200 trees. Tapping is on the S/2, d/2, 100% system and the yields are recorded by the estate on the basis of daily yield per each tapping block. During the period immediately following applications, when the yield response was highest, collection of latex was delayed till 1 p.m. on each day. Any latex drip after this was collected on the next tapping day as cup lump. The experimental area had been manured regularly during previous years with R 4 : 6 : 3 mixture at the rate of 200 lb/acre/year. The yields recorded for four applications of Ethrel from March to November 1971 are given in Table 2.

TABLE 2

YIELD OF ETHREL-STIMULATED BLOCKS AS COMPARED TO CONTROL BLOCKS

	Stimulated		Control	
	Block I	Block IV	Block II	Block III
Trees tapped	217	203	164	200
*Average yield/tapping (lb) **12·84**	28·3 **12·84**	27·9 **12·66**	12·2 **5·53**	12·8 **5·81**
Percentage scrap	20·2	19·1	7·9	7·6
Total yield for 9 months (lb) **1117·20**	2463·0 **1117·20**	2397·5 **1087·49**	1046·5 **474·68**	1076·0 **488·06**
Brown Bast trees Partially dry cuts	8	6	2	1
Totally dry cuts	11	6	6	7

Heavy type denotes metric equivalents in kg.

*Inclusive of scrap

Field experiment No. 63 — Ethrel stimulation experiment, Eladuwa Estate (L. B. Chandrasekera & D. A. Brahakmana)

Three concentrations of Ethrel 5%, 10% and 15% in coconut oil are compared with an untreated control on panel C of clone PB 86 planted in 1952. Applications are made on a 1½ in. strip of scraped bark below the tapping cut once every two months and tapped on the S/2, d/2, 100% system. The experimental design is a randomized layout with the four treatments replicated six times. Each plot consists of 50 trees. The area had been regularly manured in previous years with R 4 : 6 : 3 mixture at the rate of 200 lb an acre. The fungicide Fylomac 90 is used as a panel dressing during wet weather. During the period of peak response after each application two to three collections of latex were made each day with the last collection made around 2.30 p.m. The data recorded for three applications of Ethrel from June to end of November 1971 are given in Table 3.

TABLE 3

COMPARATIVE YIELDS OF AREAS STIMULATED WITH ETHREL AT DIFFERENT CONCENTRATIONS

	Treatments			
	5% Ethrel	10% Ethrel	15% Ethrel	No Ethrel
*Average yield (g/tree/tapping)	71·6	73·6	84·5	39·3
Percentage scrap	11·1	10·5	10·1	10·3
Total yield (lb)	2816·8	2762·1	3436·3	1518·9
	1277·68	**1252·87**	**1558·68**	**688·96**
Percentage Brown Bast				
Totally dry cuts	2·9	1·7	1·4	0·6
Partially dry cuts	1·3	2·3	1·7	0·3

Heavy type denotes metric equivalents in kg.

*Inclusive of scrap

Field experiment No. 65 — Ethrel stimulation experiment, Etana Estate (*L. B. Chandrasekera & W. T. Silva*)

The experiment consists of the following treatments applied on panel C of clone PB 86 planted in 1952 :—

(*a*) Tapped on S/2, d/3, 67% and stimulated once in two months with 10% Ethrel applied to a 1½ in. strip of scraped bark below the tapping cut;

(*b*) Tapped on S/2, d/2, 100% without stimulation.

Each treatment is applied to three tapping tasks and the yields are recorded by the estate concerned on the basis of daily yields brought in by the tappers. During the period of peak response after each application of Ethrel, an additional collection of latex was made in the evening of the day of tapping.

The area had been manured regularly in previous years with R 4 : 6 : 3 + Mg mixture at the rate of 3 lb per tree per year and tapped on the S/2, d/2, 100% system except from January 1968 to July 1970 when the tapping system was changed temporarily to 2S/2, d/4, 100%. The data recorded for two Ethrel applications, from August to end of November 1971 are given in Table 4.

TABLE 4

YIELDS OF AREAS STIMULATED WITH ETHREL AND TAPPED AT DIFFERENT INTENSITIES

	Stimulated	Unstimulated
Tapping system	S/2, d/3, 67%	S/2, d/2, 100%
Average trees/block	217	239
*Average yield in lb/tapping	25·1	11·1
	11·39	**5·03**
Percentage scrap	21·1	10·4
Total yields in lb (three blocks)	1910	1264
	866·36	**573·34**
Number of tappings	76	114

Heavy type denotes metric equivalents in kg.

*Inclusive of scrap

Field experiment No. 67 — Ethrel stimulation experiment, Dewalakande Estate (L. B. Chandrasekera & D. A. Brahakmana)

This experiment compares a progressive intensification of tapping eight years before replanting with Ethrel stimulation on the S/2, d/2, 100% tapping system. Ten acres of clone PB 86 planted in 1948 are divided into four tapping blocks and the two treatments are applied as follows :—

1. Blocks A and B with 160 trees per block tapped on the 3S/4, d/2, 150% system without stimulation;
2. Blocks C and D with 218 trees per block tapped on the S/2, d/2, 100% system with Ethrel stimulation once every two months.

In blocks A and B the tapping system is to be progressively intensified until it is due for replanting in 1978. Blocks C and D are to be tapped during this period on the S/2, d/2, 100% system with Ethrel applied to a $1\frac{1}{2}$ in. strip of scraped bark below the tapping cut. The yields are recorded by the estate on the basis of daily yields per tapping block. During the period of peak response, a late collection of latex is made around 2 p.m.

The area had been regularly manured in the past with R 4 : 6 : 5 mixture at 2 lb per tree per year and tapped on the S/2, d/2, 100% system except during 1968 and 1969 when the tapping system was 2S/2, d/4, 100%. The data recorded for two Ethrel applications from August to end of November 1971 are given in Table 5.

TABLE 5

YIELDS OF AREAS TAPPED AT HIGH INTENSITY AS COMPARED TO THOSE STIMULATED WITH ETHREL

	No Ethrel Tapped 3S/4, d/2, 150%		Ethrel stimulated Tapped S/2, d/2, 100%	
	Block A	Block B	Block C	Block D
Trees tapped	160	160	218	218
*Average yield/tapping (lb) First application	22·8 **10·34**	22·1 **10·02**	20·7 **9·39**	19·0 **8·62**
Percentage scrap	13·3	11·1	19·2	12·9
*Average yield/tapping (lb) Second application	28·0 **12·70**	27·9 **12·66**	39·7 **18·01**	35·5 **16·10**
Percentage scrap	9·6	5·4	10·3	9·6

Heavy type denotes metric equivalents in kg.

*Inclusive of scrap

The yield response to first application has been rather poor owing to rain interference of this application.

Tapping experiments

Field experiment No. 4 — 1964 "winter" tapping trial, Dartonfield (L. B. Chandrasekera & D. R. Colonne)

In this trial the following treatments are applied to 20 trees of each of the clones PB 86 and Nab 12 replicated three times :—

(*a*) Tapped on S/2, d/2, 100% system with a "winter" rest
(*b*) Tapped on S/2, d/2, 100% system without a "winter" rest

The average girth and yields recorded at the end of eight years are presented in Table 6.

TABLE 6

YIELDS IN GRAMS DRY RUBBER/TREE/TAPPING FROM AREAS TAPPED WITH AND WITHOUT A "WINTER" REST

Clone	Treatments	Yield 1971	Average girth			
			Before treatments		After treatments 1971	
			in.	cm	in.	cm
PB 86	A	37·4	27·9	70·87	36·0	91·44
	B	37·2	27·0	68·58	34·8	88·39
Nab 12	A	37·3	27·4	69·60	33·2	84·33
	B	42·1	27·5	69·85	33·5	85·09

Field experiment No. 53 — Tapping experiment, Dartonfield (L. B. Chandrasekera, S. D. Wimalaratne, L. S. S. Pathiratne & S. Kodikara)

The following tapping systems are applied to five-tree plots of each of the clones RRIC 7, 45, 52 and PB 86 replicated eight times :—

(1) S/2, d/2, 100%
(2) S/2, d/1, 200%
(3) S/1, d/4, 100%
(4) S/1, d/3, 133%
(5) 2S/2, d/4, 100%
(6) 2S/2, d/3, 133%

The yields were recorded daily. Polythene rainguards were used in order to keep to the tapping frequency in each tapping system. The data recorded during the first year of the experiment in 1971 are summarised in Tables 7 and 8.

TABLE 7

COMPARATIVE YIELDS OF DIFFERENT CLONES TAPPED AT DIFFERENT TAPPING INTENSITIES

Tapping system	Mean yield in g/tree/tapping				
	RRIC 45	RRIC 7	RRIC 52	PB 86	Mean
S/2, d/2, 100%	15·4	14·2	17·2	21·2	17·0
S/2, d/1, 200%	13·2	13·4	14·5	18·7	15·0
S/1, d/4, 100%	35·0	29·5	32·1	60·1	39·2
S/1, d/3, 133%	34·7	29·5	35·7	39·8	34·9
2S/2, d/4, 100%	35·4	31·9	27·9	55·3	37·6
2S/2, d/3, 133%	35·4	31·9	33·3	45·2	36·5

TABLE 8

PERCENTAGES OF (A) SCRAP, (B) DRY RUBBER CONTENT, AND (C) INCIDENCE OF BROWN BAST IN DIFFERENT CLONES TAPPED AT DIFFERENT INTENSITIES

Tapping system	RRIC 45			RRIC 7			RRIC 52			PB 86		
	A	B	C	A	B	C	A	B	C	A	B	C
S/2, d/2, 100%	29·9	31·1	—	29·3	31·9	—	26·1	31·5	—	13·9	30·1	—
S/2, d/1, 200%	20·4	26·5	10·0	33·1	28·5	17·5	24·6	27·0	—	18·6	25·3	—
S/1, d/4, 100%	18·5	31·2	2·5	21·5	31·3	2·5	18·5	32·3	—	9·0	28·3	—
S/1, d/3, 133%	17·7	29·5	—	19·0	29·0	12·5	18·1	29·8	—	9·2	26·6	3·3
2S/2, d/4, 100%	17·1	31·9	2·5	25·2	33·3	—	20·7	32·6	—	7·6	30·7	3·3
2S/2, d/3, 133%	19·9	30·6	2·5	18·4	30·0	—	20·4	32·1	—	9·5	28·0	3·3

Field experiment No. 54 — Tapping experiment, Dartonfield (L. B. Chandrasekera & D. A. Brahakmana)

The two tapping systems S/2, d/3, 67% and S/2, d/2, 100% are compared on each of two clones PB 28/59 and RRIC 89. The two clones were planted in 1961 at approximately 650 trees per clone and tapped on the S/2, d/2, 100% system since March 1968. In January 1971, each tapping system was introduced to approximately half the number of trees in each clone, and test-tapped on two normal tapping days in each month. The average yields recorded during the first year of the experiment are given in Table 9.

TABLE 9

COMPARATIVE YIELDS FROM TWO TAPPING SYSTEMS ON TWO CLONES

	RRIC 89		PB 28/59	
	S/2, d/2, 100%	S/2, d/3, 67%	S/2, d/2, 100%	S/2, d/3, 67%
Grams dry rubber/tree/tapping	24·0	30·5	23·1	45·0
*Lb dry rubber/tree/year	7·4	6·3	7·1	9·3
Theoretical yield/acre (130 trees) lb	962·0	819·0	923·0	1209·0

*Theoretical value for 280 tapping days.

Field experiment No. 59 — Tapping experiment — Vogan Group (R. Satchuthananthavale & I. Amarasinghe)

This experiment compares two tapping knives, the Michie-Golledge and the Jebong on each of the tapping systems S/2, d/2, 100% and 2S/2, d/4, 100% in clone RRIC 52. The tapping cuts are marked at 62 in. above the graft union for the S/2, d/2, 100% system and at 62 in. and 31 in. above the graft union for the 2S/2, d/4, 100% system. The data recorded during the first year of the experiment in 1971 are given in Table 10.

TABLE 10

YIELD RESULTS OF AREAS TAPPED WITH TWO TYPES OF TAPPING KNIVES
(AVERAGE YIELD IN GRAMS DRY RUBBER/TREE/TAPPING)

Knife	No. of test tappings	S/2, d/2, 100%		2S/2, d/4, 100%		Thickness of bark consumed per tapping
		Trees tapped	Yield	Trees tapped	Yield	
Michie - Golledge	10	250	17·86	250	58·42	1·6 mm
Jebong	10	250	17·04	275	61·90	1·5 mm

Clone evaluation trials

Field experiment No. 7 — 1954 clone trial, Nivitigalakele (*L. B. Chandrasekera & W. T. Silva*)

All clones are planted in 40-tree plots replicated five times. The yields of the two best selections, IRCI 7 and PB 28/59, are compared with RRIM 501 in Table 11.

TABLE 11

COMPARATIVE YIELDS OF IRCI 7 AND PB 28/59 WITH PB 86 AS CONTROL
YIELD OF DRY RUBBER PER TREE PER YEAR (140 TAPPINGS)
(Tapped S/2, d/2, 100% from March 1960)

Year of tapping	IRCI 7		PB 28/59		RRIM 501	
	lb	kg	lb	kg	lb	kg
1961	10·2	4·63	14·2	6·44	9·7	4·40
1962	9·2	4·17	15·3	6·94	11·9	5·40
1963	8·8	3·99	14·2	6·44	12·6	5·72
1964	9·5	4·31	15·1	6·85	13·6	6·17
1965	10·6	4·81	16·3	7·39	13·1	5·94
1966	13·1	5·94	19·5	8·85	13·9	6·31
1967	15·4	6·99	18·6	8·44	13·3	6·03
1968	14·8	6·71	17·2	7·80	12·5	5·67
1969	12·7	5·76	15·0	6·80	11·1	5·03
1970	10·9	4·94	13·7	6·21	10·0	4·54
1971	11·2	5·08	12·3	5·58	10·7	4·85
Brown Bast trees	—	—	5	—	4	—

Field experiment No. 15 — 1953 clone trial, Nivitigalakele (*L. B. Chandrasekera & W. T. Silva*)

The clone RRIC 45 is planted as a monoclonal block in an extent of approximately 5 acres. The test tapping results for the past ten years are given in Table 12.

TABLE 12

YIELD OF DRY RUBBER PER TREE PER YEAR (140 TAPPINGS) OF RRIC 45 OVER A TEN-YEAR PERIOD

(Tapped S/2, d/2, 100%)

Year of tapping	RRIC 45 lb	RRIC 45 kg
1962	8·9	4·04
1963	10·2	4·63
1964	10·6	4·81
1965	10·3	4·67
1966	11·0	4·99
1967	12·1	5·49
1968	13·2	5·99
1969	11·9	5·40
1970	9·5	4·31
1971	9·9	4·49
Brown Bast trees	—	—

Field experiment No. 19 — 1962 large scale clone trial, Nivitigalakele (L. B. Chandrasekera & W. T. Silva)

All clones are planted in unreplicated plots of 150 trees per clone. Test tapping results during the first three years in tapping are summarised in Table 13.

TABLE 13

YIELD IN LB DRY RUBBER PER TREE PER YEAR (140 TAPPINGS) IN LARGE SCALE CLONE TRIAL

(Tapped S/2, d/2, 100%)

Clone	Average girth 1971 in.	Average girth 1971 cm	Yield 1969	Yield 1970	Yield 1971
RRIC 93	24·9	63·25	10·4	8·7	12·3
			4·72	**3·95**	**5·58**
RRIC 5	25·8	65·53	7·8	9·7	12·2
			3·54	**4·40**	**5·53**
RRIM 628	21·9	55·63	16·0	15·1	11·3
			7·26	**6·85**	**5·13**
RRIC 94	21·4	54·36	13·8	12·0	10·3
			6·26	**5·44**	**4·67**
RRIC 39	25·5	64·77	8·7	8·7	10·3
			3·95	**3·95**	**4·67**
RRIC 92	23·4	59·44	10·7	11·2	10·1
			4·85	**5·08**	**4·58**
RRIM 623	24·0	60·96	10·3	8·7	9·6
			4·67	**3·95**	**4·35**
RRIC 95	29·7	75·44	10·6	8·1	9·2
			4·81	**3·67**	**4·17**
RRIC 91	27·0	68·58	7·8	9·1	9·0
			3·54	**4·13**	**4·08**
RRIC 86	23·7	60·20	8·1	6·3	8·8
			3·67	**2·86**	**3·99**
PB 86	23·5	59·69	9·2	8·4	8·2
			4·17	**3·81**	**3·72**
IAN 45 - 717	25·1	63·75	9·0	8·6	7·6
			4·08	**3·90**	**3·45**

Heavy type denotes metric equivalents in kg.

Field experiment No. 21 — 1964 yield trial, Nivitigalakele (L. B. Chandrasekera & W. T. Silva)

This trial compares the yields for four clones RRIC 41, 45, 52 and 86. Each clone is planted in 106-tree plots replicated three times. The test tapping results during the first two years are given in Table 14.

TABLE 14

YIELD IN LB DRY RUBBER/TREE/YEAR (140 TAPPINGS) OF FOUR RRIC CLONES OVER TWO YEARS
(Tapped S/2, d/2, 100% from 1970)

Clone	No. of trees tapped 1971	Average girth 1971 in.	cm	Yield 1970	1971
RRIC 41	145 — 190	22·7	57·66	8·4 **3·81**	9·5 **4·31**
RRIC 45	155 — 208	22·8	57·91	8·2 **3·72**	10·2 **4·63**
RRIC 86	132 — 184	22·4	56·90	6·5 **2·95**	8·0 **3·63**
RRIC 52	229 — 248	26·9	68·33	5·3 **2·40**	6·7 **3·04**

Heavy type denotes metric equivalents in kg.

Field experiment No. 11 — 1951 small scale clone trial, Hedigalla (L. B. Chandrasekera & S. Wilbert)

All clones are planted in 25-tree plots replicated three times. Test tapping results of the best selection RRIC 99 are compared with PB 86 in Table 15.

TABLE 15

YIELD IN LB DRY RUBBER PER TREE PER YEAR (140 TAPPINGS) OF RRIC 99 AS COMPARED TO THAT OF PB 86
(Tapped S/2, d/3, 67% from 1958 ; tapped S/2, d/2, 100% from 1960

Year of tapping	RRIC 99	PB 86
1961	14·2 **6·44**	13·3 **6·03**
1962	19·4 **8·80**	16·3 **7·39**
1963	17·7 **8·03**	15·9 **7·21**
1964	20·4 **9·23**	17·0 **7·71**
1965	17·9 **8·12**	16·9 **7·67**
1966	18·2 **8·26**	17·7 **8·03**
1967	15·7 **7·12**	19·4 **8·80**
1968	15·0 **6·80**	18·9 **8·57**
1969	16·3 **7·39**	16·6 **7·53**
1970	12·9 **5·85**	12·9 **5·85**
1971	9·6 **4·35**	15·6 **7·07**
Girth in in. 1971	33·0 **83·82** mm	33·2 **89·33** mm
No. of trees tapped 1971	45	52
Brown Bast trees 1971	3	2

Heavy type denotes metric equivalents in kg.

Field experiment No. 14 — 1955 large scale clone trial, Hedigalla (L. B. Chandrasekera & S. Wilbert)

Twelve RRIC clones were originally planted in monoclonal blocks of 750 trees per clone. Test tapping results of the two best selections for yield and good secondary characters are given in Table 16.

TABLE 16

YIELD IN LB DRY RUBBER PER TREE PER YEAR (140 TAPPINGS) OF CLONES RRIC 13 AND RRIC 50
(Tapped S/2, d/2, 100%)

Year of tapping	RRIC 13	RRIC 50
1962	9·4 **4·26**	5·5 **2·49**
1963	10·2 **4·63**	10·2 **4·63**
1964	10·7 **4·85**	11·9 **5·40**
1965	14·0 **6·35**	12·4 **5·62**
1966	14·9 **6·76**	18·4 **8·35**
1967	16·7 **7·58**	18·1 **8·21**
1968	18·2 **8·26**	15·4 **6·99**
1969	15·2 **6·89**	15·4 **6·99**
1970	19·2 **8·71**	15·3 **6·97**
1971	17·3 **7·84**	15·8 **7·17**
Average girth in in. 1971	29·3 **74·42** mm	29·3 **74·42** mm
Trees tapped in 1971	485—515	391—456
Percentage Brown Bast	12	15
Wind damage trees	11	13

Heavy type denotes metric equivalents in kg.

Field experiment No. 16 — 1956 clone trial, Hedigalla (L. B. Chandrasekera & S. Wilbert)

In this trial, 18 local and foreign clones were initially planted in monoclonal blocks of 300 trees per clone. The test tapping yields of the best selections are given in Table 17.

TABLE 17

YIELD IN LB DRY RUBBER PER TREE PER YEAR (140 TAPPINGS) OF THE MOST PROMISING FIVE CLONES OF EIGHTEEN TESTED

(Tapped S/2, d/2, 100% from July 1963)

Clone	Trees tapped in 1971	Girth 1971 in.	cm	Yiled 1964	1965	1966	1967	1968	1969	1970	1971
PR 252	213	27·1	68·83	7·6 **3·45**	10·9 **4·94**	10·2 **4·63**	10·6 **4·81**	10·0 **4·54**	8·6 **3·90**	14·4 **6·53**	15·3 **6·94**
IRCI 9	126—200	29·0	73·66	7·3 **3·31**	9·8 **4·45**	12·0 **5·44**	11·3 **5·13**	12·0 **5·44**	10·4 **4·72**	14·2 **6·44**	13·0 **5·90**
AVROS 1447*	120—152	26·8	68·07	5·3 **2·40**	7·0 **3·18**	10·9 **4·94**	10·9 **4·94**	9·8 **4·45**	12·0 **5·44**	11·5 **5·22**	11·1 **5·03**
RRIC 48*	183—214	25·9	65·79	8·0 **3·83**	8·8 **3·99**	12·3 **5·58**	12·8 **5·81**	10·8 **4·90**	11·4 **5·17**	12·3 **5·58**	10·7 **4·85**
PB 86	223—228	30·2	76·71	6·4 **2·90**	7·1 **3·22**	8·7 **3·95**	9·1 **4·13**	8·0 **3·63**	8·3 **3·76**	11·2 **5·08**	12·8 **5·81**

Heavy type denotes metric equivalents in kg.

*First tapped in March 1964

Field experiment No. 25 — 1957 clone trial — Estate A — Kalutara District (L. B. Chandrasekera & I. H. Stephen)

All clones are planted in unreplicated plots of 300 trees per clone. Test tapping results of the best selection for yield IRCI 2 are compared with clone PB 86 in Table 18.

TABLE 18

YIELD IN LB DRY RUBBER PER TREE PER YEAR (140 TAPPINGS) OF IRCI 2, COMPARED TO PB 86

(Tapped S/2, d/2, 100% from March 1964)

Clone	Girth 1971 in.	cm	Trees tapped 1971	Yield 1965	1966	1967	1968	1969	1970	1971
IRCI 2	27·8	70·61	245—250	8·4 **3·81**	8·3 **3·77**	12·4 **5·63**	12·6 **5·72**	14·8 **6·72**	14·7 **6·67**	17·7 **8·04**
PB 86	26·6	67·56	250	5·3 **2·41**	5·1 **2·32**	7·2 **3·27**	8·0 **3·63**	8·4 **3·81**	8·2 **3·72**	11·0 **4·99**

Heavy type denotes metric equivalents in kg.

Field experiment No. 26 — 1957 clone trial — Estate B — Kalutara District (L. B. Chandrasekera & I. H. Stephen)

This trial is planted in two blocks of 10 acres and 20 acres in plots of 300 trees per clone. The test tapping yields of the best selections are compared with clone PB 86 in Tables 19 and 20.

TABLE 19

YIELD IN LB DRY RUBBER PER TREE PER YEAR (140 TAPPINGS) OF AVROS 1734 AS COMPARED WITH PB 86

(Tapped from April 1964 on S/2, d/2, 100%)

Clone	Girth 1971 in.	cm	Trees tapped 1971	Yield 1965	1966	1967	1968	1969	1970	1971
AVROS 1734	29·7	75·44	160—192	12·5 **5·68**	12·3 **5·58**	11·3 **5·13**	14·4 **6·54**	16·4 **7·45**	12·7 **5·77**	11·8 **5·36**
PB 86	27·6	70·10	189—205	7·3 **3·31**	9·0 **4·09**	10·4 **4·72**	9·9 **4·49**	8·7 **3·95**	9·5 **4·31**	11·7 **5·31**

Heavy type denotes metric equivalents in kg.

TABLE 20

YIELD IN LB DRY RUBBER PER TREE PER YEAR (140 TAPPINGS) OF RRIM 623 AND WR 101 COMPARED WITH PB 86

(Tapped on S/2, d/2, 100% from March 1964)

Clone	Girth 1971 in.	cm	Trees tapped 1971	Yield 1965	1966	1967	1968	1969	1970	1971
RRIM 623	29·5	74·93	212—230	10·3 **4·68**	12·1 **5·49**	9·9 **4·49**	12·0 **5·45**	11·9 **5·40**	12·1 **5·49**	12·3 **5·58**
WR 101*	28·5	72·39	100—178	5·9 **2·68**	8·7 **3·95**	11·4 **5·18**	10·0 **4·54**	10·2 **4·63**	9·2 **4·18**	9·4 **4·27**
PB 86	27·2	69·09	235—254	6·1 **2·77**	7·2 **3·27**	7·9 **3·95**	8·4 **3·81**	8·5 **3·86**	8·5 **3·86**	9·7 **4·40**

Heavy type denotes metric equivalents in kg.

*The clone WR 101 is found to be sensitive to Brown Bast on the S/2, d/2, 100% tapping system.

Field experiment No. 27 — 1958 clone trial — Estate B — Kalutara District (*L. B. Chandrasekera & I. H. Stephen*)

All clones are planted in unreplicated plots of 300 trees per clone. Test tapping yields of the better yielders are given in Table 21.

TABLE 21

YIELD IN LB DRY RUBBER PER TREE PER YEAR (140 TAPPINGS) OF BEST YIELDING CLONES IN 1958 CLONE TRIAL

(Tapped S/2, d/2, 100% from April 1965

Clone	Girth 1971 in.	Girth 1971 cm	Trees tapped 1971	Yield 1966	1967	1968	1969	1970	1971
IRCI 2	24·7	62·74	238—240	6·7 **3·04**	8·1 **3·68**	8·6 **3·90**	7·4 **3·36**	12·0 **5·45**	13·3 **6·04**
RRIC 36	29·2	74·17	200—204	8·6 **3·90**	8·5 **3·06**	9·1 **4·13**	9·4 **4·27**	13·7 **6·22**	12·6 **5·72**
RRIC 55*	25·8	65·53	175—185	10·1 **4·59**	9·8 **4·55**	8·5 **3·86**	7·8 **3·54**	9·5 **4·31**	9·6 **4·36**
PB 86	27·2	69·09	190—215	7·1 **3·22**	7·1 **3·22**	7·0 **3·18**	7·1 **3·22**	8·1 **3·68**	9·6 **4·36**
RRIC 45	24·9	63·25	238—250	6·8 **3·09**	8·7 **3·95**	8·7 **3·95**	7·6 **3·45**	6·9 **3·13**	7·2 **3·27**
RRIM 605	24·9	63·25	240—250	6·9 **3·13**	8·6 **3·90**	7·4 **3·36**	7·4 **3·36**	7·3 **3·31**	6·4 **2·91**
RRIC 52	31·3	79·50	235—250	4·6 **2·09**	4·7 **2·13**	4·9 **2·22**	5·7 **2·58**	6·0 **2·72**	5·6 **2·54**

Heavy type denotes metric equivalents in kg.

*The clone RRIC 55 is rather susceptible to *Oidium* leaf disease.

Field experiment No. 29 — 1964 yield trial, Salawa Estate (*L. B. Chandrasekera & U. K. D. Lewis*)

Clones Nab 15, RRIC 45, 86 and 88 are planted in 150-tree plots replicated three times. Tapping commenced in 1971. Test tapping results of the various clones are given in Table 22.

TABLE 22

1964 YIELD TRIAL—YIELD IN LB DRY RUBBER PER TREE PER YEAR (140 TAPPINGS)

(Tapped S/2, d/2, 100% from 1971)

Clone	Girth 1971 in.	Girth 1971 cm	Yield 1971
Nab 15	22·6	57·40	7·2 **3·27**
RRIC 45	20·4	51·82	6·6 **3·00**
RRIC 86	21·1	53·59	5·4 **2·45**
RRIC 88*	20·6	52·32	4·9 **2·22**

Heavy type denotes metric equivalents in kg.

*Clone RRIC 88 is susceptible to wind damage.

Spacing trials

Field experiment No. 24 — Spacing trial, Kuruwita (L. B. Chandrasekera & J. D. Karunatilleke)

Each of the clones RRIC 41, 45 and 52 are planted in 150-tree plots at spacings of 8′ × 30′ and 12′ × 20′ and replicated three times. Tapping commenced in 1971. The test tapping results during the first year are given in Table 23.

TABLE 23

SPACING TRIAL — YIELD IN GRAMS DRY RUBBER PER TREE PER TAPPING
(Tapped S/2, d/2, 100%)

Clone	8′ × 30′				12′ × 20′			
	Trees tapped	Girth 1971 in.	Girth 1971 cm	Yield	Trees tapped	Girth 1971 in.	Girth 1971 cm	Yield
RRIC 45	195	18·9	48·01	26·9	221	19·1	48·51	26·7
RRIC 41	185	20·9	53·09	22·0	305	21·3	54·10	23·2
RRIC 52	253	22·3	56·64	11·8	294	22·8	57·91	11·9
Mean	—	20·7	52·58	20·2	—	21·1	53·59	20·6

Immature arears

The following are the growth statistics of immature areas :

Field experiment No.	Year planted	Extent Acres	Extent Hectares	Clones	Points per clone	Average girth (1971) in.	Average girth (1971) cm
22	1965	10	4·05	RRIC 45	1800	20·4	51·82
23	1965	5	2·02	RRIC 45	(50 × 3)=150	18·3	46·48
				,, 88	,,	20·6	52·32
				,, 89	,,	17·6	44·70
				,, 90	,,	15·4	39·12
				,, 91	,,	20·1	51·05
				RRIM 600	,,	17·1	43·43
36	1966	10	4·05	RRIC 45	(135 × 3)=405	17·8	45·21
				,, 86	,,	18·6	47·24
				,, 88	,,	19·1	48·51
				RRIM 701	,,	18·6	47·24
37	1966	10	4·05	RRIC 5	(150 × 3)=450	16·1	40·89
				,, 45	,,	11·9	30·23
				Nab 15	,,	14·4	36·58
				RRIM 701	,,	10·9	27·69

(Continued)

Field experiment No.	Year planted	Extent		Clones	Points per clone	Average girth (1971)	
		Acres	Hectares			in.	cm
38	1966	10	4·05	RRIC 45	(134 × 3)=402	17·8	45·21
				,, 88	,,	19·1	48·51
				,, 91	,,	18·0	45·72
				AVROS 427	,,	15·4	39·12
39	1966	15	6·07	RRIC 45	(250 × 3)=750	15·7	39·88
				RRIM 605	,,	16·0	40·64
				RRIM 701	,,	13·4	34·04
40	1966	10	4·05	RRIC 36	(150 × 3)=450	19·6	49·78
				,, 41	,,	17·5	44·45
				,, 45	,,	16·0	40·64
				RRIM 605	,,	17·7	44·96
41	1966	20	8·09	RRIC 36	(265 × 3)=795	15·4	39·12
				,, 41	,,	17·3	43·94
				,, 86	,,	16·0	40·64
				PB 86	,,	15·5	39·37
44	1967	10	4·05	RRIC 36	(135 × 3)=405	13·7	34·80
				,, 45	,,	14·2	36·07
				,, 89	,,	14·2	36·07
				RRIM 600	,,	14·5	36·83
45	1967	10	4·05	RRIC 36	(175 × 3)=525	8·7	22·10
				,, 45	,,	7·7	19·56
				,, 89	,,	8·3	21·08
				PB 86	,,	9·4	23·88
48	1969	10	4·05	RRIC 45	(135 × 3)=405	—	—
				,, 100	,,	—	—
				,, 101	,,	—	—
				AVROS 1734	,,	—	—
49	1969	27	10·93	RRIC 45	(165 × 3)=495	—	—
				,, 88	,,	—	—
				,, 89	,,	—	—
				,, 90	,,	—	—
				,, 91	,,	—	—
				,, 100	,,	—	—
				,, 101	,,	—	—
				RRIM 600	,,	—	—
				PB 86	,,	—	—
51	1966	10	4·05	RRIC 45	(150 × 3)=450	12·7	32·26
				,, 75	,,	13·1	33·27
				,, 88	,,	14·3	36·32
				,, 89	,,	12·2	30·99
64	1971	35	14·16	RRIC 13	(300 × 3)=900	—	—
				,, 45	,,	—	—
				,, 48	,,	—	—
				,, 50	,,	—	—
				PR 252	,,	—	—
				IRCI 2	,,	—	—
				AVROS 1734	,,	—	—

Intercropping trials

Field experiment No. 30 — 1964 trial — 15 acres — *Rosebury Estate, Koslanda* (*L. B. Chandrasekera & U. K. D. Lewis*)

Clones RRIC 45, 52 and PR 107 are planted in plots of 300 trees per clone replicated three times. The rubber is planted in contour rows at spacings of 8′ × 30′. Half of each plot was interplanted with cacao in 1967.

The average girth of rubber at seven years of age are given in Table 24.

TABLE 24

AVERAGE GIRTH OF TREES

Clone	Average girth 1971 in.	cm	percentage tappable trees (over 20″ girth)
RRIC 52	16·8	42·67	35
RRIC 45	14·5	36·83	5
PR 107	14·1	35·81	6

The very poor growth of clones in this trial is characteristic of the very dry climatic conditions that pravail in this district.

Field experiment No. 60 — 1970 trial — 34 acres — Vykumbra Group (*L. B. Chandrasekera & U. K. D. Lewis*)

The clone RRIC 45 is planted in replicated plots of 250 trees per plot at spacings of 12′ × 20′ and 20′ × 20′ to provide for initial stands of 180 and 100 trees per acre, respectively. The plots with an average stand of 100 rubber trees to the acre are to be interplanted with cacao at a later stage.

Stock experiments

Field experiment No. 34 — 1966 small scale stock experiment — Nivitigalakele (*A. C. I. Yahampath & W. T. Silva*)

In this trial, planted in 1966, clone PB 86 was budded on seedling stocks of clones RRIC 7, 41, 52, 86, 88, 89 and *Hevea spruceana* and planted as randomized single tree plots. The average girth of these buddings at $4\frac{1}{2}$ and $5\frac{1}{2}$ years of age are summarized in Table 25.

TABLE 25

AVERAGE GIRTH OF CLONE PB 86 BUDGRAFTED ON DIFFERENT SEEDLING STOCKS

Seedling stock/clone	Scion/clone	Average girth 1970 in.	cm	Average girth 1971 in.	cm
RRIC 7	PB 86	18·4	46·74	21·4	54·36
,, 88	,,	18·0	45·72	21·2	53·85
,, 86	,,	17·9	45·47	21·6	54·86
,, 52	,,	17·9	45·47	20·7	52·58
,, 41	,,	17·9	45·47	21·2	53·85
,, 89	,,	16·2	41·15	19·4	49·28
Tjir 1	,,	17·0	43·18	20·1	51·05
H. spruceana	,,	13·8	35·05	16·5	41·91

Field experiment No. 47 — 1968 small scale stock experiment, Nivitigalakele (A. C. I. Yahampath & W. T. Silva)

In this trial seedlings of clones RRIC 7, 41, 52, 86, Gl 1, Wagga 6278 and Tjir 1 were budded with clone RRIC 45. The buddings were planted in May 1968 as randomized single tree plots. The average girth of buddings at $2\frac{1}{2}$ and $3\frac{1}{2}$ years of age are given in Table 26.

TABLE 26

AVERAGE GIRTH OF BUDGRAFTS OF CLONE RRIC 45, BUDDED ON DIFFERENT SEEDLING STOCKS

Seedling stock/clone	Scion/clone	Average girth 1970 in.	Average girth 1970 cm	Average girth 1971 in.	Average girth 1971 cm
Gl 1	RRIC 45	6·1	15·49	9·3	23·62
Wagga 6278	,,	5·6	14·22	9·1	23·11
RRIC 7	,,	5·9	14·99	9·9	25·15
,, 41	,,	5·9	14·99	9·5	24·13
,, 52	,,	5·9	14·99	9·7	24·64
,, 86	,,	5·7	14·48	9·7	24·64
Tjir 1	,,	5·9	14·99	8·5	21·59

Field experiment No. 61 — 1969 stock experiment, Nivitigalakele (A. C. I. Yahampath & W. T. Silva)

The clone RRIC 45 was budded on seedling stocks of clones RRIC 5, 41, 89, 52, RRIM 623 and Tjir 1 and planted in May 1969 as replicated single tree plots. The average girth of trees at $1\frac{1}{2}$ years and $2\frac{1}{2}$ years of age are summarized in Table 27.

TABLE 27

AVERAGE GIRTH OF BUDGRAFTS OF CLONE RRIC 45 GRAFTED ON DIFFERENT SEEDLING STOCKS

Seedling stock/clone	Scion/clone	Average girth 1970 in.	Average girth 1970 cm	Average girth 1971 in.	Average girth 1971 cm
RRIC 5	RRIC 45	3·9	9·91	6·8	17·27
,, 41	,,	3·9	9·91	6·3	16·00
,, 89	,,	3·9	9·91	6·6	16·76
,, 52	,,	3·8	9·65	6·6	16·76
RRIM 623	,,	3·8	9·65	6·5	16·51
Tjir 1	,,	3·8	9·65	5·9	14·99

Field experiment No. 62 — 1971 stock experiment, Nivitigalakele (A. C. I. Yahampath & W. T. Silva)

The clone RRIC 45 was budded on seedling stocks of clones RRIC 5, 7, 36, 45, 52, RRIM 623, AVROS 427, Gl 1, Tjir 1, PB 86, TR 1406, WR 101 and Wagga 6278 and planted in May 1971 as replicated single tree plots. The average height of buddings above the graft union at eight months of age are given in Table 28.

TABLE 28

HEIGHT OF BUDDINGS OF CLONE RRIC 45 ABOVE THE GRAFT UNION, WHEN BUDDED ON DIFFERENT SEEDLING STOCKS

Seedling stock	Scion	Height ft	Height cm
RRIC 5	RRIC 45	3·5	106·68
,, 7	,,	2·8	85·34
,, 36	,,	3·2	97·54
,, 45	,,	3·0	91·44
,, 52	,,	3·2	97·54
RRIM 623	,,	2·9	88·39
AVROS 427	,,	3·3	100·58
Gl 1	,,	3·3	100·58
Tjir 1	,,	3·3	100·58
PB 86	,,	3·3	100·58
TR 1406	,,	3·6	109·73
WR 101	,,	3·5	106·68
Wagga 6278	,,	3·7	112·78

Other investigations

Rainguards (R. Satchuthananthavale & I. Amarasinghe) : A rubber rainguard on the gutter principle, having a simple design was fabricated and tested out on a small scale under field conditions. These were also fixed to cut stems of rubber trees and left exposed to sun and rain. After four months, the rainguards have maintained their original shape, having a good "V" shaped gutter. Fixing of these rainguards to uneven surfaces and panels with nodules did not present difficulties.

Bacterial coagulation of latex (R. Satchuthananthavale in collaboration with (Mrs.) V. Satchuthananthavale) : Work connected with the culture of bacterial species for coagulation of latex was continued.

Two more species of bacteria were isolated from cup coagula and cultured in coconut water medium. Complete coagulation of field latex at initial concentration was achieved in 4 hr by seeding the latex with liquid cultures of these bacteria.

Seven-day old liquid cultures of bacteria (culture R6) were centrifuged in a Sharples centrifuge and the separated bacterial cells dried in a desiccator over silica gel. The dried bacteria were stored under laboratory conditions in small polythene vials. The oldest bacteria available was six months old. When these bacteria were added directly to field latex, complete coagulation took place in 6 — 7 hr. The coagulum was odourless and white in colour.

Tissue culture (*R. Satchuthananthavale & G. de Mel*: Callus cultures from anthers of *Hevea brasiliensis* — cultivars KH 440 and RRIC 52 — have been established and grown successfully for the first time on a solid agar medium, containing macro and micro elements, carbohydrates, vitamins and growth substances. The callus cultures were sub-cultured and maintained throughout the year. Callus formation occurred from the pollen grains as well as from cells forming the wall of the anther. Attempts to induce callus tissue from anthers to differentiate into plantlets were not successful.

Studies on phytoalexins (*R. Satchuthananthavale in collaboration with* (*Mrs.*) *V. Satchuthananthavale*): Studies on phytoalexins were carried out using mature pods of clones RRIC 45, 52 and Wagga 6278. Diffusates collected 42 hr after inoculation of pods with *Phytophthora* zoospore suspensions showed complete inhibition of germination of zoospores.

Acknowledgements

The author acknowledges with thanks the valuable assistance given by Mr.W. G. V. Fernando, the Senior Technical Assistant of the Botany Department, in the preparation of summaries and analysis of data from field experiments.

Index to field experiments

Experiment No.

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7	1954 clone trial — Nivitigalakele
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61 1969 stock experiment — Nivitigalakele
62 1971 stock experiment — Nivitigalakele
63 1971 Ethrel stimualtion experiment — Eladuwa Estate, Paiyagala
64 1971 yield trial, Farnham Estate, Puwakpitiya
65 1971 Ethrel stimulation experiment — Etana Estate, Warakapola
67 1971 Ethrel stimulation experiment — Dewalakanda Estate, Dehiowita.

REVIEW OF THE GENETICS & PLANT BREEDING DEPARTMENT

By

D. M. Fernando

SUMMARY

Large scale plots of RRIC 101 and RRIC 103 were brought into tapping at five years of age and showed very satisfactory yields and percentage of trees that could be opened early. A few seedlings were obtained with a combined source of SALB resistance. RRIC 102 yielded satisfactorily at Matale at an elevation of 1,400 ft. An inhibitor was isolated from rubber seed oil. A population of 3,000 seedlings from 31 different clonal sources was tested individually and 330 seedlings selected for further study.

DETAILED REVIEW

General

Eight more selections were given RRIC numbers in order to diversify the material issued to estates. The details of the RRIC 100 series are now as follows :—

RRIC No.	Parentage	Original clone No.
RRIC 100	RRIC 52 × PB 86	663
RRIC 101	Ch 26 × RRIC 7	1174
RRIC 102	RRIC 52 × RRIC 7	1103
RRIC 103	RRIC 52 × PB 86	451
RRIC 104	RRIC 52 × Tjir 1	734
RRIC 105	RRIC 52 × Tjir 1	739
RRIC 106	RRIC 52 × PB 5/139	788
RRIC 107	RRIC 52 × RRIC 86	1290
RRIC 108	RRIC 36 × Ch 26	2992
RRIC 109	Ch 26 × RRIC 36	3333
RRIC 110	LCB 1320 × RRIC 7	6333

Staff

The Head of the Department, Mr. D. M. Fernando, was on duty throughout the year. The Assistant Geneticist, Mr. N. E. M. Jayasekera left Ceylon in September for post-graduate studies in Genetics at the University of Birmingham. Mr. C. M. B. Ratnayake, Assistant Geneticist, was on duty throughout the year.

The Senior Field Assistant, Mr. H. B. H. de Silva ; Technical Assistants, Messrs. P. Samaranayake and M. S. C. de Silva ; Field Assistants, Messrs. D. S. Gamage, W. A. C. Wijesinghe, A. K. M. S. Senaratne and B. M. S. G. Peiris were on duty throughout the year. Two graduate trainees were attached to the Department during the year. Nine daily paid workers were appointed on a monthly pay basis in the Department.

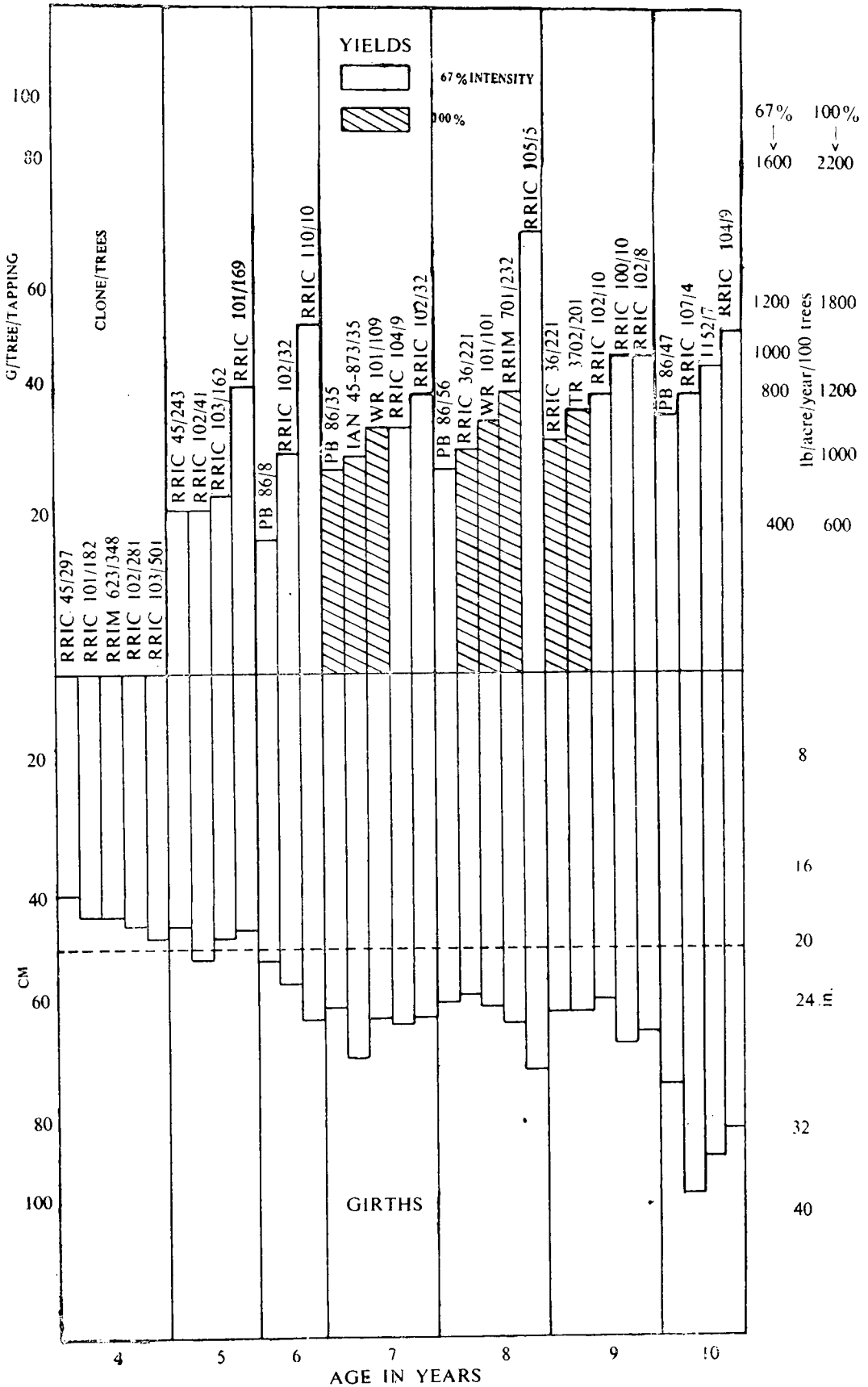


Fig. 1. Yields and girths of some of the newer clones

Visits

The Head of the Department made 36 visits and the rest of the staff made 171 visits in connection with experimental work.

Meetings

A meeting of the International Rubber Research & Development Board was attended during the year.

Publications

The following publications were prepared in the Department :—

(i) Annual Review of the Department for 1971

(ii) Annual Report of the Department for 1971

(iii) Fernando, D. M. and De Silva, M. S. C. (1971). A new basis for the selection of *Hevea* seedlings. *Q. Jl. Rubb. Res. Inst. Ceylon* **48,** 19 — 30.

(iv) Fernando, D. M. (1971). The yields and secondary characters of clone RRIC 102. *Q. Jl. Rubb. Res. Inst. Ceylon* **48,** 56 — 67.

(v) Jayasekera, N. E. M. and Senanayake, Y. D. A. (1971). A study of growth parameters in a population of nursery rootstock seedlings of *Hevea brasiliensis,* cv. Tjir 1. *Q. Jl. Rubb. Res. Inst. Ceylon* **48,** 66 — 81.

(vi) Fernando, D. M., Tambiah, M. S., Abeywardena, V. and Samaranayake, P. (1971). A study of the heritability of oil content in cotyledons of *Hevea* seedlings. *Q. Jl. Rubb. Res. Inst. Ceylon* **47,** 70 — 72.

Buildings and facilities

Mains current was supplied to Kuruwita during the year. It was not possible to call for tenders for the laboratory at Kuruwita.

Research investigations

Clone evaluation (*D. M. Fernando*)

Two more RRIC 100 series clones, *viz.* RRIC 101 and RRIC 103 came into tapping on a larger scale. Both clones were tapped at five years of age and showed better yields than the control clone, RRIC 45. The first year high yields of RRIC 101 exhibited in the original ten-tree plot were repeated on the replicated 100-tree plots at Kuruwita and Nivitigalakele (Table 15 and Fig. 1). RRIC 102 continued to show outstanding yields and favourable secondary characters (Table 13 and Fig. 1). In addition to RRIC 100 and 101, two more clones, RRIC 102 and RRIC 103, are therefore available for the necessary diversification of planting material. The original seven-tree plot of RRIC 101 showed a drop in yield in the sixth year of tapping.

Rubber seed oil (*C. M. B. Ratnayake*)

The components of rubber seed oil, separated by paper chromatography, were assayed for inhibitory and stimulatory activity ; a paper on the findings was submitted to an international congress scheduled for early 1972.

Seedling variability — Tjir 1 (*N. E. M. Jayasekera & P. Samaranayake*)

Leaf area measurements were taken and the plants were budded with clone RRIC 45. Arrangements for a 1971 N. E. planting did not materialise and a 1972 S. W. planting is planned.

Seedling variability — polyclone (*C. M. B. Ratnayake & M. S. C. de Silva*)

Randomized seedlings from seven sources already analysed for growth, latex and oil content, were budded with RRIC 101 and RRIC 103 prior to field planting, for an estimate of stock-scion effect.

Selection (1) (*D. M. Fernando & M. S. C. de Silva*)

One hundred seedlings each from 31 sources were tested for latex content and vigour and 300 selections established for further study.

Selection (2) (*W. D. Gunadasa & C. Weerasinghe*)

Three thousand seedlings from the clone 1004 which seeded heavily this season, were tested for selection of vigorous plants with a high latex content.

Total lipid content (*D. M. Fernando & P. Samaranayake*)

Investigations were continued for the purpose of evolving a quick method of estimating total lipid content from plant tissues after separating the chlorophylls.

Pollen germination (*C. M. B. Ratnayake*)

The lowered viability of pollen appeared to be due to the presence of a fungus in the anthers of the flower even prior to opening. Samples of material were handed over to the Plant Pathology Department for further identification.

Artificial pollination programme (*C. M. B. Ratnayake, D. S. Gamage & B. M. S. G. Peiris*)

The programme was directed towards combination of SALB-resistant sources which have reached satisfactory yield levels. Differing flowering times and the severe epiphytotic of *Oidium* leaf disease lowered the number of seedlings that could be obtained (Table 1). It is proposed to repeat this programme in 1972.

TABLE 1

PROGENY OBTAINED BY ARTIFICIAL POLLINATION (1971)

Station	Cross	No. of seed-lings
Dartonfield	5326 (RRIC 51 × F 4542) × 2473 (RRIC 45 × IAN 45 - 873)	27
,,	,, × 3229 (RRIC 52 × RRIC 36)	15
,,	,, × 8501 (RRIC 52 × FX 360)	6
,,	2473 (RRIC 45 × IAN 45 - 873) × 5326 (RRIC 51 × F 4542)	6
,,	,, × 3229 (RRIC 52 × RRIC 36)	10
,,	,, × 1461 (RRIC 52 × T 792)	3
,,	1461 (RRIC 52 × T 792) × 2473 (RRIC 45 × IAN 45 - 873)	6
,,	,, × 3229 (RRIC 52 × RRIC 36)	8
Peenkande	IAN 45 - 717 (PB 86 × F 4542) × IAN 45 - 717 (PB 86 × F 4542)	4
Kuruwita	8501 (RRIC 52 × FX 360) × IAN 45 - 710 (PB 86 × F 409)	6
,,	,, × 8501 (RRIC 52 × FX 360)	2
,,	,, × 3229 (RRIC 52 × RRIC 36)	8
,,	,, × 2473 (RRIC 45 × IAN 45 - 873)	6
,,	506 (RRIC 52 × PB 86) × IAN 45 - 710 (PB 86 × F 409)	30
,,	,, × 5326 (RRIC 51 × F 4542)	13
,,	,, × 2473 (RRIC 45 × IAN 45 - 873)	10

Disease resistance

Oidium (*C. M. B. Ratnayake & D. S. Gamage*)

The yields of RRIC 102 (Table 2) at Matale (elevation of 1,400 ft), improved in the second year as expected. This increase in yield and girth would permit the use of this clone for upland planting. In the case of clones such as 860, 828, 864 and 877 though foliage and growth were satisfactory, yields were very low. Regular tapping was more feasible than in the wet zone in this area.

TABLE 2

1963 N. E. CLONE TRIAL — MATALE

(Tapped S/2, d/3, 67% from 1970)

Clone	Parentage	Trees tapped	Mean girth cm 1970	Mean girth cm 1971	Mean girth in. 1971	Yield in g/tree/tapping 1970	Yield in g/tree/tapping 1971
RRIC 102	RRIC 52 × RRIC 7	33	47·4	51·9	20·4	15·4	25·7
1108	RRIC 52 × RRIC 7	23	45·8	53·9	21·2	10·6	17·3
815	PB 5/139 × RRIC 52	22	50·8	58·4	22·9	11·3	17·7

Colletotrichum *leaf fall* (*H. B. H. de Silva*)

RRIC 52 progeny 3221 and 3229 were free of leaf fall and showed increased yields. RRIC 50 had some *Colletotrichum* (*Gloeosporium*) leaf fall but the yields, of a few trees (Table 3) from the plot selected for test tapping, were satisfactory : the growth of this clone was however less than that of RRIC 52 progeny. The wind-resistant branching habit and other favourable secondary characters of clones 3229 would permit further trial of this clone in this district.

TABLE 3

1964 CLONE TRIAL — NAKIADENIYA GROUP

(Tapped S/2, d/2, 100% from 1970)

Clone	Parentage	Trees tapped	Mean girth cm 1970	Mean girth cm 1971	Mean girth in. 1971	Yield in g/tree/tapping 1970	Yield in g/tree/tapping 1971
3221	RRIC 52 × RRIC 36	10	55·8	63·9	25·1	22·5	38·1
3229	RRIC 52 × RRIC 36	4	51.7	72·0	28·3	20·0	37·9
RRIC 50	Tjir 1 × PB 86	7	43·8	51·1	20·1	17·7	34·3
6338	LCB 1320 × RRIC 7	5	49·5	55·3	21.7	22·1	32·0
79	RRIC 41 × (PB 86 × AVROS 157)	21	51·8	63·9	25·1	21·0	31·9
1923	RRIC 51 × LCB 1320	19	54·3	65·4	25·7	22·5	31·7
815	PB 5/139 × RRIC 52	10	57·3	72·5	28·5	21·7	30·0
3202	RRIC 52 × RRIC 36	20	60·3	68·7	27·0	20·8	29·9
1018	RRIC 52 × RRIC 7	10	53·8	63·4	24·9	20·8	28·3
IAN 6505		2	47·3	52·0	20·4	26·4	28·2
687	RRIC 52 × PB 86	4	51·5	59·5	23·4	15·6	28·1
PB 86		2	41·8	42·7	16·8	19·8	27·0
2018	RRIC 52 × RRIC 7	20	56·5	61·7	24·2	17·5	25·1
864	PB 5/139 × RRIC 52	9	49·8	57·6	22·6	14·1	24·8
3189	RRIC 52 × RRIC 7	8	53·5	60·7	23·8	16·0	24·3
2040	RRIC 52 × RRIC 7	15	54·5	61·9	24·3	15·5	23·9
IAN 6585	FX 43 - 651 × PB 86	9	51·3	58·9	23·1	15·0	22·8

Phytophthora (*D. M. Fernando*)

RRIC 101 showed a very poor flowering and fruit-set and was relatively unaffected by *Phytophthora* leaf fall. RRIC 102 also showed comparatively poor flowering and fruit-set and was free of *Phytophthora* leaf fall in the larger plots at Kuruwita. Selfed progeny of RRIC 52 did not show sufficiently high yields in the 1963 clearing at Kuruwita for further trials on the basis of self-sterility.

Microcylus (*formerly* Dothidella) (*D. M. Fernando, C. M. B. Ratnayake, D. S. Gamage & W. D. Armon*)

As shown in Table 4, IAN 45 - 873 showed yields and growth superior to PB 86.

As shown in Table 5, satisfactory early opening and yields were shown in Dartonfield in a number of clones incorporating SALB-resistant material. The interspecific hybrid 5326 wintered very sparingly and was not attacked by *Oidium heveae*. A similar series of clones planted in 1963 at 1,400 ft elevation (Table 6) showed some set-back owing to dry conditions : appreciable resistance to leaf disease was however evident during the very severe 1971 epiphytotic of *Oidium heveae*.

TABLE 4

1960 CLONE TRIAL — PEENKANDE

(Tapped 2S/2, d/4, 100%)

Clone	Trees tapped	Girth cm 1970	Girth cm 1971	Yield per average cut in g/tree/tapping 1967	1968	1969	1970	1971
IRCI 7	36	69·2	71·2	32·1	46·4	48·6	39·8	41·8
C 695	34	61·9	62·3	27·2	29·9	38·5	32·7	38·5
IAN 45 - 873	35	73·8	74·7	33·2	38·5	38·5	33·4	35·5
PB 86	40	65·4	66·8	26·1	28·3	26·4	29·8	33·3
PR 228	28	64·9	65·5	35·5	33·7	36·3	33·4	32·0
IAN 45 - 717	36	67·9	70·7	23·6	30·2	33·0	29·9	30·9
IAN 45 - 710	37	66·5	68·1	23·4	25·9	32·1	28·8	29·3
RRIC 86	15	63·5	63·7	16·2	22·7	25·4	29·5	29·0
AVROS 385	1	71·2	60·1	19·2	24·0	27;6	33·0	28·6
FX 2261	36	64·0	65·4	22·4	36·3	37·2	30·5	27·8
FX 3810	38	74·9	79·2	19·1	22·2	25·4	22·5	27·6
TR 1548	32	67·1	67·7	21·3	22·9	24·4	26·4	24·8
AVROS 427	24	56·5	58·0	47·3	34·6	28·3	30·9	16·4
IRCI 10	24	57·9	57·9	15·5	21·9	26·6	21·8	16·4
Harbel 1	28	58·4	59·7	24·2	15·3	21·3	22·1	16·1
ST 71	33	59·9	60·2	21·6	23·2	19·8	17·9	13·0
OY 1	29	55·6	57·3	8·7	12·0	12·0	9·6	7·4

TABLE 5

1965 SMALL SCALE CLONE TRIAL — DARTONFIELD

(Tapped S/2, d/3, 67% from 1970)

Clone	Parentage	Trees tapped	Mean girth cm 1970	Mean girth cm 1971	Mean girth in. 1971	Yield in g/tree/tapping 1970	Yield in g/tree/tapping 1971
6306	RRIC 36 × FX 516	7	47·9	53·7	21·1	23·9	34·9
RRIC 102	RRIC 52 × RRIC 7	4	49·7	53·3	20·9	25·8	32·4
2417	RRIC 45 × FX 4098	5	49·8	53·9	21·2	21·7	31·0
3164	LCB 1320 × RRIC 51	4	55·4	61·5	24·2	22·0	27·3
1461	RRIC 52 × T 792	10	55·0	59·5	23·4	20·0	27·2
2473	RRIC 45 × IAN 45-873	11	48·8	53·5	21·0	14·8	23·2
RRIC 45	RRIC 8 × Tjir 1	80	48·0	51·6	20·3	18·7	22·7
691	PB 86 × RRIC 52	4	50·6	57·5	22·6	13·1	20·9
2885	Ch 26 × RRIC 52	10	56·8	63·4	24·9	14·6	20·9
2416	RRIC 45 × FX 4098	13	54·6	61·4	24·1	16·7	20·8
5326	RRIC 51 × F 4542	11	48·8	54·9	21·6	16·2	20·5
5352	RRIC 52 × IAN 45-710	13	52·6	61·2	24·0	13·6	18·8
6182	PB 28/59 × IAN 45-873	11	50·8	57·1	22·4	14·7	18·7
IAN 45-710	PB 86 × F 409	4	44·9	51·1	20·1	13·7	16·9
RRIM 623	PB 49 × PilB 84	9	48·9	53·7	21·1	16·2	16·1
RRIC 106	PB 5/139 × RRIC 52	13	54·9	58·9	23·1	16·0	14·4

TABLE 6

1963 CLEARING — HAPUGASPITIYA

(Tapped S/2, d/3, 67% from 1970)

Clone	Parentage	Trees tapped	Mean girth cm 1970	Mean girth cm 1971	Mean girth in. 1971	Yield in g/tree/tapping 1970	Yield in g/tree/tapping 1971
2427	RRIC 45 × FX 4908	1	45·4	52·0	20·4	17·4	17·9
1108	RRIC 52 × RRIC 7	23	45·8	53·9	21·2	10·6	17·3
2414	RRIC 45 × FX 4098	1	42·5	48·2	18·9	10·7	17·0
2418	RRIC 45 × FX 4098	1	44·8	51·2	20·1	16·0	14·3
2483	RRIC 45 × IAN 45 - 873	2	46·5	54·5	21·4	10·2	14·2
2464	RRIC 88 × FX 4098	1	47·0	52·0	20·4	13·2	13·7
2425	RRIC 45 × FX 4098	1	47·0	53·3	20·9	10·0	13·3
2458	RRIC 88 × FX 4098	1	42·0	48·1	18·9	11·0	11·1

Clone trials

1961 small scale clone trial — Kuruwita (W. A. C. Wijesinghe & B. M. S. G. Peiris)

Yields of RRIC 100, 101, 104 and 107 appear to have reached a peak and show signs of levelling off at the sixth year (Table 7). If this trend is seen to continue in 1972 it should be possible to increase yields by moving to 133% intensity in 1973.

TABLE 7

1961 SMALL SCALE CLONE TRIAL — KURUWITA

(Tapped 67% in 1966, 1967; 100% in 1968, 1969; 67% in 1970, 1971)

Clone	Trees tapped	Mean girth cm 1970	cm 1971	in. 1971	Yield in g/tree/tapping 1966	1967	1968	1969	1970	1971
RRIC 100	10	64·9	68·5	26·9	34·0	66·5	91·2	63·7	58·6	51·3
RRIC 100	4	65·3	66·8	26·2	39·5	75·5	87·3	67·3	78·5	59·8
RRIC 101	7	65·6	67·9	26·7	64·4	76·3	47·9	56·5	46·1	35·0
RRIC 104	9	80·2	84·3	33·1	28·8	42·9	58·7	52·6	68·4	56·4
RRIC 107	4	87·1	91·2	35·9	28·9	38·4	53·8	62·2	44·1	47·8
RRIC 107	4	83·3	87·3	34·3	33·6	54·7	53·8	58·1	62·6	60·8
1152	7	70·4	74·1	29·1	35·8	61·9	67·4	49·6	66·6	61·7
1152	5	70·1	74·4	29·2	33·3	61·8	47·8	48·7	55·9	51·3
1305	6	77·5	80·0	31·4	44·2	48·6	64·7	73·8	51·4	58·2
1305	3	85·3	88·0	34·6	57·5	70·9	62·6	66·1	104·9	96·2
82	9	73·0	78·1	30·7	27·5	45·9	46·3	40·6	52·2	35·6
PB 86	47	67·8	70·6	27·7	26·0	30·1	35·0	37·8	40·2	45·7

1961 N. E. clone trial — Moneragala (A. K. M. S. Senaratne)

As the adjoining area of PB 86 took ten years to come into maturity the tapping of the experimental plot was delayed. Two-tree plots of clones from the 1961 trial at Kuruwita were planted in this experiment. RRIC 101 (Table 8) showed the comparatively high first year yields exhibited at Kuruwita. Satisfactory girth and yields were also shown by RRIC 104. RRIC 106 showed satisfactory girth but lower first year yields. Corroboration of these findings is expected later from the 1965 trial in the same estate where replicated ten-tree plots of some of these selections have been planted.

TABLE 8

1961 N. E. CLONE TRIAL — MONERAGALA
(Tapped S/2, d/2, 100%)

Clone	Parentage	Trees tapped	Girth 1971 cm	Girth 1971 in.	1971 Yield in g/tree/ tapping
1857	RRIC 45 × LCB 1320	1	76·4	30·0	57·6
1464	Nab 20 × RRIC 7	1	75·4	29·6	52·2
86	RRIC 41 × RRIC 10	1	56·4	22·2	52·0
1307	— do —	1	85·5	33·6	51·2
RRIC 101	Ch 26 × RRIC 7	2	61·2	24·0	43·9
1463	Nab 20 × RRIC 7	1	70·0	27·5	40·8
RRIC 104	RRIC 52 × Tjir 1	1	78·7	30·9	40·3
302	Tjir 1 × RRIC 50	2	79·5	31·2	39·3
1487	Nab 20 × RRIC 7	1	67·5	26·5	38·6
1218	Ch 26 × RRIC 36	1	60·4	23·7	36·9
1867	RRIC 45 × LCB 1320	2	64·8	25·5	34·1
1461	RRIC 52 × T 792	1	76·5	30·1	33·5
2018	RRIC 52 × RRIC 7	1	63·5	25·0	33·0
1068	Tjir 1 × Wagga 6278	2	69·6	27·4	28·4
PB 28/59	—	5	64·3	25·3	24·9
1485	Nab 20 × RRIC 7	2	48·3	19·0	23·7
2335	RRIC 52 × H 151	2	75·5	29·7	23·6
1304	RRIC 41 × Ch 26	1	65·0	25·5	23·5
79	RRIC 41 × PB 86 × AVROS 157	2	51·7	20·3	21·8
2315	RRIC 52 × AVROS 157	2	73·2	28·8	21·8
1923	RRIC 51 × LCB 1320	2	74·8	29·4	19·3
RRIC 88	—	5	63·4	24·9	19·0
PB 86	—	5	54·5	21·4	18·9
2353	RRIC 52 × H 151	2	66·8	26·2	18·8
RRIC 106	PB 5/139 × RRIC 52	2	69·3	27·2	18·3
RRIC 89	—	5	52·0	20·4	17·4
2043	RRIC 52 × RRIC 7	1	58·3	22·9	15·6
RRIC 7	—	5	55·9	22·0	15·3
516	RRIC 52 × PB 86	1	58·5	23·0	12·0
RRIC 52	—	5	63·3	24·9	10·6

1962 S. W. clone trial — Kuruwita (B. M. S. G. Peiris)

As shown in Table 9, RRIM 701, TR 3702 and RRIC 36 showed the best yields. There seems to be appreciable variation in yields and order of yields when these clones are compared with a similar plot at Nivitigalakele (test-tapped by the Botany Department). This may be due to differing soils. RRIC 36 appears consistently high in both fields though requiring fungicidal protection against Bark Rot.

TABLE 9

1962 S. W. CLONE TRIAL — KURUWITA

(Tapped S/2, d/2, 100%)

Clone	Trees tapped	Girth cm 1970	Girth cm 1971	Yield in g/tree/tapping 1969	Yield in g/tree/tapping 1970	Yield in g/tree/tapping 1971
RRIM 701	232	62·6	64·2	32·1	51·7	50·7
TR 3702	201	57·9	60·2	38·0	38·5	45·8
RRIC 36	221	55·7	60·1	35·3	37·3	43·0
PR 228	109	56·2	58·3	37·8	46·9	39·8
RRIM 628	130	57·3	51·3	52·2	38·0	39·6
WR 101	101	59·9	60·9	40·9	45·6	38·2
RRIM 623	223	63·2	63·7	46·5	49·7	36·9
PB 86	185	56·7	59·1	30·0	31·9	36·1
IRCI 7	108	56·3	58·0	39·5	36·9	35·6
RRIM 707	213	60·3	62·2	—	47·6	34·3
RRIC 45	213	56·7	58·0	36·9	39·6	32·5
RRIC 37	108	58·6	59·6	27·5	38·7	32·3
PR 259	91	51·1	52·4	35·0	36·3	32·0
IAN 45 - 717	226	55·8	59·1	21·0	25·1	31·5
RRIM 607	210	57·3	60·5	24·9	31·4	30·1
AVROS 529	102	60·2	62·4	35·2	21·8	29·8
PR 251	108	55·5	56·7	39·3	26·6	29·5
RRIC 14	195	61·5	66·0	31·4	29·3	24·8
TR 1548	221	57·8	60·1	25·0	22·4	26·2
RRIC 7	112	57·8	56·5*	43·7	37·0	26·1
IAN 6497	113	52·1	58·5	21·4	16·3	23·9
AVROS 2037	198	61·6	64·4	24·1	20·7	23·6
Harbel 1	226	54·0	55·5	30·8	20·6	22·1
RRIC 52	257	61·9	68·9	10·2	14·8	19·9
RRIC 51	206	58·5	60·3	17·3	12·8	14·3

* Girth measured on more trees than 1970

1962 small scale clone trial — Kuruwita (B. M. S. G. Peiris)

RRIC 102 showed the best yields (Table 10). Other test clones of the same parentage as RRIC 102 showed better growth but lower yields.

TABLE 10

1962 SMALL SCALE CLONE TRIAL — KURUWITA

(Tapped S/2, d/2, 100%)

Clone	Trees tapped	Girth cm 1970	Girth cm 1971	Yield in g/tree/tapping 1968	1969	1970	1971
RRIC 102	8	60·3	62·2	58·3	48·5	55·3	57·2
1458	10	60·9	62·4	48·6	38·9	42·8	35·7
2031	10	67·2	69·3	36·5	31·3	43·8	39·8
2005	10	56·2	58·1	51·7	39·5	43·7	32·8

1962 small scale clone trial — Nivitigalakele (D. S. Gamage)

RRIC 102 showed satisfactory yields in this trial (Table 11). Unlike most of the other clones in this trial all the original ten trees are still in tapping indicating some resistance to wind damage.

TABLE 11

1962 S. W. SMALL SCALE CLONE TRIAL — NIVITIGALAKELE

(Tapped S/2, d/3, 67% 1968 and 1969 ; S/2, d/2, 100% 1970 and 1971)

Clone	Trees tapped	Girth cm 1970	Girth cm 1971	Yield in g/tree/tapping 1968	1969	1970	1971
RRIC 102	10	57·1	58·5	40·1	41·4	32·7	49·2
RRIC 45	6	56·1	60·0	36·3	32·5	29·0	45·6
82	6	72·2	80·0	45·4	42·2	33·2	44·8
RRIM 607	8	64·3	70·7	—	—	30·7	37·3
815	3	58·4	65·2	—	37·2	23·1	36·4
1458	8	54·4	59·2	38·6	39·3	23·3	35·1
1317	10	63·5	67·5	31·2	28·8	22·4	30·2
RRIC 52	7	65·0	71·0	20·5	24·1	19·6	28·1
IAN 6497	4	57·8	62·1	—	—	22·2	24·5
Harbel 1	9	50·5	51·7	—	—	19·1	23·2
RRIC 7	7	53·8	56·4	—	—	26·8	22·1

1963 small scale clone trial — Kuruwita (W. A. C. Wijesinghe)

RRIC 105 and RRIC 109 showed satisfactory combination of yields and growth though the clearing was brought into tapping at five years of age (Table 12). The rising yield trend indicates that a 67% intensity of tapping is desirable in this clearing for a few more years.

TABLE 12

1963 SMALL SCALE CLONE TRIAL — KURUWITA

(Tapped S/2, d/3, 67%)

Clone	Parentage	Trees tapped	Mean girth cm 1970	Mean girth cm 1971	Mean girth in. 1971	Yield in g/tree/tapping 1968	Yield in g/tree/tapping 1969	Yield in g/tree/tapping 1970	Yield in g/tree/tapping 1971
3279	Tjir 1 × LCB 1320	6	65·8	70·3	27·6	—	37·0	58·7	82·4
RRIC 105	RRIC 52 × Tjir 1	5	68·2	72·7	28·6	21·0	44·3	70·8	78·8
RRIC 109	Ch 26 × RRIC 36	6	64·0	67·4	26·5	—	45·8	49·9	73·7
3606	RRIC 45 × LCB 1320	2	72·9	74·9	29·4	—	39·2	50·4	71·0
3060	Ch 26 × Wagga 6278	7	66·4	70·0	27·5	33·1	38·3	18·7	65·1
GT 711	—	8	57·6	60·6	23·8	28·5	43·4	40·9	59·2
1620	Tjir 1 × LCB 1320	5	62·9	64·3	25·3	29·9	38·1	57·2	57·8
RRIC 108	RRIC 36 × Ch 26	7	57·3	59·6	23·4	32·4	42·7	62·2	55·8
4011	RRIC 52 × RRIC 52	7	59·8	62·8	24·7	—	—	47·5	54·4
2994	RRIC 36 × Ch 26	8	62·0	65·0	25·5	32·7	35·6	42·0	53·9
T 132	RRIC 37 × Wagga 6278	7	60·1	63·6	25·0	31·7	37·8	41·1	52·8
2231	RRIM 513 × LCB 1320	10	57·3	60·1	23·6	25·2	42·1	53·6	45·6
T 57	PR 107 × LCB 1320	9	50·2	52·7	20·7	—	34·5	40·4	45·5
3076	RRIC 45 × Wagga 6278	6	55·8	57·1	22·4	—	36·2	56·7	43·4
2284	RRIM 513 × RRIC 36	8	60·4	62·1	24·4	28·2	37·7	48·3	43·3
1501	RRIC 45 × GPM 1	10	55·4	58·2	22·9	19·4	36·5	28·0	41·8
4008	RRIC 52 × RRIC 52	10	64·9	68·6	27·0	20·8	24·3	32·8	40·7
1729	RRIC 51 × PR 107	8	52·8	54·5	21·4	—	36·0	38·5	39·7
PB 86	—	56	55·1	58·5	23·0	24·2	26·2	28·5	33·3
2053	RRIC 52 × RRIC 7	9	59·2	61·8	24·3	33·5	35·0	43·6	30·7
2228	RRIM 513 × LCB 1320	10	63·4	65·1	25·6	20·8	45·2	44·7	28·3

1964 clone trial — Kuruwita (W. A. C. Wijesinghe)

RRIC 110 showed a very satisfactory rate of growth and yield. The large plots of RRIC 102 (Table 13) showed a very satisfactory foliage, and uniform growth and yield ; both factors were a considerable improvement on the control clone PB 86.

TABLE 13

1964 CLONE TRIAL — KURUWITA

(Tapped S/2, d/3, 67%)

Clone	Parentage	Trees tapped	Mean girth cm 1970	cm 1971	in. 1971	Yield in g/tree/tapping 1969	1970	1971
RRIC 110	LCB 1320 × RRIC 7	10	62·2	65·5	25·7	27·3	61·9	64·2
RRIC 102	RRIC 52 × RRIC 7	32	58·5	60·4	23·7	26·8	45·3	49·4
RRIC 102	— do —	34	58·5	60·8	23·9	—	43·4	44·3
266	Mil 3/2 × Tjir 1	18	60·5	67·6	26·6	20·3	41·6	46·8
6326	LCB 1320 × RRIC 7	27	54·3	56·3	22·1	23·5	39·2	37·9
1152	RRIC 45 × RRIC 13	18	58·4	61·9	24·3	21·6	32·5	33·4
6310	LCB 1320 × RRIC 7	26	52·9	56·0	22·0	20·0	36·2	29·5
PB 86	—	8	48·8	52·7	20·7	—	25·3	25·4

1965 N. E. clone trial — Moneragala (D. S. Gamage)

Additional casualties occurred in this trial owing to damage by elephants during the year : RRIC 101 showed the best resistance to drought as shown in Table 14. If other clones are planted in these drier areas, a higher original stand per acre is advocated in order to have a sufficient stand per acre for tapping. An initial planting density of 200 trees per acre is advised for these areas. RRIC 103 showed the best growth though survival was less than RRIC 101. Opening of tapping at seven years appears possible in these drier areas for the newer clones (which could be opened at five years in the wet zone).

TABLE 14

1965 N. E. CLONE TRIAL — MONERAGALA

GIRTH MEASUREMENTS

Clone	Parentage	Plants total	No. of plots	Survival %	Girth 1971 Mean cm	Range
RRIC 101	Ch 26 × RRIC 7	31	3	87	33·4	16·3—51·0
RRIC 102	RRIC 52 × RRIC 7	44	4	66	33·5	10·0—58·2
RRIC 103	RRIC 52 × PB 86	30	3	70	41·4	11·2—54·1
RRIC 104	RRIC 52 × Tjir 1	40	4	60	35·0	14·2—55·4
IAN 45 - 710	PB 86 × F 409	94	9	60	27·3	8·3—47·5
RRIC 45	RRIC 8 × Tjir 1	95	9	56	33·2	13·4—49·4
RRIC 89	—	94	9	68	27·9	11·0—50·0
RRIM 623	PB 49 × PilB 84	65	6	71	35·5	16·4—51·6
1305	RRIC 41 × Ch 26	30	3	77	37·3	14·4—49·8
266	Mil 3/2 × Tjir 1	42	4	86	36·4	13·6—48·4
1307	RRIC 41 × Ch 26	33	3	79	36·0	13·5—54·0
1068	Tjir 1 × Wagga 6278	32	3	78	35·9	20·4—50·8
1108	RRIC 52 × RRIC 7	42	4	69	31·9	12·8—51·6
1923	RRIC 51 × LCB 1320	31	3	74	30·4	15·3—49·7
1259	Ch 26 × RRIC 52	30	3	77	30·2	18·5—49·0
444	RRIC 52 × PB 86	24	2	71	29·8	14·0—45·0
828	PB 5/139 × RRIC 52	43	4	58	25·5	9·8—37·7
516	RRIC 52 × PB 86	43	4	88	25·0	12·3—43·3
1010	T 170 × RRIC 52	32	3	69	23·8	12·8—34·6
778	RRIC 52 × Tjir 1	32	3	50	21·9	13·2—32·0

1966 clone trials — Kuruwita and Nivitigalakele (W. A. C. Wijesinghe & H. B. H. de Silva)

The trees were opened at five years and the first year yields are shown in Table 15. These are the first large plots of the RRIC 100 series to come into tapping. RRIC 101 showed relatively high yields as earlier exhibited in the small scale trial. RRIC 103 also showed a high percentage of trees that could be brought into tapping ; the RRIC 52 parentage of RRIC 103 is expected to result in appreciable increase of girth after tapping. Two cases of Brown Bast in the RRIC 45 plots at Nivitigalakele would appear to indicate that early opening of this control clone may not be advisable.

TABLE 15

1966 CLONE TRIALS — KURUWITA AND NIVITIGALAKELE

(Tapped S/2, d/3, 67% from March 1971)

Clone	Parentage	Kuruwita			Nivitigalakele			Trees	Girth cm	Replications
		Trees tapped	% of total	Yield g/t/t	Trees tapped	% of total	Yield g/t/t			
RRIC 101	Ch 26 × RRIC 7	169	77·2	48·2	—	—	—	200	47·4	3
RRIC 103	RRIC 52 × PB 86	162	74·3	31·7	182	74·0	28·7	448	48·0	6
1004	T 170 × RRIC 52	106	47·1	18·1	65	31·4	25·7	422	40·3	7
828	PB 5/139 × RRIC 52	187	74·5	11·9	—	—	—	249	45·2	3
RRIC 45	RRIC 8 × Tjir 1	243	83·5	28·3	53	33·0	30·8	466	46·3	7

1967 N. E. clone trial — Bibile Group (H. B. H. de Silva)

The growth rate in this dry zone planting would enable tapping to commence one or two years later than in the wet zone. Clone 1305 which has shown high yields in the wet zone could be expected to show satisfactory girth and yield in the dry zone. RRIC 101 and RRIC 103 appear to be more suitable than RRIC 100 for this area as shown in Table 16.

TABLE 16

1967 N. E. CLONE TRIAL — BIBILE

GIRTH MEASUREMENTS

Clone	Parentage	No. of plots	Total trees	Mean girth 1971	
				cm	in.
1108	RRIC 52 × RRIC 7	4	600	27·3	10·7
1305	RRIC 41 × Ch 26	3	431	25·9	10·1
RRIC 101	Ch 26 × RRIC 7	3	509	25·3	9·9
1004	T 170 × RRIC 52	3	404	25·0	9·8
RRIC 103	RRIC 52 × PB 86	2	312	24·7	9·7
RRIC 45	RRIC 8 × Tjir 1	3	499	24·4	9·6
RRIC 100	RRIC 52 × PB 86	3	450	24·1	9·4
IAN 45 - 710	PB 86 × F 409	3	506	23·6	9·2
1010	T 170 × RRIC 52	1	165	19·6	7·7

1967 S. W. clone trial — Gikiyanakande (D. S. Dedduwakumara)

As shown in Table 17 the trees have shown a sufficiently rapid rate of growth to be taken into tapping in 1972 at five years of age. Thus, from 1972, yields of RRIC 102 and RRIC 103 would be available from replicated plots in three locations in two different wet zone planting districts.

TABLE 17

1967 S. W. CLONE TRIAL — GIKIYANAKANDE

GIRTH MEASUREMENTS

Clone	Parentage	Trees	Plots	Mean girth 1971 cm	Mean girth 1971 in.
RRIC 103	RRIC 52 × PB 86	501	3	46·7	18·3
RRIC 102	RRIC 52 × RRIC 7	281	2	44·2	17·5
RRIM 623	PB 49 × PilB 84	348	3	42·8	16·8
1004	T 170 × RRIC 52	371	3	43·1	16·9

1967 N. E. clone trial — Peenkande (W. D. Armon)

It would appear (Table 18) that the large scale plots of RRIC 100 and RRIC 101 could be easily brought into tapping at five years of age in this planting. Clone 1004 showed a double cycle of flowering which released appreciable seed during the year for early test.

TABLE 18

1967 N. E. CLONE TRIAL — PEENKANDE

GIRTH MEASUREMENTS

Clone	Parentage	No. of trees	Plots	Mean girth cm 1970	Mean girth cm 1971	Mean girth in. 1971
RRIC 100	RRIC 52 × PB 86	543	3	19·5	34·8	13·7
RRIC 101	Ch 26 × RRIC 7	576	4	21·2	35·1	13·8
1004	T 170 × RRIC 52	518	3	20·8	33·3	13·1
815	PB 5/139 × RRIC 52	489	3	24·2	40·6	15·9
RRIM 623	PB 49 × PilB 84	509	3	18·7	33·3	13·1
RRIC 45	RRIC 8 × Tjir 1	411	3	15·2	28·8	11·3

New plantings

Three new plantings were carried out incorporating the newer selections for the production of hybrid seed for later test and selections. The details of the clones used were as follows :—

(1) *Tatuwalakande (5 acres)* : 150 plants of RRIC 100; 200 plants of RRIC 101, 1458 and 1457 ; 30 to 50 plants each of RRIC 103, 2427, 6182, 8501.

(2) *St. Andrews (2 acres)* : RRIC 102 and RRIC 45.

(3) *Lened Estate (5 acres)* : Clones 6182, 5352, 5326 of SALB - resistant origin and RRIC 101.

Index to field experiments

Field experiment No.	*Description*	*Site*
1	1961 small scale clone trial	Kuruwita
1A	1960 clone trial	Peenkande
2	1961 medium and small scale clone trial	Kuruwita
3	1962 large scale clone trial	Kuruwita
4	1962 small scale clone trial	Kuruwita
5	1962 ,, ,, ,, ,,	Nivitigalakele
6	1963 ,, ,, ,, ,,	Kuruwita
6A	1963 ,, ,, ,, ,,	Matale
7	1964 clone trial (S.W. and N.E.)	Kuruwita
8	1965 small scale clone trial	Dartonfield
9	1965 ,, ,, ,, ,,	Moneragala
10	1965 clone trial	Matale
11	1966 ,, ,,	Kuruwita
12	1966 ,, ,,	Nivitigalakele
13	1966 ,, ,,	Moneragala
14	1967 ,, ,,	Nivitigalakele
15	1967 small scale clone trial	Kuruwita
16	1967 clone trial	Gikiyanakande
17	1967 ,, ,,	Peenkande
18	1967 ,, ,,	Gampola
19	1967 ,, ,,	Hedigalla
20	1967 ,, ,,	Bibile
21	1968 small scale clone trial	Kuruwita
22	1968 clone trial	Pannagula
23	1968 ,, ,,	Hedigalla
24	1968 ,, ,,	Bibile
25	1968 ,, ,,	Wariapola
26	1969 ,, ,,	Sirikandura
27	1969 ,, ,,	Pantiya
28	1969 small scale clone trial	Kuruwita
29	1969 clone trial	Eladuwa
30	1969 ,, ,,	Hedigalla
31	1970 ,, ,,	Palmgarden
32	1971 polyclone planting	Tatuwalakande
33	1971 ,, ,,	Lened
34	1971 ,, ,,	St. Andrews

REVIEW OF THE PLANT PATHOLOGY DEPARTMENT

By

O. S. Peries

SUMMARY

The incidence of *Oidium* leaf disease was very heavy during the refoliating season of 1971, whereas the incidence of *Phytophthora* and *Gloeosporium* leaf diseases was negligible during the S. W. monsoon season. In addition to the favourable weather conditions, the poor pod-set consequent to the heavy infection of rubber flowers by *Oidium*, helped to reduce *Phytophthora* leaf fall. Spore trap experiments carried out on an estate at an elevation of 1200 ft above mean sea level, indicated that the propagation of the fungus at high elevations was also closely related to weather conditions just as in the wet low country districts. However, weather conditions conducive to the rapid build-up of fungal inoculum were more prevalent at high elevations, so that *Oidium* infection is more virulent in such situations.

The results of field experiments on *Fomes* control have shown that the use of small quantities ($\frac{1}{4}$ lb) of sulphur in the planting holes, to control White Root disease, is not likely to have any retarding effect on the growth of the young trees. It has also been shown that there is every possibility of retaining the timber from the old stand in replanted areas when the incidence of *Fomes* in the old stand had been low, if certain precautions are taken.

Preliminary trials on the control of *Gloeosporium* leaf disease in young clearings, have indicated that nickel chloride may be an effective fungicide for the control of this disease.

Two more effective species of bacteria were isolated from cup coagula for the coagulation of latex. Bacterial cultures, dried over silica gel and stored in polythene vials for varying periods of time, have been found to be effective for latex coagulation, producing a white odourless coagulum.

DETAILED REVIEW

Staff

The Plant Pathologist, Dr. (Mrs.) V. Satchuthananthavale was on duty throughout the year. Mr. G. W. Liyanage was appointed Assistant Plant Pathologist and assumed duties on 1st July 1971. Mr. T. M. Fernando was promoted to the post of Senior Technical Assistant, with effect from 1st July 1971. The Senior Technical Assistant and Messrs. W. C. Dayaratne, Z. E. Irugalbandara, D. M. Dantanarayana, L. Halangoda, R. D. Sebastian and S. S. Jayasooriya, Technical Assistants, were on duty throughout the year.

Mr. A. de S. Liyanage, Assistant Plant Pathologist, and Mr. H. L. Munasinghe, Senior Technical Assistant, continued their studies in the U.K. at Wye College, University of London and at the University of Exeter, respectively. Mr. Munasinghe was successful in his M.Sc. examination and was adjudged one of the best students

who read for the M.Sc. in plant pathology at Exeter, in 1971. He sent in his resignation from the services of the Institute, with effect from 1st December 1971. His resignation has not been accepted by the Rubber Research Board.

Dr. (Mrs.) V. Satchuthananthavale attended the 8th session of the FAO Plant Protection Committee held at Djakarta, Indonesia, from 4th October to 11th October and submitted a report to the Rubber Research Board and to the Ministry of Plantation Industries.

Visits

The following visits were paid for advisory, experimental and other work by the departmental staff, during the period under review :—

Advisory	71
Experimental	220
Miscellaneous	26
Total	317

Meetings

The Director attended the following Planters' Association (PA) meetings during the year and addressed them on problems in plant pathology, amongst other subjects.

PA General Committee meetings	5
Kalutara PA	2
Kegalla PA	2
Kalani Valley PA	2

Publications

The following papers were prepared for publication during the year :

1. Environment and plant disease incidence.
   O. S. Peries. *Tea Quart.* (in press)
2. Histology of *Fomes* infected *Hevea* roots.
   O. S. Peries and Z. E. Irugalbandara. *Ann. appl. Biol.* (in press)

Laboratory investigations

Diseased specimens : Only a few specimens were received at the Institute for disease identification, these are listed below :—

(*a*) *Fungi*

Oidium heveae on leaves	2
Gloeosporium spp. on leaves	3
Fomes lignosus on roots	1

(b) *Other causes*

Lightning damage	1

Routine fungicide tests : The fungicide HOE 6006, containing an organo-tin compound as the active ingredient, was tested for toxicity to *Phytophthora* spp. by the standard laboratory tests, recommended by the RRIC. The fungicide was found to be toxic to *Phytophthora* spp. at a concentration of 523 g/100 letres of water. However, this fungicide is not completely soluble in water, and therefore, may not be a suitable material as a water-miscible fungicide for Bark Rot control on *Hevea* (S. A. R. D. Sebastian).

Phytophthora spp.

Biology of Phytophthora *spp :* Single zoospore isolates of type culture 60 and its progeny which resembled type culture 62 failed to produce zoospores at 20°C and all the isolates are compatible with isolate 62.

Sporangial production of isolates, especially those which produce them very sparsely, was induced in a number of ways. Incubation in continuous white light and the presence of plant material in the medium appear to induce sporulation (V. Satchuthananthavale, D. M. Dantanarayana & S. S. Jayasooriya).

Survival of Phytophthora *spp. in Soil :* Soil sampling for this purpose was resumed in May, after a lapse of a number of months. The direct isolation method of Ocano and Tsao was found to be unsuitable under conditions obtaining locally, the plates being overrun by *Pythium* spp. Subsequently the cocoa pod baiting method was used, but here again contamination by *Pythium* spp. was a problem. Attempts are now being made to alter the concentrations of the chemicals recommended by Ocano and Tsao.

Phytophthora spp. were obtained from soils in the year 1969, only during the *Phytophthora* season; in that year a fairly serious attack of *Phytophthora* leaf disease was observed. Thus the inability to obtain any isolates in 1971 may be due to the mild attack of *Phytophthora* pod and leaf disease that prevailed in the area where soil sampling was done. However, the possible limitations of the methods of isolation or soil sampling and storage should be further investigated (O. S. Peries & S. A. R. D. Sebastian).

Sterilized fibre glass tapes were used to study the persistence of *Phytophthora* spp. in different soils. Sporangia and mycelia rapidly disintegrated when buried in the soil (O. S. Peries & S. A. R. D. Sebastian).

Fomes lignosus

Nutrition of F. lignosus : A simple nutrition experiment was performed using three wood-rotting fungi, namely *F. noxius*, *F. lignosus*, and *Ganoderma pseudoferreum*. The three fungi were grown in eight different media having different C : N ratios varying from 6.25 : 1 to 800 : 1. The results of this experiment have shown that the growth of all these fungi vary significantly when the C : N ratio is altered. One of the reasons for carrying out this experiment was to establish whether *F. noxius* and *G. pseudoferreum* had a greater capacity to recycle nitrogen or produce a mycelium with a very low nitrogen content and therefore could survive in artificial media at lower nitrogen concentrations than *F. lignosus* in which the ability to compensate for low nitrogen in the substrate was limited. The results indicate that the opposite may be the case, because *F. lignosus* produced more mycelial growth at lower levels of nitrogen than the other two fungi. This experiment will be repeated in order to confirm the results obtained in the first experiment (O. S. Peries & S. A. R. D. Sebastian).

Decay of wood by F. lignosus : A study was initiated to assess the effect of different levels of nitrogen in the food base on the rate of decay, caused by *F. lignosus.* Rubber wood dowels of known weight, were embedded in agar media containing various levels of nitrogen, and inoculated with *F. lignosus* to assess the rate of loss weight by decay. In preliminary studies, it was found that it was difficult to control contamination of the media in this type of study, as the moisture levels have to be maintained. This experiment will be repeated with the necessary changes in experimental procedure, in order to minimise contamination (O. S. Peries & S. A. R. D. Sebastian).

Biology of F. lignosus : Studies on the colonisation of rubber wood chips by fungi ; survival of *F. lignosus* ; dacay of rubber wood and rate of decay of wood in sulphur-treated and untreated soils are being carried out (V. Satchuthananthavale & L. Halangoda).

Soil microbiology

Soil fungi : A preliminary study of the fungi present in cultivated soils was started in preparation for exhaustive studies in soil microbiology, to devise methods for the biological control of *F. lignosus.* Soil from the Institute's premises was collected at a depth of 3 in. from an area carrying a good cover of *Pueraria phaseoloides.* The characteristics of the soil were :—

pH	6·2
Moisture content	12·62%
Moisture holding capacity	50·48%

Dilution plates were prepared using Czapek's Dox Agar (CDA) with 33 ppm Rose Bengal as a bacteriostatic agent. The plates were examined daily for seven days and colony counts recorded. Isolations were made form these plates into normal CDA for identification of fungi. A dilution of 1 : 10,000 was found to be the most convenient for these studies. The following fungal species were identified in the first set of trials :—

Mucor spp.	1
Fusarium spp.	1
Penicillium spp.	4
Aspergillus spp.	5
Nigrospora spp.	1
Trichoderma spp.	2
Unidentified spp.	6
Total	20

Studies on all soil series in the rubber growing areas have been started, initially to establish whether there is any clear pattern of distribution of soil fungi associated with the different rubber growing soils in Ceylon (O. S. Peries & T. M. Fernando).

Physiology of disease resistance

Phytoalexins : Studies on phytoalexins were carried out using pods of a few clones. These studies confirmed the earlier findings recorded in the review for 1970.

Phenols : Though plant material was collected and prepared for analysis, the work had to be postponed for want of chemicals (R. Satchuthananthavale, V. Satchuthananthavale & D. M. Dantanarayana).

Bark diseases

Studies on Bark Rot : Preliminary studies were carried out to determine growth on wood tissue. Contamination of tissues by other fungi prevented any useful observations (V. Satchuthananthavale & Z. E. Irugalbandara).

Mould contamination of sheet rubber

Studies were initiated on the viability of spores of *Aspergillus niger*, which can survive at relatively high temperatures, at different humidities, to determine the critical humidity at which spores could only survive for a very short period. The growth and sporulation of this fungus was inhibited at RHs below 63%. Samples maintained at 63% RH remained free from contamination for 11 months, at 50 and 52—62% RH, specimens remained free of fungal growth for 12 months.

Fungicide KM 9 was tested at various dilutions against *A. niger*, *P. citrinum*, *P. frequentans*, *A. ochraceous* and *Paecilomyces varotii*. Except *A. niger*, the others were inhibited at 0·5% dilution, *A. ochraceous* being the most sensitive to this fungicide. *A. niger* was inhibited at 1·0% dilution.

At the request of the Rubber Chemist, Mr. S. W. Karunaratne, acetone extracts of rubber samples resistant and susceptible to mould contamination were tested for inhibition of germination of spores of *A. niger*. Percentage germination of spores in all treatments was compared with the control (V. Satchuthananthavale & W. C. Dayaratne).

Studies were carried out to establish the effect of low humidities on fungal spores, using *A. niger* as the test organism. This fungus tolerated high temperatures during earlier studies on spore germination. Spores were dusted on sterile glass fibre tapes and maintained at 80 — 85% RH. Such spores, stored for 20 days at low RH, germinated just as well as those maintained at 98 — 99% RH when sown on agar.

Trials were initiated in collaboration with the Rubber Chemistry Department to determine the difference between mould contamination of latex crepe prepared from fractionated and unfractionated latex. Similar studies are being carried out to ascertain whether smoked sheet is more resistant to mould contamination than sun-dried sheets (W. C. Dayaratne).

A survey was initiated to determine the dominant fungal types that contaminate RSS at different times of the year and in different rubber planting districts. Samples collected from various districts were tested for chemical control of the dominant fungi. Two chemicals, KM9, a pale yellow, mild smelling liquid containing a combination of alkyl phenols as the active ingredient, and paranitrophenol (PNP) are being tested at 0·1% concentration.

Fresh contaminated rubber samples were collected from seven different rubber growing areas. 0·8 sq in. pieces of contaminated rubber were shaken in 300 ml of the chemical for 60 sec. These were allowed to dry and then incubated in desiccators at 95—99% RH. A control was run along with each trial, where an equal number of contaminated pieces were washed in distilled water for 60 sec. Results, recorded after three days, showed that control samples were covered with four different types of fungi mainly *A. ochraceus*, others being a green *Penicillium* species, light green *A. flavus* and *Mucor* spp.

Two fungicides, paranitrophenol (PNP) and KM 9, a polyphenol formulation, were used at a concentration of 0.1% with a wetting agent to assess their relative merits for the control of fungal growth on RSS. Samples collected from different rubber growing districts and showing fungal growth were cut into 0.8 sq in. pieces and shaken with the fungicide solution for 60 sec, allowed to drain and incubated at 28°C and 97 — 99% RH. Sufficient numbers of controls were run through sterile distilled water and treated in the same manner for comparison.

KM 9 controlled fungal growth on 11% of the samples of contaminated rubber, as against 53% by paranitrophenol. Growth intensity and density was lower in the treated samples than on the control — the lowest growth intensity was observed in the PNP treatment. In each trial *A. ochraceus* was observed to be the most dominant, and the most resistant fungus out of the species present (O. S. Peries & W. C. Dayaratne).

PNP, with new improved Teepol as a wetting agent, was tested separately for the control of mould growth. PNP was used at a standard concentration of 0.1% and Teepol at 0.2% and 0.4% concentration. The results indicated that the higher concentration of Teepol is more effective and that an increase in dipping time, from 60 sec to 120 sec, gives better results. The fungal colonies were observed to prevent the PNP solution from wetting the sheet rubber completely, and the fungicides failed to wet the fungal colonies altogether. The PNP often ran off the samples due to one or both these reasons. The addition of the wetting agent assisted in obtaining a better coverage of the sheets. Observations made under the dissecting microscope showed that the addition of a wetting agent to the fungicide solution resulted in the even deposition of the fine grains of PNP on the surface of the sheets, on drying, whereas coarse grains of the material were deposited unevenly on the sheets, when PNP was applied in the absence of a wetting agent. These studies are being continued in an attempt to improve the efficacy of chemical control of fungal contamination and to reduce fungicide concentration and dipping time.

Chemically treated and control samples of rubber were technically specified. Treatment with KM 9 resulted in very high nitrogen values ; PNP treatment too gave rise to high nitrogen figures, although they were much lower than for KM 9 treatment (W. C. Dayaratne).

Different fungal species contaminating smoked sheets : This study was started in July 1971. Contaminated samples were collected from seven different rubber growing areas, *viz.* Matugama, Alutgama, Kalutara, Panadura, Horana, Avissawella and Ratnapura.

Observations carried out so far, show that *A. ochraceus* is the most common species contaminating smoked sheets ; *Mucor* spp. too were detected quite often ; a number of different species of *Aspergillus* and *Penicillium* have been isolated from the samples collected (O. S. Peries & W. C. Dayaratne).

Histological studies

Wax-embedded sections of (*a*) renewing bark, (*b*) various plant organs, *e.g.* endocarp and pulvinus, and (*c*) fructifications obtained from an infected oil palm, are being prepared for further study (V. Satchuthananthavale & Z. E. Irugalbandara).

A new project was initiated in collaboration with the Botany Department to study chromosome patterns in *Hevea*, using immature *Hevea* flowers (R. Satchuthanənthavale & Z. E. Irugalbandara).

The measurement of cells and vessels of various sections of *Hevea* roots was carried out for studies on the mode of infection of rubber roots by *Fomes lignosus* (O. S. Peries & Z. E. Irugalbandara).

Bacterial coagulation

Work connected with culturing of species of bacteria used for coagulation of latex was continued.

Isolation of species of bacteria : Two more species of bacteria were isolated from cup coagula. Both species were cultured in coconut water media and tested for their ability to coagulate field latex. Complete coagulation of field latex at initial concentration was achieved in 4 hr by seeding the latex with liquid cultures of these bacteria.

Coagulation of latex with dried bacterial cells : Seven-day old liquid cultures of bacteria (species R 6) were centrifuged in a Sharples centrifuge and the separated bacterial cells dried in a desiccator over silica gel. The dried bacteria was stored under laboratory conditions in small polythene vials and tested for viability from time to time. When this dried bacteria was directly added to field latex, complete coagulation was achieved in 6 or 7 hours. The coagulum thus obtained was white in colour and odourless.

This showed that dried bacterial cells could be stored under ordinary laboratory conditions and used for coagulating field latex (V. Satchuthananthavale & R. Satchuthananthavale).

Leaf diseases

Oidium *leaf disease*

The incidence of *Oidium* leaf disease was extremely heavy during the refoliating season of 1971. The resulting foliage was perhaps the thinnest observed in Ceylon during the last ten years. Most susceptible clones refoliated two to three times, and the leaves that were finally held by the trees were also badly affected by the disease, so that they were riddled with secondary *Oidium* spots.

The weather during the refoliating season, with low temperatures, misty mornings and short sharp showers in the evenings, which helped to maintain high humidities right through the nights, was very conducive to the rapid propagation of the causal fungus. Wintering was also delayed because of unseasonal rains in December ; these factors made the control of the disease rather difficult. However, Estate Superintendents who clearly understood the relationship between weather conditions and disease incidence, and took the necessary precautions, had good results from sulphur dusting.

The incidence of *Oidium* leaf disease was very severe in most of the rubber growing districts. A survey was made in the Dartonfield Group. At Nivitigalakele only a small area on a hill top was affected by the disease. Here most of the clones escaped disease because of early wintering. At Dartonfield Estate a few clones were attacked. RRIC 7 defoliated thrice and at the end of the season had sparse foliage with small leaves. The disease was severe at Hedigalla estate which is on a higher elevation and is humid. The most striking fact was that clone RRIC 52 was not affected either at Hedigalla or at Dartonfield (V. Satchuthananthavale, W. C. Dayaratne & S. A. R. D. Sebastian).

Phytophthora *leaf disease*

The incidence of *Phytophthora* leaf disease was negligible during 1971. One of the factors that no doubt contributed to the very low incidence of the disease was the heavy incidence of *Oidium* leaf disease ; the causal fungus, *O. heveae*, affected the flowers too, so that the pod-set in 1971 was extremely poor. The lack of pods generally in Ceylon was dramatically illustrated by the fact that many estates did not have sufficient seed to plant up their nurseries. The Institute, in fact, made tentative arrangements to obtain rubber seed from Malaysia, through the good offices of the Rubber Research Institute of Malaya, for the Rubber Controller's nurseries at Egal Oya.

The weather conditions generally, during the South West monsoon season, were not conducive to the rapid propagation of the fungus and the spread of the disease.

Gloeosporium leaf disease

The incidence of *Gloeosporium* leaf disease was low throughout 1971, and only a very few requests were received at the Institute for assistance in identification and control of the disease. The incidence of this disease has been low for nearly five years now. It is apparent that, either the weather conditions during this period have militated against the disease, or that the clones that have been planted recently have a fair degree of tolerance to it. These factors will be investigated by the Statistics Section.

Field experiments

Leaf diseases

Economics of Oidium *and* Phytophthora *leaf disease control :* An experiment was laid down at Malaboda Estate, Matugama, to assess the economic importance of *Oidium* and *Phytophthora* leaf diseases on *Hevea*. This is a 4 × 5 randomized block experiment, where the following treatments will be compared :

A. *Oidium* control only — with sulphur dusting
B. *Phytophthora* control only — with copper dusting
C. *Oidium* and *Phytophthora* control — with sulphur and copper dusting in the respective seasons
D. Control — no treatment.

Each of the above treatments will be replicated five times, on clone PB 86; the plot size is 1½ acres in extent, with adequate guard rows. There are nine leaf collecting beds 6 ft × 6 ft centrally, in each plot. Twenty trees in the middle of each plot is being test-tapped regularly to estimate yields.

This experiment was started in March 1971, but no dusting was carried out for *Phytophthora* leaf disease control during the year, as the incidence of the disease was very low (O. S. Peries, T. M. Fernando, W. C. Dayaratne & Z. E. Irugalbandara).

Incidence of Phytophthora *leaf fall :* Observations were made in three estates (Dartonfield, Frocester and Mirishena) during the season on the incidence of leaf fall due to *Phytophthora* and meteorological data were collected from these estates.

In Dartonfield Estate except for the experimental area of the Botany Department, fungicides were not applied on the tapping cut even during the wet season. Leaf fall was confined to a few trees (V. Satchuthananthavale & D. M. Dantanarayana).

Gloeosporium *leaf disease :* A preliminary small scale experiment was carried out on the control of *Gloeosporium* leaf disease in the 1969 replanted area, clone RRIC 45. The following fungicides were tested :

Antimucin — active ingredient : mercury (1 oz Antimucin in 2½ gal water)
Nickel chloride — active ingredient : nickel (1 oz nickel chloride in 10 gal water)
Perenox — active ingredient : copper (2 oz Perenox in 5 gal water).

Sixty selected trees were marked out into three blocks of twenty trees each and one of the above fungicides was sprayed on each block of trees, using a mist-blower. Two applications were made with an interval of ten days between them. This was purely a preliminary comparative study between the selected fungicides. The following is a record of the incidence of disease :—

TABLE 1

NUMBER OF TREES WITH INFECTED LEAVES OUT OF TWENTY TREATED

	Copper	Mercury	Nickel
First observation	9	3	4
Second observation	4	1	4

These results indicate that nickel chloride can control *Gloeosporium* leaf disease. Therefore, further laboratory and field studies have been undertaken to assess the efficacy of this material as a fungicide against *Gloeosporium* leaf disease (O. S. Peries, G. W. Liyanage & T. M. Fernando).

Incidence of Oidium *leaf disease in smallholdings :* Field experiments carried out in 1970 showed that the control of *Oidium* leaf disease was warranted only in areas higher than 300 ft above mean sea level. Arrangements have been made to conduct further experiments in smallholdings, in order to confirm this and other conclusions made on the basis of the results of the 1970 experiments. The Divisional Advisory Officers and Rubber Instructors of the Galle, Homagama, Kegalla, Panadura, Pasyala and Ratnapura divisions were briefed on the methods of experimentation (O. S. Peries & G. W. Liyanage).

Spore trapping Oidium *leaf disease :* A " Burkard " constant recording volumetric spore trap was fixed in a ten-year old PB 86 replanting, at Nikakotuwa Estate, Matale, at an elevation of 1200 ft. A "Casella" rainfall recorder, a " Luft " thermohygrograph and a "Casella" sunshine recorder were also maintained near the spore trap, to record climatic conditions. The spore trap was operated from 20th February 1971, when defoliation commenced on that field. The spore trapping surface was changed weekly until 3rd April 1971, when the experiment had to be concluded because of insurgent activities in the country. At this time the fresh leaves were in the apple green stage; they were covered with *Oidium* patches and leaf fall was quite pronounced.

Oidium conidia were recorded on the slides from the second week in March, when refoliation commenced on a majority of the trees. The spore concentration increased from that time and leaf fall commenced at the end of the third week in March.

The pattern of spore dispersal followed that recorded in the low-country (Kalutara) in the 1970 refoliation season. There was a pronounced periodicity of spore dispersal with a peak in the early afternoon. It was confirmed that high humidities in the nights and early morning hours with low temperatures, short duration of bright sunshine and scattered light showers in the evenings were conducive to the propagation of the fungus and there was a build-up of inoculum, under these weather conditions (T. M. Fernando).

Fomes : *management :* A field experiment was laid down in 1967 to assess whether it would be possible to retain the timber from the old stand in replanted areas, without undue risk of a high incidence of White Root disease occurring in the young replanting. The following treatments were replicated five times, in an area where the incidence of root disease in the old stand was limited to the occasional tree, the total incidence being less than 5% of the standing trees.

T 1 — Uproot and burn timber as in usual practice.

T 2 — Uproot, stack timber, do not burn.

T 3 — Uproot, stack timber, burn all stumps.

T 4 — Uproot, stack timber, do not burn but use sulphur in planting holes.

Two rounds of observations are carried out usually every year. However, insurgent activities in Ceylon precluded the mid-year census. The results of the census carried out in November 1971, are tabulated below :

TABLE 2

INCIDENCE OF *FOMES* INFECTED TREES

	Treatments			
Replicates	T1	T2	T3	T4
1	1	2	1	2
2	1	—	5	2
3	—	—	1	1
4	2	1	—	1
5	—	—	—	—
Total	4	3	7	6

There is no significant difference between treatments, up to date, with respect to the incidence of White Root disease. This indicates that where the incidence of *Fomes* is low in the old stand, there is no danger in retaining the timber on the replanted area, as long as precautions are taken to uproot the old stumps and stack them some distance away from the planting rows, preferably mid-way between rows (O. S. Peries & T. M. Fernando).

Effect of sulphur on tree growth : Girth measurements of the trees in the *Fomes* control experiment at Galawatte Estate, where sulphur was used in the planting hole to minimise *Fomes* incidence, were taken when the trees came into tapping in April 1971. There were a total of twelve plots treated with sulphur and twelve control plots without sulphur. The average plot size was 165 trees—maximum 195 and minimum 131 trees. Girth measurements were taken at a height of 55 in. from the union.

The mean girth of trees in the treated plots was 16·83 in. and that of the control trees 16·68 in. An analysis of variance on the mean tree girths showed that there was no significant difference between the sulphur-treated and control trees. This implies that where the incidence of White Root disease is high in the old stand, small quantities of sulphur ($\frac{1}{4}$ lb) may be used to control the disease when replanting, without retarding the rate of growth of the trees (V. Satchuthananthavale & Z. E. Irugalbandara).

Sulphur and collar protectants for Fomes control : Two experiments were laid down at Malaboda Estate, Matugama, and Milleniya Estate, Paragastota, to study the effect of sulphur and collar protectants, separately and in combination, on the incidence of White Root disease. The details of these experiments have been given in the Annual Review for 1970. A census was taken regularly at quarterly intervals, of *Fomes*-infected trees in these two areas. There are no useful observations to be made on these experiments at present and an analysis will be made after about the fifth year of growth (V. Satchuthananthavale & L. Halangoda).

Decay of rubber wood : An experiment was laid down in December to determine the rate of decay of rubber wood and to identify the fungi causing most rapid decay under various field conditions, *viz.* a cover of *Pueraria phaseoloides*, a mixed natural cover of grasses, legumes and other species, clean-weeded area. A randomized block design with six replicates is being used for this experiment (G. W. Liyanage & O. S. Peries).

Fungal associations : A study was initated to identify the soil fungi associated with healthy *Hevea* roots and those infected with root diseases. A dilution plate technique, using Rose Bengal as a bacteriostatic agent, is being used to identify rhizosphere mycoflora of healthy and infected roots (O. S. Peries & G. W. Liyanage).

REVIEW OF THE SOILS CHEMISTRY DEPARTMENT

By

O. S. Peries

SUMMARY

A detailed soil survey of the Panadura-Horana one inch to a mile topographic map was started and more than half the area has been mapped. The studies on volatalization of urea showed that this was controlled by the moisture status and the texture of the surface soil. Intercropping trials have indicated that pineapple could be a profitable crop in rubber during the first few years after replanting.

Field experiments have indicated that variation in fertilizers in the mature phase does not affect yields ; this requires further investigation. In two of the diagnostic physiologique (DP) experiments, 6 lb of R. 4:6:3 + Mg gave 23% and 54% yield increases over the control. Two field experiments have shown that potassium has a significant effect on yield and girth increment, and a third that phosphorus has a significant linear effect on yield. It has also been shown that rock phosphate is significantly better than super phosphate and ammonium phosphate and that there is no difference between the latter two. Dolomite has been found to be better than epsom salt or kieserite in the presence or ammonium sulphate but not urea, which is an unexpected result. Studies on cover crops have shown that rubber plants grow better in areas planted with leguminous covers than those with volunteer plants. Nursery experiments have confirmed that the current policy of applying a complete NPK + Mg mixture to young seedlings is correct and that the normal soil application of fertilizers is generally better than foliar applications.

DETAILED REVIEW

Staff

Messrs. C. G. Silva, Soils Chemist, and N. Yogaratnam, Assistant Soils Chemist, were on duty throughout the year. Dr. R. S. John, Soils Chemist, was on duty throughout the year, except for the period 30.4.71 — 28.8.71.

Mr. E. Bellis, C-Plan Consultant in Soils Chemistry, arrived on 20th October 1971, and studied the work of the Department in detail in consultation with the departmental staff and the Director, in preparing a programme of work for the Department.

Mr. T. Kanthasamy, Senior Technical Assistant, and Messrs. H. A. Seemon, F. P. W. Silva, A. M. A. Perera, G. N. de Silva, B. P. M. Arsecularatne and L. J. Wickremasinghe, Technical Assistants, and Messrs. W. M. Abeysinghe, M. A. Mendis, A. D. M. Karunaratne, K. S. A. C. Peiris and J. Wijenaike, Field Assistants, were on duty throughout the year.

Visits

The following visits were paid for advisory, experimental and other purposes by the Soils Chemists and the Assistant Soils Chemist :—

Advisory	21
Experimental	132
Miscellaneous	33
Total	186

Meetings and conferences

Mr. C. G. Silva, Soils Chemist, attended the following meetings :—

Working Group on Fertilizers (7)
Standing Committee on Agrochemicals (3)
Annual Sessions of the Ceylon Association for Advancement of Science (1)
Miscellaneous meetings at Ministries and Import Control (6)

Publications

The following papers were prepared for publication, by the staff of the Department.

1. A survey of wind damage in rubber plantations.
   C. G. Silva and M. U. J. de Silva.
2. Volatilization of ammonia from urea containing fertilizer mixtures.
   C. G. Silva and A. M. A. Perera.
3. The cultivation of oil palm in Ceylon.
   C. G. Silva and F. P. W. Silva.
4. Fertilizer responses in *Heavea brasiliensis* seedlings grown in the field nursery.
   N. Yogaratnam and A. D. M. Karunaratne.
5. The advisory circular on fertilizers was revised.

Advisory work

The advisory circular on manuring was revised and brought up to date. Many changes have been made in the new circular especially with regard to the quantities of fertilizer recommended for application and the times of application. Different mixtures have been recommended for use according to varying soil characteristics. In view of the importance of urea-based mixtures, their composition and application have been discussed fully in the circular.

A radical change in the nomenclature of the mixtures has been suggested in the circular, and if this is acceptable to the planting public and the fertilizer firms, it will be adopted. The new nomenclature would lead to a far better understanding of the composition of fertilizer mixtures by the planter.

Advice on the methods of increasing growth or yield by correct fertilizer practices was given by visiting the estates concerned, where necessary, or through correspondence, where this was considered adequate.

A number of advisory visits were made to Nakiadeniya Group and Perth Estate in order to ascertain the reasons for suspected nutrient imbalances on oil palm, brought to the notice of the Institute, following leaf discolourations. Changes in fertilizer recommendations were made for the Nakiadeniya plantations, based on foliar analyses.

Research investigations

Soil surveys : Mr F. P. W. Silva underwent a short course of instructions at the Resources Survey Division of the Survey Department on the use of surveying instruments and principles of cartography.

A detailed soil survey of the Panadura - Horana one inch to a mile topographic map was started and more than half the area has been mapped (C. G. Silva & F. P. W. Silva).

Laboratory and greenhouse studies : Nine hundred soil samples were taken from Gallewatta Estate between January and August in connection with the study of nutrient changes associated with wintering and leaf fall. Of these samples, 154 were analysed for total introgen and 360 for organic carbon. This work has been discontinued (L. Wickremasinghe).

The laboratory and field investigations in relation to the volatilization studies from urea containing fertilizer mixtures, were concluded. These studies indicate that these formulations could be broadcast on most soils and that it is the texture of the surface soil and the moisture status of the soil which control the loss of ammonia. The urea containing formulations with kieserite showed good storage properties (A. M. A. Perera).

The analysis of soils from the tea area at Neuchatel Group, could not be completed. The fertilizer experiment started in the same area was serviced regularly (G. N. de Silva).

Soil samples from Nelunuyana Estate, representing the Boralu series, were collected at two depths, *viz.* 0—15 and 15—30 cm from 30 sampling points within a 100 m × 100 m grid. These samples were collected for soil fertility studies and investigation into the phosphorus status of rubber soils.

Bulk samples were also collected for the depth range 0—30 cm from the same locality by bulking two auger samples from each of the 30 sampling points, for greenhouse studies (R. S. John).

Foliar studies

(i) Foliar analyses — ' DP ' trials

Data on the nutrient composition of *Hevea* leaves obtained during the period 1960 to 1969 from the ' DP ' experimental plots were collated, pending statistical analysis.

(ii) Foliar analyses — miscellaneous trials and advisory samples

The following analyses on leaf samples were carried out :—

N	P	K	C	Mg	Cu	Zn
53	88	88	34	—	2	2

Miscellaneous : In the trial at Paiyagala Estate, where half an acre of 1971 replanted rubber was interplanted with the Kew variety of pineapples, about 4000 suckers were planted on 18.11.70 and were managed according to the recommendations of the Horticultural Officer of the Central Agricultural Research Institute. Towards

the end of 1971 this area suffered a set-back as a result of mealy bug attack. About 40 diseased plants were uprooted and burnt. Calcium carbide application was made late last year for uniform fruiting. The first crop is expected in March 1972. The rate of fruiting and the size of fruits indicate that intercropping with pineapple is economical (C. G. Silva.)

Investigations were conducted in order to ascertain whether the daily fluctuation in yield of latex could be attributed to changes in the moisture regime in the soil. This work is being continued (D. R. Peiris).

Latex from trees stimulated with Ethrel and from unstimulated trees, were analysed to evaluate the excess nutrients drained as a result of higher yields with stimulation. This work is being continued (L. Wickremasinghe).

Field experiments

1. Fertilizer experiments

Experiment No. 1 :— Effect of N and K in the presence of P, Hedigalla Division — 1952 clearing — PB 86, AVROS 225, LCB 870 and PB 86 crown budded with LCB 870 5 × 5 Greco Latin square.

The yield data for 1971 indicate that the fertilizers applied during the mature phase did not have any significant effect on yield of any clone under investigation. The girth records, however, indicate that the converted NPK treatment had a significant positive effect over the control, on girth of clone PB 86 (N. Yogaratnam & M. A. Mendis).

TABLE 1

MEAN GIRTH OF THE CONVERTED TREATMENTS OF CLONE PB 86

Treatments	Mean girth	
	in.	cm
O	28·79	73·13
P	29·08	73·86
NP	29·26	74·32
PK	28·04	71·22
NPK	30·35	77·09
L.S.D.	1·06	2·69
C.V.	2·5%	—

Experiment No. 2 — Studies on the effects of high and low potash on growth and yield of six clones, Eladuwa Estate, Kalutara, 1958 replanting — randomised block.

This experiment was laid down to investigate the effects of high and low potash on growth and yield of mature rubber. The manure mixtures tested are R. 4 : 6 : 2, R. 4 : 6 : 3, R 4 : 6 : 5 and R 4 : 6 : 8. The analysis of yield data for 1971 shows a significant increase in yield due to the treatment R. 4 : 6 : 3 over R. 4 : 6 : 8 and due to the treatment R. 4 : 6 : 5 over R. 4 : 6 : 2 and R. 4 : 6 : 8. The girth data however do not show any significant difference on growth due to the treatments. The mean yields are presented in Table 2 (R. S. John & W. M. Abeysinghe).

TABLE 2

MEAN YIELD OF DRY RUBBER FROM TREES RECEIVING DIFFERENT LEVELS OF POTASSIUM

Treatments	Mean yield of dry rubber per tree per tapping (g)
R.4 : 6 : 2	20·00
R.4 : 6 : 3	21·18
R.4 : 6 : 5	22·81
R.4 : 6 : 8	18·50
L.S.D.	2·11

This experiment was terminated in January 1972.

Experiment Nos. 6 to 9

Physiological diagnosis : In these experiments the response to the application of fertilizer, on the basis of physiological diagnosis and the response to the application of different rates of the standard fertilizer mixture are assessed and compared. All four experiments are laid down on a randomised block design, with four replicates.

Experiment No. 6 : Nakiadeniya Group, Galle District, 1956 replanting, clone PB 86.

The yield and girth data for 1971 do not indicate any significant differences due to the fertilizer treatments under comparison (R. S. John & M. A. Mendis).

Experiment No. 7 : Gallawatta Estate, Agalawatta, 1960 replanting, clone PB 86.

The girth data for 1971 do not indicate any significant effect of the fertilizer treatments on growth (R. S. John & W. M. Abeysinghe).

Experiment No. 8 : Parambe Group, Kegalle District, 1951 replanting, clone Gl 1.

The mean yields for 1971, presented in Table 3, indicate that the application of 6 lb of R. 4 : 6 : 3 + Mg mixture resulted in an increase in yield of 23% over the control. However, the girth data do not indicate any significant effect due to the fertilizer treatments (R. S. John & W. M. Abeysinghe).

TABLE 3

MEAN YIELD OF DRY RUBBER FROM TREES RECEIVING DIFFERENT FERTILIZERS

Treatments	Mean yield of dry rubber per tree per tapping (g)	% increase or decrease over the control
No fertilizer	25·87	100
DP complete	23·66	91
R.4 : 6 : 3 + Mg , 2 lb	26·59	103
R.4 : 6 : 3 + Mg , 4 lb	27·08	105
R.4 : 6 : 3 + Mg , 6 lb	31·91	123

Experiment No. 9 : Eladuwa Estate, Kalutara, 1949 replanting, clone PB 86.

The mean yields of this experiment, presented in Table 4, show a significant increase in yield of 54% over the control due to the application of 6 lb of R. 4 : 6 : 3 + Mg. However, the girth data do not indicate any significant effect on growth due to the treatments (R. S. John & W. M. Abeysinghe).

TABLE 4

MEAN YIELD OF DRY RUBBER FROM TREES RECEIVING DIFFERENT FERTILIZERS

Treatments	Mean yield of dry rubber per tree per tapping (g)	% increase or decrease over the control
No fertilizer	23·18	100
DP complete	30·53	132
R.4 : 6 : 5 + Mg, 2 lb/plant	28·63	124
R.4 : 6 : 3 + Mg, 4 lb/plant	30·49	131
R.4 : 6 : 3 + Mg, 6 lb/plant	35·74	154
L.S.D.	2·78	12

Experiment No. 11 — Forms of magnesium

This experiment has a split plot design, where two forms of magnesium are the main treatments and different levels of NPK form the sub-treatments. The girth data as well as the yield data show that the effect of potassium is significant at the 1% level. The mean girths and yields are presented in Table 5 (C. G. Silva & K. S. A. C. Peris).

TABLE 5

MEAN GIRTHS OF TREES FOR THE DIFFERENT TREATMENTS

Treatment	Mean girth (in.)	L.S.D.	Mean yield (g)	L.S.D.
N_0	22·70) **57·66)**		41·69))	
N_1	23·08) **58·62)**		43·25))	
P_0	22·63) **57·48)**	0·99	41·76))	
P_1	23·36) **59·33)**		43·18))	3·81
K_0	22·11) **56·16)**		39·80))	
K_1	23·88) **60·66**		45·14))	
Epsom salt	22·58) **57·35)**	0·93	41·75))	3·47
Dolomite	23·40) **59·44)**		43·19))	

Heavy type denotes metric equivalents in cm.

Experiment No. 12 — Levels of nitrogen and phosphorus

Three levels each of nitrogen and phosphorus with uniform applications of potassium and magnesium are being tested on clone PB 86 at the Kuruwita Sub-station in a 1961 replanted area. The girth data do not show any significant difference between the treatments. An analysis of the yield records Table 6 however indicates that the linear effect of phosphorus is significant at the 5% level (C. G. Silva & K. S. A. C. Peiris).

TABLE 6

YIELD DATA OF THE DIFFERENT TREATMENTS

Treatment	Mean yield (g)	L.S.D.
N_0	36·83	
N_1	39·31	
N_2	39·26	
P_0	36·11	
P_1	39·46	2·96
P_2	39·83	

Experiment No. 13 — Levels of potassium and magnesium

This experiment with three levels of potassium and magnesium, with a uniform application of nitrogen and phosphorus is sited at the Kuruwita Sub-station. An analysis of variance of the girth data shows a quadratic effect of potassium, significant at the 5% level. The mean girths are given in Table 7. The yield data show a linear effect of potassium which is highly significant, and a quadratic effect of potassium which is significant at the 5% level (C. G. Silva & K. S. A. C. Peiris).

TABLE 7

MEAN GIRTHS AND YIELDS CORRESPONDING TO THE DIFFERENT TREATMENTS

Treatment	Mean girth in.	Mean girth cm	L.S.D.	Mean yield (g)	L.S.D.
K_0	22·16	56·29		34·27	
K_1	23·75	60·33	1·11	39·84	3·68
K_2	23·08	58·62		41·72	
Mg_0	23·73	60·27		39·82	
Mg_1	22·54	57·25		38·67	
Mg_2	22·72	57·71		37·34	

Experiment No. 14 — Assessment of different fertilizer materials

Response of clone PB 86 to three different forms each of nitrogen, phosphorus and magnesium tested on a 3^3 factoral design, at Gallawatta Estate, 1961 replanting.

The girth data show that, in general, rock phosphate is significantly better than either super phosphate or ammonium phosphate, that there is no significant difference between the latter two and that dolomite is significantly better than epsom salt or kieserite. Considering nitrogen × magnesium interaction, it is seen that (a) there are no significant differences between the three forms of magnesium in the presence of urea, (b) with sulphate of ammonia, dolomite is significantly better than the other two forms, which is contrary to what would be expected, and (c) with ammonium nitrate, epsom salt is superior to the other two forms, which do not differ significantly among themselves (C. G. Silva & M. A. Mendis).

TABLE 8

MEAN GIRTH PER TREE IN INCHES

Treatment	Girth	L.S.D.
Ammonium nitrate	21·68 **55·07**	
Ammonium sulphate	21·84 **55·47**	
Urea	21·94 **55·73**	
Super phosphate	21·88 **55·58**	
Rock phosphate	22·19 **56·36**	0·60 **1·52**
Ammonium phosphate	21·39 **54·33**	
Common epsom salt	21·83 **55·45**	
Dolomite	22·35 **56·77**	
Kieserite	21·28 **54·05**	

	Ammonium nitrate	Sulphate of ammonia	Urea
Common epsom salt	22·77 **57·84**	21·17 **53·77**	21·55 **54·74**
Dolomite	21·72 **55·17**	23·11 **58·70**	22·17 **56·31**
Kieserite	20·55 **52·20**	21·18 **53·80**	22·11 **56·16**

L.S.D. = 1·05
2·67

Heavy type denotes metric equivalents in cm.

Experiment No. 15 — Concentrated compound fertilizer

The growth response to three brands of complete compound concentrated fertilizers was tested at Gallawatta Estate on a 1961 replanted area, clone PB 86. This experiment was terminated with effect from 1971 (C. G. Silva & M. A. Mendis).

Experiment No. 18 — Clonal response to fertilizers

The response of the four clones PB 86, RRIC 45, RRIC 52, and RRIC 7 to eight levels of the same fertilizer mixture is being tested at Kuruwita Sub-station in a 1963 replanting. The yield data show that the linear effect of levels of R 4:6:3 + Mg is significant at the 1% level for clone RRIC 45, but not significant for any of the other clones. The girth data show that the linear effect of treatments is significant for clones PB 86 and RRIC 7 at the 0.1%, for RRIC 45 at the 1% and for RRIC 52 at the 5% level. The mean girths for all clones and the mean yields for RRIC 45 are given in Table 9 (C. G. Silva & K. S. A. C. Peiris).

TABLE 9

MEAN GIRTHS OF THE DIFFERENT CLONES AND MEAN YIELDS OF RRIC 45 AT DIFFERENT LEVELS OF FERTILIZER APPLICATIONS

Level of fertilizer	Mean girth in inches								
	PB 86		RRIC 7		RRIC 45		Yield (g)	RRIC 52	
	in.	cm	in.	cm	in.	cm		in.	cm
0	14·88	37·80	16·85	42·80	19·17	48·69	25·54	21·05	53·47
1	17·68	44·91	17·66	44·86	22·36	56·79	31·63	23·56	59·84
2	17·97	45·64	19·38	49·23	22·04	55·98	38·57	22·80	57·91
3	17·04	43·28	19·01	48·29	21·31	54·13	36·84	24·26	61·62
4	18·64	47·35	19·78	50·24	22·44	57·00	40·21	25·17	63·93
5	18·02	45·77	19·91	50·57	21·55	54·74	35·17	23·94	60·81
6	18·65	47·37	19·99	50·77	22·16	56·29	40·33	25·37	64·44
7	19·19	48·74	20·98	53·29	23·44	59·54	39·04	23·77	60·38
L.S.D.	1·46	3·71	1·67	4·24	1·88	4·78		2·96	7·52

Experiment No. 20 — Response of unfertilized mature rubber to fertilization

This experiment for testing different levels of NPK and Mg on an unmanured mature area at Pannilla Estate, Welipenna, was terminated with effect from 1971 (C. G. Silva & M. A. Mendis).

Experiment No. 21 — Frequency of fertilizer application

Investigations on frequencies of fertilizer application were carried out on Pembroke Estate, Kalutara, on a 1969 replanting, clone RRIM 605 — design : randomised block replicated four times. Mean diameters recorded two years after planting are given in Table 10.

TABLE 10

VARIATION OF MEAN DIAMETER OF PLANTS WITH FREQUENCY OF FERTILIZER APPLICATION

Treatments	Mean diameter (cm)
2 applications/year	4·51
3 ,, ,,	4·27
4 ,, ,,	4·41
5 ,, ,,	4·45
6 ,, ,,	4·13
	L.S.D. 0·73

The effect of the treatments is not significant and indicates that the growth of young plants is not likely to be influenced by the treatments under comparison. This experiment was terminated in January 1972 (N. Yogaratnam & A. D. M. Karunaratne).

Experiment No. 22 — Response of mature rubber to fertilizer elements

This is an experiment at Malaboda Estate to evaluate the relative importance of the three nutrients nitrogen, phosphorus and potassium on trees being tapped on renewed bark of clone PB 86. The girth and yield data do not indicate any significant difference between the different treatments (C. G. Silva & M. A. Mendis).

Experiment No. 23 — Frequency of fertilizer application

Investigations on frequencies of fertilizer application were carried out at Durampitiya Estate, Getahetta, on a 1970 replanting, clone RRIC 45, design: randomised block, replicated four times.

Diameter measurements taken 15 months after planting are given in Table 11.

TABLE 11

VARIATION IN MEAN DIAMETER WITH FREQUENCY OF FERTILIZER APPLICATION

Treatments	Mean diameter (cm)
2 applications/year	3·05
3 ,, ,,	2·97
4 ,, ,,	3·03
5 ,, ,,	3·06
6 ,, ,,	2·91
	L.S.D. 0·15

The treatments under comparison do not show any significant effect on diameter. This experiment was terminated in January 1972 (N. Yogaratnam & K. S. A. C. Peiris).

Experiment No. 24 : Studies on the effects of manuring of rubber in relation to ground covers, Pussella Group, Parakaduwa, 1970 replanting, clone RRIM 623, design : split plot replicated twice.

The aim of these experiments is to determine whether the application of extra nitrogen in areas with non-legume covers could improve growth during their maturity and yield during early maturity to the extent obtainable by growing legumes. Mean diameters at the end of one year from planting recorded below, indicate that plants in leguminous covers exhibit better growth than the plants in natural covers.

Treatment	*Mean diameter (cm)*
Legumes	3·38
Naturals	3·54
L. S. D.	0·1

None of the fertilizer treatments showed any significant effect on growth (N. Yogaratnam & K. S. A. C. Peiris).

Experiment No. 25 : Studies on the effects of manuring of rubber in relation to ground covers, Paiyagala Estate, Kalutara — 1970 replanting, clone RRIM 701, design : split plot replicated twice.

Diameter measurements recorded at the end of one year do not indicate any significant effect of covers and the fertilizer treatments on growth (N. Yogaratnam & A. D. M. Karunaratne).

Experiment No. 26 : Studies on the effect of manuring of rubber in relation to ground covers, Hedigalla Division, Dartonfield Group, in 1970 replanting, clone RRIC 101, design : split plot replicated thrice.

Diameter measurements recorded one year after the commencement of the experiment do not indicate any significant effect of covers on growth. The fertilizer treatments were introduced in June 1971 (N. Yogaratnam & A. D. M. Karunaratne).

Experiment No. 27 : Experiment to study the effects of three levels of N, P and K on yield and bark regeneration — 1964 replanting, clone RRIM 623. This experiment was started in 1971 (C. G. Silva & F. P. W. Silva).

Experiment No. 28 : Experiment to study the effects of three levels of the standard fertilizer mixture R. 4 : 6 : 3 + Mg on rubber grown in areas which were previously in tea—1971 planting, clone PB 217. This experiment was started in 1971 (C. G. Silva & G. N. de Silva).

2. Nursery fertilizer experiments

N_1, N_2, N_3 and N_4 — Nivitigalakele Sub-station

These experiments were laid down in September 1969 to study the effect of the nutrients N,P,K and Mg on growth and nutrient uptake of young seedlings in the field nursery. The results of these experiments support the present policy of applying a complete NPK+Mg mixture to plants in the seedling nursery. The results will be discussed in detail in an article that is being prepared for publication in the Quarterly Journal (N. Yogaratnam, A. D. M. Karunaratne, R. S. John & W. M. Abeysinghe).

N 5 : Vogan Group, Matugama

This experiment was laid down to study the influence of normal soil application of fertilizer and foliar sprays of fertilizer on growth and nutrient uptake of young seedlings in the field nursery. The results at the end of the experiment indicate that both diameter and height respond positively to normal soil application of fertilizer but not to foliar sprays. Leaf nitrogen content was found to increase with normal soil application and decrease with foliar sprays. Leaf phosphorus content was found to increase significantly to application of higher concentrations of foliar sprays, in the absence of soil application of fertilizer. In the absence of normal soil application of fertilizer, however, there was a significant decrease in leaf magnesium content and with the soil application of fertilizer, there was significant increase in leaf magnesium content with foliar sprays of fertilizer (R. S. John & J. Wijeynayake).

3. Weed control experiments

No. W_1 : *Terminated.*

No. W_2 : Culloden Group, Neboda. An experiment was laid down in a randomised block layout replicated twice, to confirm the effectiveness of MSMA-based herbicide mixtures. The experimental treatments and their results are presented in Table 12 (N. Yogaratnam & A. D. M. Karunaratne).

TABLE 12

VISUAL ESTIMATES OF PERCENTAGE CONTROL (TRANSFORMED VALUES)

Treatments (per acre)	Date of scoring % control			
	19.4.71	5.5.71	21.5.71	5.6.71
1 pt MSMA + 1 pt 2,4—D	43·57	45·00	39·23	6·46
2 pt ,, + ,,	46·44	42·12	39·20	12·92
1 pt ,, + ,, + 3 lb sodium chlorate	61·72	58·40	47·89	18·43
2 pt ,, + ,, + 3 lb sodium chlorate	58·40	56·79	46·44	22·50
1 pt ,, + ,, + 5 lb sodium chlorate	56·79	52·25	39·23	20·61
2 pt ,, + ,, + 5 lb sodium chlorate	58·40	56·87	49·32	28·29
1 pt ,, + ,, + 2 lb Dalapon	56·79	55·26	47·93	20·61
2 pt ,, + ,, + 2 ,,	67·21	58·40	50·77	31·42
1 pt ,, + ,, + 4 ,,	60·11	56·79	50·77	29·89
2 pt ,, + ,, + 4 ,,	60·00	56·79	47·89	31·60
2 lb sodium arsenite	49·37	40·66	31·61	6·46
6 lb ,, ,,	65·32	55·26	49·32	18·43
10 lb ,, ,,	71·57	65·32	55·26	33·21
L.S.D.	5·38	5·89	6·31	10·79

These results confirm the earlier findings that MSMA-based herbicide mixtures are as effective as sodium arsenite on most of the weeds in the rubber plantations of Ceylon. However, weed control with these mixtures is not likely to be as cheap as that with sodium arsenite.

Index to field experiments

No. 1 - Experiment with nitrogen and potassium in the presence of phosphorus, on four clonal materials — 1952 clearing — Hedigalla

No. 2 Effect to four levels of potassium in the presence of N and P on six clones — 1958 clearing — Eladuwa Estate

No. 4 Terminated

No. 5 Terminated

No. 6 DP experiment — Nakiadeniya Group — 1956 clearing — Galle District — PB 86

No. 7 DP experiment — Gallawatta Estate — 1960 clearing — Kalutara District — PB 86

No. 8 DP experiment — Parambe Group — 1961 clearing — Kegalle District — Gl 1

No. 9 DP experiment — Eladuwa Estate — 1949 clearing — Kalutara District — PB 86

No. 10 Terminated

No. 11 NPK experiment in the presence of magnesium from two sources — PB 86 — 1961 clearing — Kuruwita Sub-station

No. 12 3^3 N × P × cultivation in the presence of K and Mg — clone PB 86 — 1961 replanting — Kuruwita Sub-station

No. 13 3^3 K × Mg × cultivation experiment in the presence of N × P — clone PB 86 — 1961 replanting — Kuruwita Sub-station

No. 14 Growth response to the three major nutrients N, P and K each, from three different fertilizer materials — 1961 clearing — Gallewatta Estate

No. 15 Terminated

No. 16 Terminated

No. 17 Terminated

No. 18 Effect of eight levels of the standard fertilizer mixture R. 4 : 6 : 3 + Mg on four clones — 1963 clearing — Kuruwita Sub-station

No. 19 Terminated

No. 20 Terminated

No. 21 Experiment on the frequency of fertilizer application — 1969 clearing — Pembroke Estate

No. 22 Experiment to evaluate the relative importance of the different nutrients on trees that are being tapped on the renewed bark — Malaboda Estate

No. 23 Experiment on the frequency of fertilizer application — 1970 clearing RRIC 45 — Durampitiya Estate

No. 24 Experiment to study the effect of manuring of rubber in relation to covers — 1970 clearing — RRIM 623 — Pussella Group

No. 25 Experiment to study the effect of manuring of rubber in relation to covers — 1970 clearing — RRIC 701 — Paiyagala Estate

No. 26 Experiment to study the effect of manuring of rubber in relation to covers — 1970 clearing — RRIC 101 — Hedigalla Sub-station

No. 27 Experiment to study the effects of three levels of N, P and K on yield and bark regeneration — 1964 replanting — RRIM 623

No. 28 Experiment to study the effects of three levels of the standard fertilizer mixture R. 4 : 6 : 3 + Mg on rubber grown in areas which were previously in tea — 1971 planting — PB 217

Nursery fertilizer experiments

No. N1 To study the effect of three levels of N, P, K and Mg on growth of young seedlings in the nursery — Nivitigalakele, Sub-station

No. N2 To study the effect of five levels of phosphorus on growth of young seedlings in the nursery — Nivitigalakele Sub-station

No. N3 To study the effect of five frequencies of application of fertilizer on growth of young seedlings in the nursery — Nivitigalakele Sub-station

No. N4 To compare the effect of two sources each of nitrogen (sulphate of ammonia and urea) and phosphorus (saphos phosphate and ordinary super phosphate) applied at three levels of each, on the growth of seedlings in the nursery — Nivitigalakele Sub-station

No. N5 To study the effects of foliar applied fertilizers (Folifertil), with and without the application of standard fertilizers, on the growth of young seedlings in the nursery — Vogan Group

Weed control experiments

No. W1 Terminated

No. W2 Experiment to confirm the effectiveness of MSMA-based herbicide mixtures — Culloden Group, Neboda.

REVIEW OF THE RUBBER CHEMISTRY DEPARTMENT

By

M. Nadarajah

SUMMARY

The Rubber Chemistry Department continued to give advice to large estates on problems connected with the manufacture of raw rubber. Articles on proposals to improve and increase quality production of pale crepe in Ceylon and to increase quality production of RSS in Ceylon have been written. These proposals suggest that in Ceylon at least in the period of the next five years the controlled preparation of pale crepe in central factories and RSS in group processing centres may be preferable to conventional production of block rubbers.

Promising results were obtained in attempts to produce easy processing RSS by coagulating latex without dilution, but after the addition of mineral oil and RPA No. 3. Preliminary experiments have shown that RSS made by coagulation without dilution and with 10% mineral oil and 0·2% RPA No. 3, on the dry rubber content, may be suitable for tyre manufacture, as the premastication step could be eliminated. Experiments have also indicated that a block rubber may be made from this easy processing RSS by extrusion and hot pressing. Tree lace from clones PB 86 and RRIC 45 could, after chemical treatment, be easily made into SCR 20. Tree lace from clones Wagga 6278 and Gl 1 may be made into SCR 20 by chemical treatment and blending with cup lump or shell scrap.

Experiments with pale crepe have shown that oxalic acid and sodium bisulphite increase storage hardening, whilst RPA No. 3 reduces storage hardening. Controlled sun-drying of sheet followed by smoking appears to be a way of solving the problem of insufficient smoke house capacity. However the use of PNP would be necessary to minimise any deleterious effect by sunlight and also to inhibit mould growth. Experiments have shown that unfractioned pale crepe is more susceptible to mould contamination than pale crpe manufactured after taking a fraction. Rubber rainguards fabricated on the design of rigifoam rainguards currently used in Malaysia were supplied by the Ceylon Institute of Scientific and Industrial Research and fitted as an experiment on eight estates. A suitable method for the manufacture of soluble chlorinated rubber from field latex has been devised. Chlorinated rubber has uses in paints, adhesives and printing inks. A form of crumb rubber made by mixing field latex with paraffin wax (10% on dry rubber) is suitable for mixing with bitumen for use in roads.

It was found that fresh latex could be used to prepare rubber hydrochloride and that creamed field latex gave a faster reaction. Cyclised rubber masterbatch 90 : 10 which is a powder was found suitable for use in injection moulding. Better results were obtained when methyl methacrylate-grafted latex (25% methyl methacrylate) was substituted for natural rubber latex when preparing the masterbatch.

Among the possibilities of using locally manufactured graphite in the rubber industry is that of employing its lubricating power, which improves the rheological properties of the compound in the uncured state. One promising application is in the preparation of stereos for flexographic printing.

Natural rubber latex, extended with oil, was tested for reducing seepage in irrigation channels and for checking soil erosion under different field conditions. These applications seem to be promising ; however, in the treatment of irrigation channels, weed growth and insect attack would have to be checked by the use of appropriate weedicides and insecticides.

Coagulation of latex by hydrochloric acid (HCl) was investigated. There are safety limits for coagulation of latex with HCl. Excessive degradation takes place if acid concentration exceeds 0·2%, based on dry rubber. HCl coagulation is cheaper than oxalic acid, formic acid or acetic acid coagulation. Within the safety limits of operation, natural rubber coagulated with HCl stands up to accelerated ageing equally well compared to natural rubber coagulated with formic or acetic acid. Intrinsic viscosity studies indicate that the acid used for coagulation has little or no effect on the molecular characteristics of the rubber. Lower T. C. strain values in the case of HCl coagulated rubber indicate that the process does not contribute to a retardation of cure.

Investigations on PRI studies on scrap grades and its relation to soil Mn content indicate that there is no correlation between the level of total catalytic poisons (mainly Cu and Mn) and PRI, but generally the PRI of field coagula from areas having a high soil Mn content is lower than the PRI of field coagula from areas having a low soil Mn content. PRI of field coagula, both cup lumps and tree lace, can fluctuate between wide limits irrespective of the levels of total Cu and Mn in the rubber.

The specification unit continued to test rubber from Peenkande and the Cenat Factory, at an average output of about eight samples a day for all the specification tests. A survey of the technological properties of all RSS grades sampled from the various Commodity Purchase Department Stores in the Kalutara District has been completed. This survey was undertaken to evaluate the different grades of RSS for use in tyre production.

DETAILED REVIEW

Staff

The Head of the Rubber Chemistry Department, Mr. M. Nadarajah, and the Rubber Chemist, Mr. S. W. Karunaratne, were on duty throughout the year. Dr. (Mrs.) M. Rajasingham, Rubber Chemist, resigned from the services of the Institute with effect from 2.11.71. Mr. D. S. Muthukuda, Assistant Development Officer, was on duty throughout the year. Messrs A. M. A. Amarapathy and Boyd Cooray joined the staff as Assistant Rubber Chemists on 1.4.71 and Mr. L. M. K. Tillakeratne jointed the staff as Assistant Specifications Officer on 1.4.71.

Mr. M. Nadarajah attended the 5th Technical Seminar of the Indian Rubber Manufacturers' Research Association held in Bombay, in January 1971. In July 1971, Mr. S. W. Karunaratne attended a meeting of Specifications Officers from all the natural rubber producing countries at the Rubber Research Institute of Malaya.

Messrs. A. M. A. Amarapathy, B. Cooray and M. R. N. Fernando, Assistant Rubber Chemists left for the U.K. in September on Colombo Plan scholarships, to do post-graduate courses, leading up to the M.Sc. at the University of Aston in Birmingham, Mr. L. M. K. Tillakeratne, Assistant Specifications Officer left for Malaysia in October on a Colombo Plan scholarship for training in NR specifications, at the Rubber Research Institute of Malaya.

Messrs. A. Coomaraswamy, R. Tharmalingam, G. Varathungarajan and P. A. J. Yapa, Assistant Rubber Chemists, continued their post-graduate studies in U.K. Mr. K. P. N. de Silva, Technical Assistant, followed a one-year course in draughtmanship at the College of Technology, Katubedde. Technical Assistants, Messrs. A. S. Dekumpitiya, W. D. Dharmasena, L. S. Goonewardena, S. Kasinathan, J. K. Kirubakaran, D. D. Medagama, H. Narangoda, K. A. Piyadasa and P. P. Jayasinghe, were on duty throughout the year. Mr. P. P. Jayasinghe was successful at the 1971 L.I.R.I. Examination. Messrs. W. G. Karunasena, M. N. R. Cooray and W. M. M. Weerakkody, final year Engineering students from the University of Ceylon, Peradeniya, were on vacation studies in the Department for a period of four months. Messrs. E. G. Somapala, D. Wahalatantri and R. C. Wijesundera, final year Chemistry Special students, from the University of Ceylon, Peradeniya, were on vacation studies for two months. Graduate trainees, Miss K. N. Peiris, Mr. K. S. Peiris, Miss C. S. Sooriyarachchi and Miss K. K. Vithana joined the Department on 2.6.71. Miss C. S. Sooriyarachchi left the services of the Institute on 10.12.71.

Publications

Mr. M. Nadarajah presented the undernoted two papers at the Indian Rubber Manufacturers' Research Association, 5th Technical Seminar held in Bombay in January 1971. They were subsequently published in the Institute's Quarterly Journal.

(1) Some suggested improvements in the grading of pale crepe.
M. Nadarajah, M. Rajasingham, D. S. Muthukuda and P. P. Jayasinghe.
Q. Jl. Rubb. Res. Inst. Ceylon **47**, 20 — 29.

(2) Road performance studies and an investigation of some problems associated with rubberised bitumen road construction.
A. Weeraratne and M. Nadarajah.
Q. Jl. Rubb. Res. Inst. Ceylon **47**, 37 — 49.

Mr. S. W. Karunaratne organised an IRRDB Technical Specifications liaison meeting which was held in Colombo in June 1971. The following papers were presented at this meeting :—

(1) Certain aspects of the draft SCR scheme.
S. W. Karunaratne and L. M. K. Tillakeratne

(2) The significance of PRI and its meaning in relation to copper and manganese levels of field coagula from Ceylon.
S. W. Karunaratne and A. S. Dekumpitiya

(3) The organisation of a specifications laboratory in Ceylon.
M. Rajasingham and M. T. Veerabangsa

(4) Specifications in relation to production methods in some conventional grades of raw rubber.
M. Nadarajah, H. Narangoda and B. Cooray.

Papers : The undernoted papers contributed by the Department were published during the year.

(1) Preparation of Heveacrumb from first fraction coagulum.
S. W. Karunaratne.
Q. Jl. Rubb. Res. Inst. Ceylon **48**, Parts 3—4 (in press)

(2) Some naturally occurring antioxidants in *Hevea brasiliensis* latex.
M. Nadarajah, A. S. L. Tirimanne, A. Coomaraswamy and S. Kasinathan.
Q. Jl. Rubb. Res. Inst. Ceylon **48**, Parts 3—4 (in press)

(3) Suggested improvements in the manufacture of Ceylon natural rubber.
M. T. Veerabangsa and M. Nadarajah.
Q. Jl. Rubb. Res. Inst. Ceylon **48**, Parts 3—4 (in press).

(4) Possibilities of bacterial coagulation in raw rubber manufacture.
R. Satchuthananthavale, V. Satchuthananthavale, M. Nadarajah and I. Amerasinghe.
Q. Jl. Rubb. Res. Inst. Ceylon **48**, Parts 3—4 (in press).

(5) Evaluation of locally available raw materials in the natural rubber industry.
S. W. Karunaratne, L. S. Goonewardena and D. D. Medagama.
Q. Jl. Rubb. Res. Inst. Ceylon **47**, 65—69.

(6) Use of natural rubber latex to improve seepage resistance of soils.
S. W. Karunaratne, R. S. John and K. A. Piyadasa.
Q. Jl. Rubb. Res. Inst. Ceylon **47**, 51—58.

(7) A study of the free amino acids in the latex of natural rubber.
S. Kasinathan, M. Nadarajah and A. S. L. Tirimanne.
RRIC Bulletin **6**, 29—34.

(8) The use of rubber in Ceylon roads.
E. G. Mendis and M. Nadarajah.
RRIC Bulletin **6**, 12—19.

(9) A quick method for the determination of ammonia content in natural rubber latex — A modification of the B. S. method.
K. A. Piyadasa and S. W. Karunaratne.
RRIC Bulletin **6**, 19—24.

(10) The use of coconut shells as latex collection cups in Ceylon.
E. G. Mendis and M. Nadarajah.
RRIC Bulletin **6**, 24—29.

(11) Manufacture of dark factice from rubber seed oil.
M. R. N. Fernando.
Q. Jl. Rubb. Res. Inst. Ceylon **47**, 59—64.

(12) Latex coagulating tanks.
D. S. Muthukuda and M. Nadarajah.
RRIC Bulletin **6**, Nos. 3 & 4 (in press).

(13) Specifications in relation to production methods in some conventional grades of raw rubber.
M. Nadarajah, H. Narangoda and B. Cooray.
RRIC Bulletin **6**, Nos. 3 & 4 (in press).

(14) Proposals to improve and increase quality production of pale crepe in Ceylon.
M. Nadarajah, P. A. Bartholomeusz and D. S. Muthukuda.
RRIC Bulletin **6**, Nos. 3 & 4 (in press).

(15) A new look for Ceylon's pale cerpe.
G. Scott and G. Varathungarajan.
RRIC Bulletin **6**, Nos. 3 & 4 (in press).

Meetings and lectures

Mr. M. Nadarajah, Committee Member, functioned as Acting Secretary from January to July and Mr. S. W. Karunaratne as Committee Member, of I.R.I. (Ceylon Section).

Mr. S. W. Karunaratne attended three meetings of the Metrications Board and Mr. M. Nadarajah gave 41 lectures in rubber technology at the Ceylon College of Technology, Katubedde.

A paper on "Chemistry and technology of natural rubber" was presented by Mr. M. Nadarajah at the seminar on "Chemistry and Technology of Natural Polymers" held on 10.9.71 which was organised by the Chemical Society of Ceylon and the Ceylon Section of the Royal Institute of Chemistry.

Rubber technology

Technological properties of RSS grades (*S. W. Karunaratne, L. Goonewardena & D. D. Medagama*) : RSS grades 1 to 5 were sampled from Commodity Purchase Department Stores in the Kalutara District and technological properties of these rubbers were evaluated with special reference to tyre production.

It was seen that in standard tyre tread and carcass mixes the variability within the different grades of RSS was marginal (Table 1).

The formulae used for the tread and carcass mixes are given below :—

	Tread mix	*Carcass mix*
Rubber	100	100
HAF black	45	—
FEF black	—	30
Dutrex R	5	—
Zinc oxide	5	5
Stearic acid	1·5	2
Nonox HFN	1·5	—
Nonox DPPD	—	2
Sulphur	2·5	2·5
C. B. S.	0·5	0·5

These were cured at 140°C for 40 minutes.

TABLE 1

TECHNOLOGICAL PROPERTIES OF TREAD AND CARCASS MIXES BASED ON DIFFERENT GRADES OF RSS

	Commodity Purchase Depot	Raw Mooney viscosity ML_{1+4} @ 100°C	T.C. strain %	Tread mix T.S. kg/cm²	Tread mix E.B. %	Tread mix M300% kg/cm²	Tread mix Hardness (B.S.)	Tread mix % Resilience	Carcass mix T.S. kg/cm²	Carcass mix E.B. %	Carcass mix M300% kg/cm²	Carcass mix Hardness B.S.	Carcass mix % Resilience
RSS No. 1	Alutgama	72·8	64·3	245·1	646	58·0	58·0	58·0	251·9	631	54·0	59·0	70·2
	Panadura	81·5	70·8	274·8	669	65·8	59·8	61·0	252·9	618	48·8	60·2	71·5
	Matugama	76·7	67·8	258·2	645	53·5	58·0	57·5	257·3	645	50·3	58·5	69·0
	Kalutara	75·8	68·0	267·1	637	61·6	61·0	61·0	246·7	625	52·8	59·5	71·0
	Horana	71·5	63·5	245·0	606	62·3	58·0	59·0	236·6	615	59·0	59·5	70·0
RSS No. 2	Alutgama	79·5	66·8	257·3	646	58·5	59·7	58·8	252·2	627	47·5	59·7	70·3
	Panadura	75·7	66·2	276·7	638	64·6	61·7	60·0	261·2	610	49·7	60·7	72·2
	Matugama	67·3	61·5	258·7	655	51·9	59·0	58·0	254·7	634	46·4	58·5	69·5
	Kalutara	73·8	62·5	269·5	656	57·1	61·0	59·5	243·2	619	50·1	59·5	71·0
	Horana	69·5	55·5	244·9	635	62·1	59·5	61·5	258·4	633	65·6	58·0	71·5
RSS No. 3	Alutgama	73·2	70·5	245·5	628	57·2	61·0	58·0	248·7	628	47·5	58·7	70·8
	Panadura	76·3	69·3	262·5	628	70·5	61·5	59·0	248·8	633	48·5	60·5	72·5
	Matugama	75·8	58·5	250·2	668	52·5	59·5	56·5	251·3	637	48·4	60·0	70·5
	Kalutara	76·5	66·2	273·7	653	62·4	60·0	61·0	248·9	620	47·8	59·5	72·0
	Horana	84·5	63·0	270·4	621	73·7	59·0	60·5	253·2	630	57·6	58·0	71·5
RSS No. 4	Alutgama	74·2	70·7	239·3	628	60·3	60·5	57·7	242·4	608	51·0	58·8	70·3
	Panadura	78·7	73·2	270·8	625	53·0	62·7	61·2	255·4	631	50·7	63·8	72·5
	Matugama	78·5	64·5	255·8	637	64·6	60·0	57·5	253·5	627	49·8	60·0	70·5
	Kalutara	77·3	70·2	267·6	635	60·3	60·0	60·5	250·1	628	49·4	59·5	72·0
	Horana	89·5	79·0	274·2	630	75·0	60·0	61·0	259·8	625	63·3	60·0	72·0
RSS No. 5	Alutgama	74·5	67·3	247·7	625	59·1	61·0	57·3	244·2	618	46·0	59·2	69·5
	Panadura	74·7	66·2	283·4	650	68·7	61·3	59·5	260·4	630	44·7	62·5	72·8
	Matugama	78·0	71·3	262·0	632	59·4	59·5	58·5	245·7	595	52·0	60·0	71·0
	Kalutara	78·2	67·3	254·8	647	50·2	58·5	61·0	252·5	621	55·3	59·5	72·0
	Horana	77·0	74·0	250·9	633	64·1	60·5	61·5	246·6	617	58·8	59·5	71·5

Note : The figures represent the mean values of three separate determinations based on three sampling rounds.

Use of new process rubbers in tyre manufacture (*M. Nadarajah and B. Cooray*) : Most of the 4000 tons of natural rubber consumed in Ceylon is used in the tyre industry. Normally, unless CV rubber having a Mooney viscosity range (55 — 65) is used, a separate premastication stage is necessary for compounding in tyre manufacture. It is possible to lower the Mooney viscosity of the rubber by the incorporation of oil in the latex stage to obtain a viscosity of 55 — 65 (easy processing rubber). However storage hardening could occur and result in an increase of the Mooney viscosity irreversibly. Storage hardening depends to a large extent on the relative humidity (RH).

In natural rubber producing countries where the RH is high, easy processing rubber may be suitable as storage hardening is low at high RH. Easy processing rubber may be suitable for use in NR producing countries, where the product can be expected to be utilized without long delays.

Thus the use of oil and xylenethiol (RPA No. 3) may give rubbers with satisfactory processing which can be used instead of CV rubber in the tyre industry in the natural rubber producing countries (Table 2). The latex for this process should not be diluted and gives ICR rubber ; RSS could be manufactured in this way as ICR easy processing rubber.

TABLE 2

INFLUENCE OF RPA NO. 3 AND OIL ON VISCOSITY AND ON STORAGE HARDENING

Sample	Wallace plasticity		Mooney viscosity	
	Before storage hardening	Rise after storage hardening	Before storage hardening	Rise after storage hardening
Bontrol	59	14	69	15
8% oil (Dutrex R)	40	7	57	12
10% oil	34	5	51	13
12% oil	31	4	49	9
8% oil and 0·1% RPA No. 3	30	2	50	11
8% oil and 0·2% RPA No. 3	35	6	52	11
10% oil and 0·1% RPA No. 3	29	3	49	11
10% oil and 0·2% RPA No. 3	29	4	48	12
12% oil and 0·1% RPA No. 3	25	2	43	7
12% oil and 0·2% RPA No. 3	29	5	46	8

It must be mentioned that the processability of these compounds in factory equipment is not predicted by Wallace plasticity or by Mooney viscosity since the Mooney test is generally at a shear rate of 1·6 sec^{-1} while processing equipment in general operates at about 1000^{-1} sec shear rate (White & Tokita (1965) *J. Appl. Polymer Sci.* **9**, 19).

Preliminary experiments have shown that easy processing RSS may be converted into 70 lb blocks by extrusion and by hot pressing and should be suitable as a tyre rubber as it would be expected to undergo little crosslinking or crystallisation during storage and can be compounded without premastication.

Studies on low grades of rubber with particular reference to their upgrading (*M. T. Veerabangsa, M. Nadarajah & H. Narangoda*): The area most profitable for new process rubber manufacture in Ceylon is scrap crepe. About one third of the scrap is tree lace and development work is necessary to include this type of rubber in new process rubber manufacture, because of its high copper and manganese content. These could vary due to (a) clonal variations, (b) time of contact with panel, and (c) nature of soil.

The variation of PRI, Mn and Cu for fresh tree lace from clones PB 86 and RRIC 45, collected one day, two days and three days after tapping respectively, was investigated. The PRI of fresh scrap is satisfactory and with chemical treatment could easily be made into SCR 20, the PRI being > 40, Mn < 15 ppm and Cu < 8 ppm.

The variation of PRI, Mn and Cu for fresh tree lace from clones PB 86, RRIC 45, RRIC 36, Wagga 6278 and Gl 1 from Homagama and Agalawatte soil series was investigated. It was seen that tree lace from Wagga 6278 and Gl 1 appears unsuitable for new process rubber manufacture because of its high manganese and low PRI values. However by chemical treatment and blending they may be suitably adjusted and rendered acceptable.

PRI of field coagula (*S. W. Karunaratne & A. S. Dekumpitiya*)

(A). Variability of PRI of field coagula and its relationship to soil Mn content is reported in Table 3. These results indicate that generally the PRI of field coagula from areas having a high soil manganese content is lower than the PRI of field coagula from areas having a low soil manganese content.

PRI levels can vary within wide limits irrespective of the total Mn content in the rubber. For Mn levels lower than 15 ppm the PRI can be anything between 40 and 90. For higher levels of total Mn in the rubber, there is a wide and consistent fluctuation of PRI between 20 and 60 over a range of Mn levels between 15 ppm and 40 ppm. The general conclusion is that PRI of field coagula, both cup lumps and tree lace, can fluctuate between wide limits irrespective of the levels of total copper and manganese in the dry rubber.

TABLE 3

PRI OF FIELD COAGULA AND ITS RELATIONSHIP TO CU AND MN

Soil series with total Mn level in soil ppm	Estates sampled	Cup lumps			Tree lace		
		PRI	Mn ppm	Cu ppm	PRI	Mn ppm	Cu ppm
Matale Series (1642)	Wariyapola	3·8	7·1	2·1	33·3	13·3	2·2
		42·9	11·1	5·2	37·1	21·4	2·8
		—	—	—	—	—	—
	Viharagama	1·8	7·1	2·6	40·5	30·2	1·3
		9·6	16·7	3·9	53·3	20·8	6·4
		9·8	10·8	3·1	24·4	23·6	2·7
Parambe Series (509)	Parambe Group	52·5	6·8	3·7	35·7	34·6	3·2
		42·9	4·7	8·3	39·1	41·3	3·3
		50·0	4·6	4·5	17·1	31·0	3·8
	Golinda Group	9·6	3·8	2·8	23·8	13·3	3·2
		47·9	40·5	4·3	41·4	30·9	6·9
		60·0	7·5	4·1	24·4	33·3	2·7
	Maha Oya Group	30·2	3·8	2·5	50·0	30·5	2·0
		45·8	7·7	3·5	50·0	28·7	2·0
		66·7	1·3	3·6	33·3	31·0	2·6
Ratnapura Series (280)	Carney	38·7	4·2	3·9	54·1	4·6	3·1
		21·4	4·4	2·0	3·2	3·5	6·8
		—	—	—	—	—	—
Homagama Series (148)	Abamdeniya Group	11·1	3·8	3·2	41·0	11·1	3·7
		65·0	3·7	8·6	58·6	20·4	3·7
		55·3	4·4	3·3	20·8	31·3	2·8
	Narangala Group	6·0	10·0	3·5	66·7	10·4	3·5
		50·0	11·2	5·0	51·7	7·2	5·3
		34·0	3·7	2·7	67·7	24·4	2·8
	Dalkeith Group	72·3	1·3	3·5	59·5	1·3	3·4
		19·5	3·7	7·5	27·3	11·4	4·5
		56·5	3·3	3·0	46·0	11·4	2·6
Agalawatta Series (72)	Hedigalla	37·9	18·0	2·2	69·6	3·3	4·9
		34·9	3·7	2·5	20·0	14·7	3·2
		56·3	1·3	2·6	37·5	20·2	3·3
	Dartonfield Group	52·3	14·6	4·1	31·4	21·2	3·5
		23·8	3·7	3·7	34·3	20·2	4·0
		50·0	3·7	3·0	51·2	10·8	1·4
Boralu Series (59)	Culloden Group	60·7	4·4	2·6	63·6	17·1	3·0
		64·7	4·4	3·4	36·6	20·7	2·6
		40·7	3·7	2·3	46·9	30·2	2·1
	Tudugalla	77·8	6·8	2·1	53·5	6·7	2·9
		34·8	3·3	3·0	52·0	14·3	3·2
		41·1	3·3	1·5	44·2	20·5	2·0
	Nellunuyana	50·0	17·0	5·5	52·2	20·9	2·6
		56·0	4·4	2·6	29·4	18·0	3·3
		40·4	4·4	2·3	36·7	20·0	2·9
Deniya Series (53)	Durampitiya	53·3	4·4	2·9	55·6	3·7	2·5
		50·0	7·5	4·3	54·3	13·6	2·6
		52·0	8·0	3·6	52·1	29·9	2·9

(B). Variable and low PRI values were recorded in fresh field coagula brought by the tappers in a selected group of five estates (Table 4). No attempt was made to segregate the panel scrap prior to processing into brown crepe and the variability within an estate may be partly due to the variability in the proportion of panel scrap in the mixture.

TABLE 4

PRI OF FIELD COAGULA FROM FIVE ESTATES

Estate	PRI				
	1st Collection	2nd Collection	3rd Collection	4th Collection	5th Collection
1	23·1	26·9	54·2	31·4	30·8
2	29·0	43·1	32·1	28·0	30·6
3	17·5	21·8	23·5	40·0	55·3
4	23·3	37·9	31·0	37·0	34·5
5	42·6	34·6	28·1	24·5	28·8

More uses of locally mined graphite in the rubber industry (*S. W. Karunaratne & L. Goonewardena*) : It was reported in the Annual Review for 1970 that a micronised form of graphite of particle size less than 40 μ could be successfully incorporated into dry rubber and some areas of usage were discussed. Among further applications in the use of graphite in the rubber industry is in the preparation of rubber stereos in flexographic printing. Its special lubricating power improves the rheological properties of the compound in its uncured state and at the same time gives sufficient hardness to the finished product. Among other characteristics of this compound based on graphite are good printability and good buffing characteristics, both important criteria for rubber stereos used in flexographic printing.

An accelerator system based on 2 parts MBTS, 0·5 parts MBT, 0·5 parts DPG having a very safe scorch time and a relatively high cure rate was selected and the test results were obtained using a formula based on 10 parts of graphite. Full proof rubber stereos without blemishes were not repeatedly obtained even with graphite as a processing aid due to the difficulty in controlling the platen pressure during curing of rubber stereos used in flexographic printing. Loose moulds and vulcanisers fitted with hydraulic rams were used for this operation.

Advisory service to producers

Routine advisory work

The following advisory visits were paid by Mr. D. S. Muthukuda, Assistant Development Officer.

Sheet manufacture	*Crepe manufacture*	*Sole crepe manufacture*	*Latex weighing*	*Other visits*	*Total*
58	29	14	24	22	147

Installation of central factories for latex (M. Nadarajah & D. S. Muthukuda) : An article on " Proposals to improve and increase quality production of pale crepe in Ceylon " was prepared in conjunction with Mr. P. A. Bartholomeusz, Superintendent, Padukka Group. Assistance was given to Head, Estates Advisory Department in his survey to find suitable sites for the proposed Government central factories for pale crepe. An article on " Proposals to increase quality production of RSS in Ceylon " was also prepared in conjunction with Mr. P. A. Bartholomeusz, Superintendent, Padukka Group. With Ceylon's rubber production increasing at the rate of 7,500 tons per year, central factories for pale crepe and group processing centres for RSS must be actively promoted until such time that new process rubber development takes place at a rapid pace.

Mould growth in pale crepe (H. Narangoda & M. Nadarajah)

Experiments done in collaboration with Mr. W. C. Dayaratne, Technical Assistant of the Plant Pathology Department have shown that unfractioned pale crepe is more susceptible to mould contamination than pale crepe producted after taking a fraction.

Coagulation with hydrochloric acid (S. W. Karunaratne & K. A. Piyadasa)

A fresh look at the possible side effects of hydrochloric acid (HCl) coagulation revealed that HCl coagulation is satisfactory, provided adequate control measures are taken. The tests were carried out with HCl obtainable from Paranthan Chemicals Corporation. The main conclusions are briefly stated below.

(a) There are safety limits for coagulation of latex with HCl. Rubber is more susceptible to degradation if the HCl concentration in the latex exceeds 0·2% (based on dry rubber).

(b) Within the safety limits of operation, HCl coagulated natural rubber gives good ageing properties and compares well with standard rubber (Table 5).

(c) Instrinsic viscosities of standard rubber and rubber made by HCl coagulation are similar and it is generally concluded that the molecular characteristics of the rubber are similar, irrespective of the nature of the coagulation agent.

(d) HCl coagulation does not necessarily bring about a retardation of cure.

Improvements in the grading of pale crepe (M. Nadarajah & P. P. Jayasinghe)

A paper on this subject was presented by Mr. M. Nadarajah at the Indian Rubber Manufacturers' Research Association 5th Technical Seminar held in Bombay in January 1971 and was published in our Quarterly Journal. The following further work has been done on this subject :

Gel content : The gel content was found to show a clonal variation, RRIC 100 having a high gel content and PB 86 a low gel content.

TABLE 5

EFFECT OF AGEING ON THE PRI OF HCl COAGULATED RUBBER (PALE CREPE)

	Coagulant concentration (l/kg, rubber)	PRI before ageing	PRI after ageing in oven												PRI after ageing in oxygen bomb
			50°C						70°C						30 min at 70°C under a pressure of 2·07 Mn/m²
			1 hr	2 hr	3 hr	24 hr	48 hr	1 wk	1 hr	2 hr	3 hr	24 hr	48 hr	1 wk	
0·5% hydrochloric acid	0·6	71	87	82	80	66	83	71	71	71	75	80	71	—	31
0·5% hydrochloric acid	0·9	71	77	77	78	66	81	68	67	67	70	76	71	—	32
1·0% formic acid	0·3	74	79	80	82	67	83	63	58	58	63	74	69	—	28

Mill breakdown : One of the causes of slow mill breakdown is storage hardening. Table 6 shows that in clone PB 86 the use of oxalic acid instead of formic acid as the coagulant shows more storage hardening, that sodium bisulphite increases storage hardening in the case of formic acid but not in the case of oxalic acid and that the use of RPA No. 3 reduces storage hardening. Further, crepe made from white fraction latex to which RPA No. 3 and sodium bisulphite have been added shows less storage hardening than crepe made from unfractionated latex to which RPA No. 3 and sodium bisulphite have been added. This is more marked when formic acid is used as the coagulant.

TABLE 6

STORAGE HARDENING OF PALE CREPE FROM LATEX OF CLONE PB 86

Sample	Coagulant	Initial Wallace plasticity	Plasticity after storage hardening	Rise in Wallace units	PRI
Whole latex	Formic acid	45	71	26	89
	Oxalic acid	47	82	35	113
Whole latex + Sodium bisulphite	Formic acid	46	83	37	96
	Oxalic acid	47	82	35	117
Whole latex + RPA No. 3	Formic acid	40	61	21	68
	Oxalic acid	43	74	31	105
Whole latex + RPA No. 3 + Sodium bisulphite	Formic acid	41	72	31	78
	Oxalic acid	41	75	34	107
White fraction + RPA No. 3 + Sodium bisulphite	Formic acid	39	62	23	77
	Oxalic acid	40	71	31	110

Badureliya project (S. W. Karunaratne)

In this project smallholders' latex from the Badureliya area is collected and processed into pale crepe. Advice centred on the handling and processing of smallholders' latex. The main problems encountered were :—

(1) Precoagulation during the period immediately following the wintering period and the fact that smallholders are averse to the addition of anticoagulant in the field,

(2) Smallholders' suspicion of DRC determined by the use of the metrolac and a ready reckoner. Due to periodic changes in the quality of latex it is suggested that two ready reckoners be used during the two periods March to October, November to February, respectively. During March to October a ready reckoner based on metrolac readings taken by diluting one part of latex with two parts of water should be used. During the dry months, *i.e.* November to February, due to continuous tapping smallholders' latex shows a significant drop in the average DRC and during these months a ready reckoner based on metrolac readings taken by diluting one part of latex with one part of water should be used.

A graduate trainee has been trained in the group handling and processing of smallholders' latex.

Sun-drying of RSS (H. Narangoda & M. Nadarajah) : Considerable amounts of lower grade sheet are produced in Ceylon mainly by holdings below 10 acres in extent. The quality of this category of RSS may be improved by processing the latex in group processing centres (GPCs) where smallholders' latex may be bukled and processed. A limiting factor in the development of the GPCs is the capacity of smoke houses. If this could be increased then the success of the operation of the GPCs could be considerably improved. One method of doing this is by sun-drying of sheet prior to smoking. O'Connel (1966) (*Plrs. Bull. Rubb. Res. Inst. Malaya*, No. 86 148 — 159) states that smallholders' sheet, which is frequently hung in the sun when wet, does not normally have poor heat build-up characteristics. He, however, states that rubber in the wet state is not so badly affected by sunlight as dry rubber, but is affected to some extent. He also states that the degradation that sunlight induces in raw rubber can be detected most readily by the PRI test and the Goodrich flexometer test. In our experiments the PRI test was used.

Our experiments (Table 7) indicate that sun-drying should preferably not exceed three days and should be followed by two days of drying in a smoke house. Since RSS is inadequately smoked, *e.g.* if smoked only for two days, a fungicide such as paranitrophenol (PNP) should be used to enable the RSS to be at least as mould-resistant as when fully smoked. PNP also has a beneficial effect against any deleterious effect of sunlight on the wet sheet. This may be due to the yellow stain imparted to the rubber by the PNP. Nadarajah *et al.* (1967) (*Q. Jl. Rubb. Res. Inst. Ceylon* **43**, 13—18) have stated that exposure of pale crepe, made from clone PB 86, to sunlight for 12 hr reduced the PRI to 51, whilst it was reduced to only 87 from a value of 100, with the use of a yellow filter. If RSS can be manufactured under strictly controlled conditions in GPCs and if PNP is used, then sun-drying could be adopted as a standard procedure.

TABLE 7

SUN-DRYING AND SMOKING EXPERIMENTS

No. of sun drying days	No. of smoking days	Volatile matter content	PRI
3	1	0·60	80
3	2	0·54	88
3	3	0·53	88
4	1	0·75	80
4	2	0·66	83
4	3	0·68	82
—	4	0·56	87
—	5	0·55	93
5	—	0·74	70

Rubber seed (*M. Nadarajah*) : A sample of rubber seed oil was given to Sithara Ltd., Ratmalana. They found that it could be used to extend linseed oil by 25% for use in letterpress ink.

There was very poor seed fall this year and a demand of over 500 tons of kernel could not be met by the supplier who did the collection this year. He was able to collect only about 10 tons of kernel. The poor seed fall may be due to the heavy *Oidium* attack early this year.

Colour of crepe (*D. S. Muthukuda*) : The colour of crepe obtained under Ceylon conditions from clones not mentioned in our *Handbook of Rubber Culture and Processing* is given in Table 8.

TABLE 8

Deep yellow	Yellow		Pale yellow		White
RRIM 605	AVROS	1734	IRCI	2	RRIC 36
	IRCI	9	WR	101	RRIC 48
	RRIC	13	AVROS	1447	PR 252
			RRIC	50	
	PB	28/59	RRIC	99	IRCI 7
			RRIC	48	

Advisory work in latex technology (*W. D. Dharmasena*) : Demonstrations and training were given at the Institute on the manufacture of rubber products such as teats, gloves, toys and rubber thread from concentrated latex.

Coir mattings are used to cover tea nurseries and they tend to deteriorate during outdoor exposure. To minimise this deterioration, treatment of coir mattings with natural rubber latex was done at the TRI, Talawakele. The coir mattings were treated with vulcanisable and non-vulcanisable field latex compositions.

(1) One full length, coir matting (9′ × 30′) and two pieces of water beaten mattings were impregnated in latex to cover up the strand right round to prevent from the weather conditions and to improve the service life.

(2) Two pieces of coir mattings (new and old) were brought from the TRI and spread with compounded field latex and left for ageing.

Polymer chemistry

Preparation of chemical derivatives of rubber and their uses

Rubber hydrochloride (*M. Nadarajah, S. Kasinathan, E. G. Somapala & D. D. Wahalatantri*) : The use of field latex in preparing rubber hydrochloride was investigated. The use of latex rather than rubber solutions is advantageous in that the product is more crystalline and a higher hydrochlorination (98·99%) is possible with a lower occurrence of cyclisation (Van Veersen, 1948, *Proc. 2nd Rubb. Technol. Conf.*, 87). The latices used by us were (a) fresh field latex, (b) ammonia-preserved field latex, (c) sodium hydroxide-preserved field latex, and (d) creamed field latex.

To 500 cc from each type of latex were added 100 cc of 10% Vulcastab LW solution (not done in the case of creamed field latex as Vulcastab LW was added before creaming) and 150 cc of concentrated HCl. Gaseous HCl was passed through the latices until complete hydrochlorination took place. The extent of hydrochlorination was determined visually by observing the coagulum formed by dropping aliquots of a few ml taken at intervals, into ethanol. If complete hydrochlorination had taken place, the aliquots on dropping into ethanol form a white powder which settles at the bottom. The times taken for complete hydrochlorination of different latices are given in Table 9.

TABLE 9

TIME IN HOURS FOR HYDROCHLORINATION

Type of latex	Time in hours	Quality of product
Fresh field latex	46	Good
Creamed field latex	33	Good
Sodium hydroxide-preserved field latex	32	Degraded
Ammonia-preserved field latex	52	Degraded

It will be seen from Table 9 that the most suitable latex is creamed field latex. This may be due to the reduction of water content in the latex and the removal of certain inhibitory substances present in field latex by the creaming process. An increase in temperature as well as pressure of HCl gas should shorten still further the time taken for hydrochlorination.

Cyclised rubber (*A. M. A. Amarapathy, M. Nadarajah, H. Narangoda & M. N. R. Cooray*) : The use of cyclised rubber for injection moulding was investigated. Cyclised rubber masterbatch 90 : 10, which is a powder was found suitable for use in injection moulding. However it has a tendency to degrade and to give an offensive smell during the injection moulding process. Better results were obtained when methyl methacrylate-grafted latex (25% methyl methacrylate) was used in preparing the 90 : 10 masterbatch. This masterbatch could be injection-moulded at a lower temperature.

Chlorinated rubber (*M. Rajasingham, J. K. Kirubakaran, P. P. Jayasinghe & M. Nadarajah*) : Soluble chlorinated rubber is prepared by gradually chlorinating latex after adding a chemical such as xylyl mercaptan or hydroxylamine. By soluble chlorinated rubber is understood a chlorinated rubber which is completely soluble in the conventional solvents of the paints and lacquer industry, *e.g.* chlorinated hydrocarbons, aromatic hydrocarbons and ketones. Field latex is stabilized with Vulcastab LW at 2% on the latex. Concentrated hydrochloric acid at 80% on the field latex is added with stirring. This is then followed by the gradual addition (about an hour) of sodium chlorate (64% on the latex) as a solution. Care has to be taken to keep the temperature below 40°C. Continuous agitation of the reaction mixture is necessary to ensure steady reaction conditions. After the chlorination has been carried out it is allowed to stand overnight. The product may be obtained as a powder by washing with water and drying at 45°C.

It was observed that soluble chlorinated rubber (chlorinated rubber soluble in toluene) was produced :

(a) when RPA No. 3 at 0·2% to 0·4% on the latex was added before chlorination,

(b) when hydroxylamine hydrochloride at 0·15% on latex was added before chlorination,

(c) when latex of certain clones such as PB 86 and RRIM 513 were used.

It is believed that crosslinking reactions may be the cause of the formation of insoluble chlorinated rubber and that this crosslinking is inhibited by the addition of xylyl mercaptan or of hydroxylamine.

Uses of chlorinated rubber prepared from field latex (J. K. Kirubakaran & P. P. Jayasinghe) : A 2 lb sample of chlorinated rubber was given to Sithara Ltd., Ratmalana, who were successful in manufacturing satisfactory printing inks from it, using toluene as the solvent.

Preparation of adhesives from cyclised rubber and natural rubber masterbatch (M. Rajasingham, P. P. Jayasinghe & J. K. Kirubakaran) : The masterbatch was prepared using varying proportions of cyclised rubber and natural rubber, *e.g.* 50/50, 70/30, 80/20, 50/100 and 18/100. All these masterbatches were tried as adhesive bases. Out of them the 70/30 masterbatch produced a very good general purpose adhesive.

Pressure sensitive adhesive from chlorinated rubber (M. Rajasingham, J. K. Kirubakaran & P. P. Jayasinghe) : Pressure sensitive adhesive can be defined as those adhesive which will adhere tenaciously on application with only light finger pressure. Tapes with these adhesives have gained wide acceptance because of their ease of applications and their ability to be removed cleanly from the surfaces on which they were applied. Pressure sensitive adhesives are composed of a rubber type elastomer combined with a liquid or solid resin tackifier component. The performance of a pressure sensitive adhesive is dependent on three primary factors, *viz.* the wetting ability or quick stick, adhesion and cohesive strength.

Pressure sensitive adhesives have been made from chlorinated rubber and rubber mixture and this could be used in Ceylon for various applications, *viz.* adhesion of car labels on wind screens, advertisement purposes, labels for bottles, glass and wood etc.

The compound formulation is as follows :—

Natural rubber and chlorinated rubber	100
Toluene	300
Rosin	10
Plasticiser	5
Zinc oxide	8
Magnesium oxide	5
Titanium dioxide	as required.

The method of preparation of the adhesive is as follows :—

Natural rubber is masticated in a two roll mill and an equal amount of chlorinated rubber is introduced into the mill and a well mixed masterbatch of natural rubber and chlorinated rubber is obtained. The temperature of the mill should be kept under control at about 40 to 45°C.

The masterbatch is dissolved in toluene and left overnight. The dissolved product is ground in a mortar. To this product zinc oxide, magnesium oxide and plasticiser are added one at a time with good mixing.

Rosin is dissolved in toluene and added to the above mixture and ground well. The paste so obtained is dark yellow in colour and to reduce the yellow colour the filler, titanium dioxide is added and ground well.

Uses of methyl methacrylate-grafted natural rubber field latex (M. Nadarajah) : Samples of methyl methacrylate-grafted natural rubber field latex were given to Chemical Industries (Colombo) Ltd., and to Mackwoods Ltd., Colombo, to carry out trials on their use in emulsion paints. Samples were also given to the Ceylon Leather Products Corporation for use in finishing leather as part substitution of imported acrylic binders.

Development work

Rubber in roads (M. Nadarajah, K. P. N. de Silva, W. M. M. Weerakkody & M. N. R. Cooray) : The conversion of natural rubber latex into crumb or powder form or as masterbatch so that it is in a suitable condition for easy dispersion in hot bitumen was investigated.

Paraffin wax-coated crumb : Fresh field latex was stabilized with sodium hydroxide at 0·15% on the latex. A hot 50% paraffin wax emulsion was added with stirring to the cold latex, so that there is about 10% wax in the rubber. Coagulation was done with a 50% alum solution until the latex was just acidic. On standing the rubber coagulated and the coagulum on passing through a spiral mill twice, gave crumbs. These crumbs were dried with hot air ar 80°F. These crumbs were soaked for 1 hr in kerosene oil at 10% on the bitumen and then added to the hot bitumen.

Rubber powder : Field latex was stabilized with ammonia at 0·2% on the latex. China clay at twice the weight of the latex was taken and stabilized with Vulcastab LW (as a solution) at 0·05% on the latex. Water was added to the China clay to make it into a slurry which was passed through a homogeniser and then added to the latex. The latex was coagulated with alum or formic acid and the coagulum dried in trays in an oven at 40°C. The product when passed through a smooth mill with a little water gave a powder, which was dried further in an oven at 40°C. The powder dissolved in hot bitumen to which kerosene oil at 5—10% on the bitumen had been added.

Rubber-bitumen masterbatches : Rubberised bitumen masterbatches containing 16% rubber exhibit cold flow. China clay was added at 10% on the masterbatch immediately after the addition of the latex to the hot bitumen. It was noted that the cold flow of the masterbatch was considerably reduced.

Rubber cement mixes (B. Cooray & M. Nadarajah) : The Ca^{++} ions in the cement are one of the causes of coagulation of anionically-stabilized latex when mixed with

cement. Cationic stabilization of the latex would be expected to offset the effect of the coagulating effect of the Ca^{++} ions. Table 10 gives the stabilizer to the latex, time taken for coagulation and properties of product.

TABLE 10

EFFECT OF CATIONIC LATICES ON CEMENT

Stabilizer % on latex	Life of stabilized latex in hours	Time taken for coagulation in minutes	Properties of product
2% Vulcastab LW and 2% sulphuric acid	—	6	Cracks after four days of hardening
2% Vulcastab LW and 2% formic acid	—	8	Cracks after five days of hardening
2% Vulcastab LW and 1·5% Cetrimide	336	90	Rubbery and soft
2% Vulcastab LW and 0·75% Cetrimide	168	72	Rubbery and soft
2% Vulcastab LW and 0·5% Cetrimide	24	60	Rubbery and hard
2% Vulcastab LW and 0·25% Cetrimide	18	45	Hard
2% Vulcastab LW and 0·1% Cetrimide	8	15	Hard

Whilst Vulcastab LW 2% and Cetrimide 0·5% were enough to yield a workable mixing time with cement, Vulcastab LW 2% and Cetrimide 0·75% constitute the best formulation considering workability as well as the life of the prepared latex.

Rainguards for rubber trees (*M. Nadarajah, M. R. N. Fernando & G. W. Goonesena*) : The rigifoam rainguard is satisfactory and is used on a large scale in Malaysia and in collaboration with the CISIR, attempts were made to fabricate a rubber rainguard similar to the rigifoam rainguard. A satisfactory rainguard that was made by the CISIR was tried out by us on the following estates on a tapping task with an adjacent control tapping task :

Udapolla Group, Deraniyagala ; Maha Oya Group, Dehiowita ; Ruanwella Estate, Ruanwella ; Malaboda Estate, Matugama ; Nakiadeniya Group, Nakiadeniya ; Culloden Group, Neboda ; Udabage Estate, Deraniyagala and Peenkande Estate, Udakarawita.

The adhesive used was centrifuged latex. A mixture of centrifuged latex (2 parts) and field latex (1 part) was also found to be a satisfactory adhesive.

Soil stabilization by natural rubber latex (*S. W. Karunaratne & K. A. Piyadasa*) : Irrigation channels were treated with a latex/oil emulsion containing upto 25% of an aromatic oil (Dutrex R), based on dry rubber. Experiments were conducted at the Maha Illuppalama Agricultural Research Station on loose loamy soils. Lift irrigation channels constructed in firm latosol type soils were subjected to the same

treatment in the Mannar District. It is concluded from these experiments that the treatment is satisfactory if the growth of weeds and damage by insects can be checked. An application of a residual weedicide/insecticide mixture at least every fortnight is therefore recommended. In another experiment soil stability tests were carried out after spraying with latex/oil blends and it has been observed that the percentage of oil in the blend is a critical factor in the conditioning of the soil.

An important factor in connection with any treatment envisaged for large scale application is, of course, the cost. The approximate cost of the latex/oil blend inclusive of handling charges has been estimated at Rs. 50/00 per 100 sq metres.

Analysis

Technical specifications (*S. W. Karunaratne & A. S. Dekumpitiya*) : A detailed report on a project for the establishment of a central specification laboratory for raw natural rubber was submitted and steps will be taken to implement it in the coming year. The laboratory will have facilities to test 100 samples initially in a single shift and 200 samples towards the end of the five-year period (1972—1976) in a double shift operation.

The Specifications Unit in the Rubber Chemistry Department continued to operate throughout the year. In addition to routine testing this unit participated in periodic inter-laboratory cross check tests with the French Rubber Institute and the SMR Laboratory. Three Specification Assistants were appointed during the second half of the year.

REVIEW OF THE STATISTICS SECTION

By

G. A. J. P. R. Gunasekera

'The practice sometimes followed of consulting the statistician only after the experiment is completed and asking him "what he can make of the results" cannot be too strongly condemned. It is essential to have the experiment in a form suitable for analysis and in general this can only be attained by designing the experiment in consultation with the statistician, or with due regard to the statistical principles involved'. R. C. Bowden.*

SUMMARY

The staff of the Section was busy throughout the year with the statistical services called for by all other research divisions. These included routine analysis of experiments, design and analysis of new experiments and surveys, regression analysis, graphical representations and innumerable discussions with the research officers.

Two field experiments to study the growth curves of *Hevea* plants and an investigation of the variability in rubber yields due to the influence of many factors, *e.g.* weather, rest period, etc. were initiated.

Collection of data from the meteorological station at Dartonfield became the responsibility of the Section at the beginning of the year. Maintenance of weather records received from the Institute's sub-stations and private estates, and the upkeep of instruments installed in them were attended to.

DETAILED REPORT

Statistical services

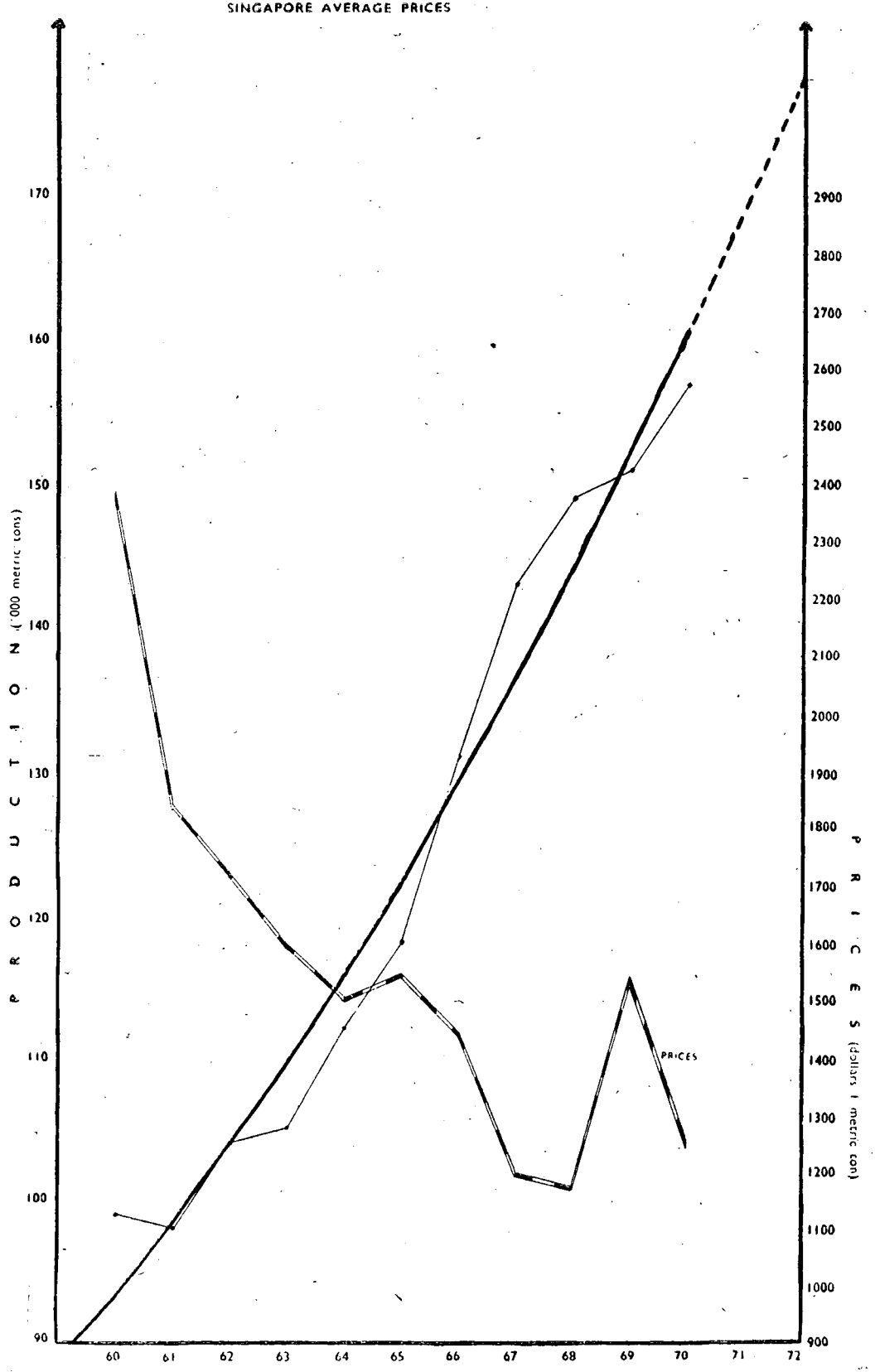
Routine work : Analysis of experiments continuing from previous years included 46 data sets of randomized block, factorial, split-plot and Graeco-latin-square designs.

Design of new experiments : The following designs totalling 17 were submitted.

Design	*Department*		
	Botany	Pathology	Soils
Randomized block	6	2	1
Split-plot	3		1
Factorial	1		2
Fully randomized			1

*Director of Ordinance Factories (Explosives) in his forward to 'Industrial Experimentation', London : HMSO, 1948.

CEYLON RUBBER PRODUCTION
AND
SINGAPORE AVERAGE PRICES



Analysis of variance (AV) of new experiments : More than hundred sets of data were analysed. Linear, quadratic and cubic treatment effects were calculated where appropriate and statistical interpretations of the results were made.

Agricultural Economics Unit

Survey on cost of production : The relationships between (a) cost of production and yield per acre, and (b) cost of tapping and yield per acre for the estates in the following groups, *viz.*

(i) 100 — 500 acres producing crepe,

(ii) 100 — 500 acres producing RSS,

(iii) 500 — 1000 acres producing crepe, and

(iv) over 1000 acres producing crepe

were found to be best described by exponential equations of the form $y=AX^{B}$.

Curves were fitted to the log-transformed sample data by the method of least squares and graphical representations were made in current co-ordinates.

A linear multiple regression equation was evaluated to investigate the dependence of yield on five factors : (1) old rubber acreage in tapping, (2) young rubber acreage in tapping, (3) young rubber acreage not in tapping, (4) abandoned acreage, and (5) percentage replanted acreage in tapping, in the 100 — 500 acre, crepe and RSS producing estates.

Regressions of cost per lb on yield per acre, total acreage and yield per acre $\times$ total acreage were determined separately for all crepe producting estates and all RSS producing estates.

Using log-transformed variates, three further multiple regressions of the same combinations as above of dependent variables were evaluated.

Smallholdings survey 1971 : A hierarchal AV was carried out to evaluate a sampling scheme for smoked sheets. All three sources of variation (*viz.* between smoke houses, smallholders and dates) were statistically significant.

Subsequently, assuming simple random sampling, sample sizes were determined to estimate the mean weight of smoked sheet for a given smallholder (irrespective of variation between dates).

Allowable percentage error	*Sample size*
2	109
3	48
4	27
5	17
7·5	8
10	4

A card format was prepared as the first step in analysing the survey data by use of a computer. We are indebted to Mr. Lakshman Ranaweera of the Insurance Corporation for the assistance given.

Botany Department

Tapping systems with rainguards : First six months' average yield data were corrected for initial differences by a covariance analysis, the concomitant variate being the average yield data of the previous year's last three months. Calculations, repeated for the clones PB 86, RRIC 45, RRIC 52, and RRIC 7, showed significant regressions in the error lines indicating that adjustments to the treatment means would be worthwhile.

Leaf area estimation : Nearly 60 samples, sample sizes ranging from 30 to 100, were subjected to regression analysis and individual errors of estimates were calculated and grouped.

It was possible to show that the length of the mid rib could also be a satisfactory estimator of leaf area.

Genetics & Plant Breeding Department

Stomatal numbers : The data comprised readings from 3600 samples. Sampling conformed to a mixed model, locations and clones being orthogonal. An AV was carried out.

Ten simple correlations of stomatal number vs. length $\times$ breadth of leaflet calculated separately for the locations, clones and their unions illustrated an important statistical result : taking individual clones in a given area there was no significant linear association, but when data for the two areas were combined RRIC 45 and 451 showed significance. This was a reflection of the fact that Moneragala had low leaf area and low stomatal density and Kuruwita had high leaf area and high stomatal density. In the case of 1103 where the stomatal density was not much different in the two areas, no significant linear relationship was shown up after pooling.

Oil content of seed : Experimental data on oil content and *Oidium* being samples of unequal size, conformed to Model II (Snedecor). An AV was calculated.

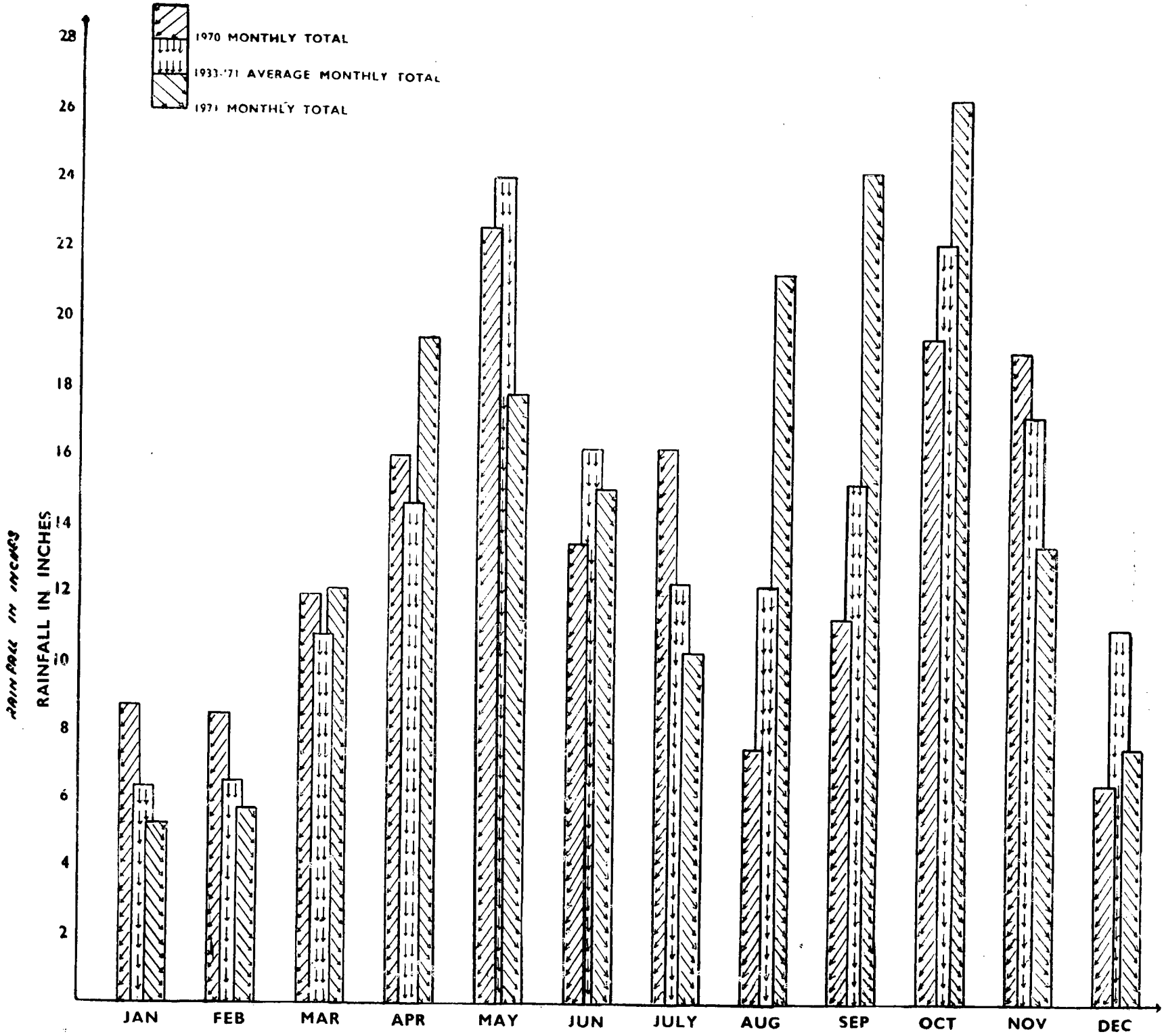
Oil content : micro-tapping : Nearly 210 simple correlations from small samples were calculated in connection with the separate studies on oil content and micro-tapping. Some regression lines were drawn on scatter diagrams.

Soils Chemistry Department

Field experiments : A report on the experiments conducted by this Department was prepared after studying the field layouts, designs and the past performances.

Loss of nitrogen : Averages and standard deviations were calculated to describe the percentage loss of nitrogen in six soil series.

Effect of fertilizer on yield (Malaboda Estate) : A covariance analysis was carried out to adjust treatment yields for pre-experimental yield differences. The data from this experiment did not show a significant regression to make adjustments worthwhile.


1970 MONTHLY TOTAL
1933-'71 AVERAGE MONTHLY TOTAL
1971 MONTHLY TOTAL
RAINFALL IN INCHES
28
26
24
22
20
18
16
14
12
10
8
6
4
2
JAN
FEB
MAR
APR
MAY
JUN
JULY
AUG
SEP
OCT
NOV
DEC

Frequency of fertilizer application (Durampitiya Estate) : An ACV to assess mean diameters of nursery plants on equal pre-experimental heights revealed non-significant correlation between the two variates.

Foliar fertilizers : The experiment conducted at Vogan Group on nursery seedlings to determine the influence of normal soil application of fertilizer and the foliar spray of fertilizer on the growth and leaf nutrient status of seedlings was analysed.

Further supplementary analyses were carried to ascertain (1) whether there were synergistic and antagonistic relationships among the leaf nutrients themselves, and (2) whether growth vigour has any influence on leaf nutrient status.

Soil moisture : Data on soil moisture determination were subjected to a hierarchal AV in order to determine the relative importance of various sources of variation and thereby arrive at a suitable method of sampling rubber soils for determining soil moisture status.

It was established that stratified sampling on the basis of contours will serve no useful purpose. Simple random sampling secures a relatively precise estimate of the soil moisture status.

Thirty one samples will ensure an estimate with an error of $\pm$ 5% whereas 7 samples will ensure an estimate with an error of $\pm$ 10%.

Visits

Fifteen visits were made in connection with survey work and nine to investigate field layouts.

Biometrical research

Effect of some weather factors on yields : The yield data of a 1954 clearing at Dartonfield were used to calculate regressions of :

y_1 = (percentage dry rubber content of 50 cc) $\div$ 10
y_2 = wet latex poundage
y_3 = dry rubber poundage

on

x_1 = rainfall since previous tapping in inches
x_2 = $x_1^{\cdot 5}$
x_3 = atmospheric pressure at 8.30 a.m. in mm of mercury
x_4 = room temperature at 8.30 a.m. in ^{0}C
x_5 = earth temperature 4″ below at 8.30 a.m. in ^{0}F
x_6 = earth temperature 4′ below at 8.30 a.m. in ^{0}F

The regression equations obtained are :

$$y_1 = 58{\cdot}42 + 0{\cdot}06x_1 - 0{\cdot}24x_2 - 0{\cdot}08x_3 - 0{\cdot}26x_4 - 0{\cdot}09x_5 + 0{\cdot}01x_6 \quad \text{.....I}$$

$$y_2 = 1372{\cdot}19 + 0{\cdot}38x_1 - 2{\cdot}92x_2 - 1{\cdot}89x_3 + 2{\cdot}53x_4 - 0{\cdot}25x_5 + 0{\cdot}71x_6 \quad \text{.....II}$$

$$y_3 = 1077{\cdot}67 + 0{\cdot}57x_1 - 2{\cdot}41x_2 - 1{\cdot}42x_3 + 0{\cdot}95x_4 - 0{\cdot}15x_5 + 0{\cdot}03x_6 \quad \text{.....III}$$

The coefficients of determinations $R_1^2 = 0 \cdot 7054$, $R_2^2 = 0 \cdot 2476$ and $R_3^2 = 0 \cdot 3677$ showed that 71%, 25% and 37% of the variations in y_1, y_2 and y_3 respectively are explained by (or could be attributed to) the factors x_1 to x_6.

The multiple regression coefficients, $R_1 = 0 \cdot 8400$, $R_2 = 0 \cdot 4976$ and $R_3 = 0 \cdot 6064$ are the predicting powers of the above equations.

In equation I, the coefficients of x_1 x_2,x_3,x_4 and x_5 are highly significant (probability level 0·001) and that of x_6 is non-significant (even at P=0·5). As the coefficients of x_1 and x_2 (the factors expressing the curvilinear influence of rainfall) are positive and negative respectively, it follows that rain decreases the percentage dry rubber content (DRC) and the rate of decrease reduces as the rainfall increases further.

It is further inferred that an increase of 1 mm in the atmospheric pressure reduces the DRC % by 0·8 ; unit increase in room temperature reduces it by 2·6 and 1°F increase in earth temperature at a depth of 4″ reduces the same by 0·9.

In II, the coefficient of x_4 only is significant (P= 0·05).

In III, the coefficient of x_3 is significant at 0·001 level, that of x_2 at 0·01 level and those of x_1 and x_4 at 0·05 level.

All significant partial regression coefficients could be interpreted as above.

This problem is being further studied with the aid of a computer and the above results may be treated as provisional.

Growth curves

Girth measurements are being taken from randomly selected plants of a number of clones at Nivitigalakele Sub-station and Govinna Estate 1970 replanted areas.

The Assistant Statistician made three visits and the technical staff 25 for this purpose.

Meteorology

Dartonfield meteorological report is given on page 107.

Rainfall recorder charts were received from Kuruwita, Nivitigalakele, Doloswela, Elpitiya and Nakiyadeniya Sub-stations and Estates.

Five visits were made by the staff to inspect the barograph and rainfall recorder locally purchased, and to receive instructions regarding the calibration of the Gunn-Bellani radiation integrator and repair instruments.

Rubber Statistics

Prices Monthly average prices, lowest prices and highest prices of smoked sheet and monthly average prices of crepe and scrap crepe in 1971

	Average price and range in cents					Average price in rupees									
	RSS grade					Crepe grade					Scrap crepe grade				
	1	2	3	4	5	1X	1	2	3	Off	1	2	3	4	Flat bark
January	82·4 80·3 — 85·0	77·8 76·8 — 80·0	75·5 74·5 — 78·3	74·1 73·0 — 77·0	68·6 67·3 — 71·5	1·10	1·09	0·99	0·83	0·72	0·71	0·69	0·66	0·63	0·59
February	79·2 77·3 — 81·3	75·4 74·0 — 77·0	73·5 72·5 — 74·8	71·5 70·3 — 73·0	67·1 60·0 — 76·5	1·12	1·11	0·97	0·81	0·70	0·70	0·67	0·65	0·62	0·59
March	79·1 74·5 — 83·3	74·1 71·8 — 77·0	73·0 70·8 — 76·3	71·0 68·8 — 74·0	66·2 64·8 — 69·8	1·16	1·14	1·01	0·79	0·69	0·70	0·66	0·62	0·59	0·57
April	84·2 81·3 — 86·8	75·5 73·3 — 77·3	74·4 72·3 — 76·0	72·6 70·5 — 74·3	68·0 65·8 — 69·8	1·20	1·19	1·06	0·80	0·70	0·69	0·65	0·63	0·59	0·57
May	86·1 84·3 — 88·0	75·9 74·0 — 78·5	75·0 73·3 — 77·3	73·3 72·3 — 75·3	68·6 67·0 — 70·8	1·28	1·27	1·13	0·88	0·72	0·74	0·72	0·66	0·62	0·59
June	81·6 79·0 — 84·8	72·5 70·8 — 74·5	71·8 70·0 — 74·3	71·4 69·5 — 73·3	65·4 64·3 — 68·0	1·29	1·28	1·10	0·82	0·70	0·72	0·71	0·65	0·61	0·58
July	78·9 76·3 — 83·3	67·0 63·3 — 70·3	65·6 62·3 — 69·5	65·1 62·0 — 69·0	59·9 85·5 — 63·3	1·28	1·27	1·04	0·70	0·66	0·60	0·58	0·56	0·55	0·54
August	75·2 68·3 — 79·0	64·9 62·5 — 66·5	62·7 61·0 — 64·8	61·7 59·8 — 63·8	56·8 55·3 — 58·5	1·26	1·25	1·10	0·79	0·64	0·64	0·62	0·60	0·58	0·57
September	76·8 75·3 — 78·8	65·4 64·3 — 66·8	62·5 61·5 — 64·3	61·9 60·8 — 63·3	57·2 56·8 — 58·3	1·15	1·13	0·92	0·76	0·67	0·66	0·65	0·64	0·60	0·58
October	74·8 72·5 — 77·5	63·6 61·3 — 66·5	60·1 58·3 — 62·3	59·3 57·8 — 61·5	55·4 53·8 — 59·3	0·97	0·93	0·82	0·72	0·68	0·67	0·66	0·64	0·59	0·56
November	74·7 70·8 — 80·5	61·4 60·3 — 62·3	58·7 58·3 — 60·3	58·2 56·8 — 59·5	54·3 53·5 — 55·8	0·93	0·90	0·79	0·73	0·72	0·70	0·66	0·65	0·61	0·58
December	69·3 64·5 — 70·3	62·9 61·0 — 64·3	61·8 59·8 — 63·3	60·2 58·0 — 61·8	55·9 53·8 — 57·8	0·83	0·81	0·76	0·74	0·73	0·70	0·67	0·64	0·61	0·58

Source : Commodity Purchase Department

Production, exports and consumption

TOTAL MONTHLY PRODUCTION, EXPORTS AND CONSUMPTION OF ALL FORMS OF RUBBER IN 1971

	Production		Exports		Consumption	
	Million pounds	Thousand metric tons	Million pounds	Thousand metric tons	Million pounds	Thousand metric tons
January	35·652	16·11	17·415	7·90	0·870	0·40
February	22·054	10·00	31·719	14·39	0·851	0·39
March	17·295	7·84	46·157	20·94	0·606	0·28
April	30·556	13·86	23·514	10·67	0·937	0·43
May	25·617	11·62	20·215	9·17	0·840	0·38
June	22·921	10·40	23·817	10·80	0·984	0·45
July	25·001	11·24	15·174	6·88	0·803	0·36
August	22·591	10·25	45·011	20·42	0·672	0·31
September	20·712	9·39	13·283	6·03	1·205	0·55
October	37·617	17·06	18·087	8·20	1·196	0·54
November	20·910	9·48	13·439	6·10	1·151	0·52
December	30·827	13·98	17·356	7·87	1·095	0·50
Total	311·753	141·41	285·187	129·36	11·212	5·09

Source : Ceylon Customs Returns

Production extrapolation

It is estimated that the production of rubber in 1972 would be 179,100 and 189,100 metric tons in 1973.

Production figures from 1960 to 1970 given in the *Rubber Statistical Bulletin* were used for the above evaluation. An exponential curve, $y = 35{\cdot}8 \times 1{\cdot}056^{X}$ was obtained by the method described in p.2. The correlation coefficient was 0·9820. The annual increase in production is inferred to be 5·6 per cent.

Year	Production metric tons		Percentage error of estimate
	Actual	Estimated	
1960	98,800	93,300	—5·6
1961	97,600	98,500	0·9
1962	104,000	104,000	·0
1963	104,800	109,800	4·8
1964	111,600	115,700	3·7
1965	118,300	122,400	3·5
1966	131,000	129,300	—1·3
1967	143,200	136,500	—4·7
1968	148,700	144,100	—3·1
1969	150,800	152,200	0·9
1970	159,200	160,700	0·9
1971		169,600	
1972		179,100	
1973		189,100	

Height above sea level 215′, 6553.2 cm

			Pressure		
west in. np.	Mean minimum on grass	Mean 4″ below earth	Mean at 8.30 a.m.	Highest at 8.30 a.m.	Lowest at 8.30 a.m.
			mm of mercury		
5 J3)	17·9	26·6	756·19	**759·50** (28)	754·25 (8)
7 F,22)	19·1	25·0	756·60	758·50 (25,26)	754·75 (6)
0 M-5)	18·4	26·9	757·71	759·00 (17)	757·25 (2,6,7)
0 A3)	20·7	28·1	757·70	758·75 (12)	755·50 (30)
0 M4)	21·7	63·3	756·78	758·50 (20)	756·25 (6,11,12)
0 J1	21·4	27·6	757·50	758·50 (9,10,11)	756·25 (29)
5 J),24)	21·2	27·4	756·52	757·75 (18)	755·40 (8,10)
0 A4)	25·3	25·6	756·48	758·40 (1)	755·20 (21)
0 S7)	19·7	27·1	756·48	758·95 (3)	**753·75** (14)
0 C8)	21·3	26·7	757·80	758·75 (27,28)	755·50 (4)
5 N0)	18·6	26·9	757·93	759·25 (10)	756·75 (27)
0 D9)	19·3	26·3	756·98	758·50 (16)	755·90 (11)
]					
]	20·4	26·8	757·10		

	SEPTEMBER		OCTOBER		NOVEMBER		DECEMBER	
4·17	15·13	155·53	22·17	227·89	17·32	178·04	11·28	115·95
9·39	7·89	81·10	6·20	63·73	6·60	67·84	5·70	58·59
6·69	12·23	304·47	72·06	374·89	69·18	408·09	51·70	253·59
7·89 (939)	1·19 — 29·62 (1957 1967)		7·01 — 36·47 (1938 1967)		6·73 — 39·70 (1938 1963)		5·03 — 24·67 (1951 1946)	

General

Staff

Assistant Statistician — G. A. J. P. R. Gunesekera

Technical Assistants — L. T. Peiris and S. L. Weerasinghe

The assistance of the Consulting Biometrician, Mr. V. Abeywardena, especially in experimentation, is acknowledged.

Equipment

The Section was fortunate to have been able to purchase an Olympia electronic calculator. This greatly facilitated the lengthy computations in multivariate analyses. The Facit electric calculator continued to give good service. A Friden calculator was also available.

REVIEW OF THE ESTATES ADVISORY DEPARTMENT AND THE ECONOMIC RESEARCH UNIT

By

A. B. Dissanayake

General

The Estates Advisory Department gives advice to all small and medium rubber estates. Advice to large estates is given only on request. The Economic Research Unit of the Department undertakes agricultural economic studies on aspects important to the rubber industry.

Staff

The Head of the Estates Advisory Department and three Assistant Estates Advisory Officers were on duty throughout the year. One Assistant Estates Advisory Officer left the services of the Institute during the second quarter. The Assistant Agricultural Economist recruited in 1970 left for England for post-graduate studies at Wye College, University of London.

Another Assistant Agricultural Economist was recruited towards the end of the year and is due to proceed to Australia to do a course in Agricultural Development Economics at the Australian National University, Canberra, in early 1972.

Correspondence

A great deal of correspondence was attended to by the Department in the form of advisory reports on visits to estates, advisory letters on simple problems and other reports on special problems, surveys and feasibility studies. A total of over 675 reports and letters have been sent by this Department for the year.

Visits

Routine visits : A total of 250 visits were made by the officers of this Department to small and medium estates. A break-up of the visits by categories would be as follows :-

TABLE 1

ROUTINE VISITS TO ESTATES

Category of estate	No. of visits
Small estates	186
Medium estates	64
Total	250

The visiting officer looks into all aspects of the working of the estate from planting to manufacture and smoking and gives advice. The visit is followed by an advisory report to the owner of the estate as well as the Superintendent or Conductor-in-charge, so that he will have on record the advice given. Whenever necessary advisory circulars are also sent for their information. The reports are sent in Sinhala where required.

Visits on request : A total of 65 visits were made by the officers of this Department. A break-up of such visits is given in Table 2.

TABLE 2

VISITS TO ESTATES ON REQUEST

Category of estate	No. of visits
Small estates	31
Medium estates	26
Large estates	8
Total	65

These visits were made in connection with specific problems referred to us by the estates. All these visits too were followed by reports to the Superintendent and the owner giving the necessary advice.

In the case of medium and small estates other aspects of the plantation were also looked into and recommendations to improve the general working of the estate were discussed.

Surveys

A total of 669 estates have been visited for surveys. A break-up of the visits would be as follows :-

TABLE 3

VISITS ON SURVEYS

Type of survey	No. of visits
Metrication survey	58
Replanting survey	44
Survey for central factories	567
Total	669

Metrication survey : This was done to help work out the cost of metrication of the rubber industry at the request of the Metrication Board. In medium estates, a 10% sample consisting of 51 estates was selected and the survey forms sent by the Metrication Board were posted to them with a request to send the completed forms direct to the Metrication Board. In small estates, a 10% sample of estates from 25 acres to 100 acres was selected for our officers to visit. The forms completed were sent to the Metrication Board.

Replanting survey : On a request by the UNDP Adviser on Rubber, our officers took part in the above survey. As the present price of rubber is very low I am of the opinion that this is psycologically the wrong time to press for replanting.

Surveys for central factories for crepe production : Surveys to assess the possibilities of putting up central factories for pale crepe production in small and medium estates were started during the year. A total of 567 estates have been visited to obtain details and for discussions. A total of 27 areas were surveyed and the position in brief is as follows :—

TABLE 4

SURVEYS FOR CENTRAL FACTORIES

Areas surveyed	No. of surveys
Tentative sites selected	7
Sites still to be approved	4
Sites unsuitable	6
Surveys still under way	10
Total	27

In addition, a site for the Baduraliya Multi-Purpose Co-operative Society Project was inspected and approved while another site for a scrap crepe factory on the outskirts of Matugama was also inspected and approved.

Other visits

The officers of this Department also attended discussions, seminars, meetings, other institutions in connection with the work of this Department and the Institute, annual verification of stores etc. A break-up of such visits would be as follows :—

TABLE 5

OTHER VISITS

Purpose of visit	No.
Seminars, discussions etc.	31
Committee meetings	10
Discussions at other institutions	16
Inquiries, staff meetings interviews and other staff matters	13
Annual verification of stores	18
Visits and discussions with foreign visiting scientists	7
Total	95

Sinhala Bulletin

Arrangements were made to print the Sinhala Bulletin. Articles of general interest to smallholders and small estates were published. Reprints of articles of technical value will be distributed to small and medium estates when the necessity arises.

Transport

On account of the high cost of repairs to vehicles and the absence of the necessary spare parts, using of private vehicles for Institute work has become increasingly difficult. A request for a few vehicles for the Department will be made to carry on the work of the Department.

Economic research

As the two Assistant Agricultural Economists are both under training and are on overseas study leave, the work of this Unit has virtually come to a halt. However, the following were under study during the year.

(1) A study of the factors affecting the cost of production of rubber in the estate sector ;

(2) A factory work study in collaboration with the Rubber Chemist ;

(3) A study to evaluate the economic life span of a rubber plantation ;

(4) An evaluation of the economic consequences of upgrading RSS in small and medium estates by the UNDP expert in collaboration with our unit ;

(5) In addition " feasibility studies " for the production of pale crepe in certain areas were carried out ;

(6) Other topics such as causes for the declining rate of replanting under the Rubber Replanting Subsidy Scheme and the advantages of fixing a " floor price " for rubber too were studied ;

(7) A critical path analysis study of the construction of a pale crepe factory was carried out and a tentative time table for the construction of five pale crepe factories for 1972 has been suggested.

Graduate trainees

(1) One of the graduate trainees attached to this Department helped Dr. Barlow of the Australian National University, Canberra, in carrying out a survey of smallholdings, in the Matugama and Agalawatta ranges. This survey is being continued by him.

(2) Four chapters from the *Handbook of Rubber Culture and Processing* have been translated into Sinhala. These are being published first in the Sinhala Bulletin.

(3) Graphs of the yearly consumption of rubber in Ceylon, rainfall maps of the rubber growing areas and other plans and charts of studies made have been drawn by them.

Acknowledgement

Lastly our thanks are due to all owners, Superintendents and Conductors of estates for the willing co-operation extended to us.

REVIEW OF THE SMALLHOLDINGS DEPARTMENT

By

H. H. Peiris

SUMMARY

The year under review was an adverse one for the smallholder as the number of tapping days have been reduced due to unfavourable weather and the low rubber prices. The field officers devoted a good part of their time in trying to organise co-operative group processing centres and in improving the quality of smallholders' sheet rubber to grade 1 RSS.

All required assistance and advice were given to new rubber planting smallholders. All new rubber planting applications received by the Rubber Controller and referred to this Department for preliminary reports were attended to. All new rubber planting areas have been visited for free lining for soil conservation works and planting holes and to advise owners in planting their lands according to rubber control regulations.

A considerable time of the field staff was also devoted for subsidy replanting work. All subsidy replanting areas were visited for free lining and advice.

The two publicity units of the Department operated in the field during the year under review. The two films of this Department on rubber were screened along with other films of agricultural interest, borrowed from various embassies.

The large scale sulphur dusting was curtailed and dusting was confined to holdings that were situated at elevations above 300 ft over mean sea level ; 14 sulphur dusting groups comprising of 1,416 acres were successfully dusted during the year under review.

DETAILED REVIEW

General

The year under review was generally an adverse one for the smallholder. Their number of tapping days has been reduced as a result of insurgent activities and the unfavourable weather that prevailed during this year. Another factor that affected the smallholder adversely was the low rubber prices.

The field officers devoted a great deal of time in trying to organise co-operative group processing centres, and improving the quality of smallholders' sheet rubber to grade 1 RSS.

Staff

Mr. H. H. Peiris, the Chief Advisory Officer Smallholdings, was on duty throughout the year. Mr. R. P. M. de Zoysa, the Deputy Chief Advisory Officer Smallholdings was on duty throughout the 1st, 2nd and 3rd quarters. He left for Malaysia during the 4th quarter on a scholarship and is expected in Ceylon in early 1972.

Mr. W. S. Dassanayake, Rubber Instructor, Polgahawela, and Mr. D. R. Wijesuriya, Rubber Instructor, Homagama were appointed as temporary Acting Divisional Advisory Officers (Kegalla) and (Homagama) respectively.

Mr. R. K. Gunatilake, former Rubber Instructor, Rambukkana, was reverted to this Department from the Mawanella Rubber Processing Unit, and was appointed Rubber Instructor in charge of Rambukkana Range with effect from 1.10.71.

Thirteen graduates were sent to this Department during the year. They were posted to various sections of this Department and the Estates Advisory Department on completion of their training period.

Mr. R. L. A. Gunasena, Office Labourer, reported for duty at this office on 1.11.71. He was transferred to Head Office on 23.11.71. Mr. K. V. Wijesena, Office Labourer, was sent to this office on 2.12.71 in place of Mr. Gunasena.

Forty eight Rubber Instructors were interviewed for promotion to the higher grade of their salary scale and 36 of them were promoted to this scale.

One hundred and eight candidates were interviewed by the Selection Committee for posts of Rubber Instructors. Appointments will be made in early January 1972.

Mr. A. L. Gunawardena, Cashier cum Stores Clerk was transferred back to Head Office with effect from 2.1.71.

The following transfers of Rubber Instructors were agreed on by mutual consent between the parties concerned and subsequently approved, during the year :—

1. Mr. M. C. Samarasekera from Veliveriya to Kesbewa Range
2. Mr. G. Senerath from Kesbewa to Veliveriya Range
3. Mr. R. Gunadasa from Pindeniya to Nelundeniya Range
4. Mr. W. D. Jayawardena from Nelundeniya to Pindeniya Range

It is with deep regret that I have to record the untimely death of Mr. P. S. G. Cooray, Divisional Advisory Officer (Homagama) on 3.1.71. Mr. Cooray came over from the Department of Agriculture when the New Rubber Planting Scheme was taken over by the Institute in October 1948. He served as a Rubber Instructor till October 1950, and was promoted as District Field Officer. He served Horana, Ratnapura, Galle and Homagama Divisions as a Divisional Advisory Officer, and his 22 years of sincere service is greatly appreciated.

Loans : The following vehicle loans were granted during the year :—

1. The Deputy Chief Advisory Officer — Rs. 18,000/- to purchase a car,
2. The Divisional Advisory Officer, Ratnapura — Rs. 12,500/- to purchase a car,
3. The Rubber Instructor, Talangama — Rs. 5,790/- to purchase a motor cycle,
4. The Rubber Instructor, Kamburupitiya — Rs. 3,500/- to purchase a motor cycle,
5. A watcher — Rs. 400/- to purchase a push cycle.

Correspondence

General :

Inward	—	6,776
Outward	—	9,063

With Rubber Controller :

Inward	—	2,027	(applications for new planting, unregistered rubber lands and new planting permits)
Outward	—	2,130	(preliminary reports, final inspection reports and special reports etc.)

From Rubber Instructors to permit holders — 2,129.

Visits

New planting : All required assistance and advice were given to new planting permit holders. All new rubber planting applications that were received by the Rubber Controller have been referred to this Department for a report as to the suitability of such lands for new planting before a permit is issued by him. These applications were in turn referred to the respective Rubber Instructors for a preliminary report after a visit to such lands, and 317 preliminary reports have been submitted to the Rubber Controller during the period. Further 194 final inspection reports and 1,619 special reports on new rubber planted lands too have been furnished to the Rubber Controller at his request. A total of 224 new planting permits covering an extent of 229 acres have been issued by the Rubber Controller during the period to new planting smallholders.

Free lining is done by the Rubber Instructors for soil conservation measures and planting holes at the request of the owners. Accordingly they have lined a total of 36 new planting permit areas for 1971, covering an extent of 60 acres for soil conservation measures and 45 permit areas, covering an extent of 78 acres, for planting holes. They have also lined a further total of 28 permit areas of the previous year's permits covering an extent of 43 acres for soil conservation measures and 26 permit areas covering an extent of 33 acres for planting holes.

One hundred and nine first visits and 760 subsequent visits were made by Instructors to new planting and new planted areas of 1970 and 1971. Further, a total of 4,184 subsequent visits too were made by them to permit areas for which permits have been issued prior to 1970.

Rubber Instructors have marked a total of 1,799 tappable trees in 29 new rubber planted smallholdings as demonstrations and marking for tapping.

Soil conservation : A sum of Rs. 1,742/95 has been paid to 41 peasant-class permit holders for conserving soil in their lands.

Fifteen peasant-class permit areas, covering an extent of 22 acres, have been measured and six of them, covering an extent of 6 acres, have been checked in the field by Divisional Advisory Officers during the period, for payment.

Replanting : A considerable amount of the time of the field staff was also devoted to subsidy replanting work. A total of 2,567 Rubber Replanting Subsidy Scheme permits covering an extent of 3,616 acres have been issued by the Rubber Controller

in respect of smallholdings during the year. Copies of these permits were received by this Department from time to time from the Rubber Controller and were in turn forwarded to the respective Rubber Instructors to visit these lands and give necessary advice and assistance to the owners. Every one of these permit areas has been visited by an Instructor. In all 5,347 visits to subsidy replanting permit areas of this year and 27,645 visits to subsidy replanted permit areas of the previous years have been made by Rubber Instructors during the period. Rubber Instructors have lined a total of 918 subsidy replanting permit areas of this year covering an extent of 1,316 acres for soil conservation works, and 1,151 subsidy replanting permit areas covering an extent of 1,631 acres for planting holes. Further, 347 subsidy replanting permit areas covering an extent of 543 acres and 358 subsidy replanting permit areas covering an extent of 578 acres of previous years' permits were lined by Instructors for soil conservation works and planting holes, respectively, during the period under review.

A total of 5,111 tappable trees, in 120 subsidy replanted holdings, have been marked by Instructors for demonstration purposes. Random checks on planting material, issued to subsidy replanting smallholders by the Rubber Controller, at various Commodity Purchase Depots, were carried out by Rubber Instructors on their visits to these depots. A total of 7,299 plants were checked at 98 random inspections by Instructors during the two planting seasons May/June and October/November this year.

Mature holdings : Visits to mature areas are being now done on requests from owners or for special reasons such as sulphur dusting work etc.

Special inspections for Rubber Control Department

Visits for preliminary reports	—	317
Visits for final inspection reports	—	194
Visits for special reports (new planting)	—	1,619
Visits for special reports (replanting)	—	365

Meetings and conferences

Village propaganda : The two Publicity Units of the Department operated in the field during the 1st, 3rd and 4th quarters. The Publicity Unit No. 2 could not be sent to the field during the 4th quarter as its generator went out of order. The agents of this generator could not repair it as no spare parts were available with them and these spares have to be imported.

The Publicity Units could not be sent to the field during the 2nd quarter due to the unrest in the country as a result of the insurgent activities that prevailed during this quarter. In view of the above facts the number of publicity meetings cum film shows conducted was greatly reduced this year. A total of 98 publicity meetings cum film shows were held during the year by the two Publicity Units of the Department. The two films on rubber owned by the Department were screened along with other films of agricultural interest, borrowed from various embassies.

The 16 mm documentary colour film is now ready for despatch from London and it is expected to be screened next year.

The following meetings and conferences were attended by the Chief Advisory Officer Smallholdings and the field staff :

1. The Chief Advisory Officer Smallholdings attended a meeting at Head Office on 30.1.71 and on 4th January and 8th April he attended two meetings at the Ministry of Plantation Industries.

2. The Chief Advisory Officer Smallholdings had a conference on 23.3.71 at this office with the Chief Administrative Officer, Divisional Advisory Officer, Galle, Mr. S. Hensen, UN Rubber Adviser and Mr. M. T. Veerabangsa. He also received a deputation at this office including the President and two members of the R.R.I.C. Employees' Union on 11.3.71.

3. The Divisional Advisory Officer, Panadura, gave a lecture on rubber to the graduate trainees at the D.R.O. Office, Kalutara on 13.4.71.

4. The Divisional Advisory Officer, Avissawella, attended the D. R. O. Office, Yatiyantota on 27.7.71 to discuss matters concerning the rubber industry.

5. All Divisional Advisory Officers attended a staff conference at this office on 2.6.71.

6. The Rubber Instructor, Yatiyantota, attended a conference at Yatiyantota D.R.O. Office on 18.1.71 in connection with the Divisional Development Council and on 24.7.71 he addressed the members of Napitiya and Polpitiya Societies in connection with development of selected villages.

7. The Rubber Instructor, Kamburupitiya, attended a shramadana programme at Deniyaya electorate in January.

8. The Rubber Instructor, Imaduwa, attended the Regional Development Council meeting in July.

Publications

Vol. 1 and Vol. 2 (No. 1) of the " Rubber News " Sinhala Bulletin (a bi-annual publication) for free issue to rubber smallholders were published during the year.

No arrangement could be made to reprint the smallholdings leaflets that were out of stock.

Experiments

Sulphur dusting : This year the large scale dusting was curtailed and dusting was confined to holdings that were situated at elevations above 300 ft over mean sea level. A total of 21 dusting groups, comprising 1951 acres, were formed and 14 groups, comprising of 1,416 acres, were successfully dusted during this year. Out of the seven that did not operate, three were cancelled due to non-payment of dues, three groups could not be dusted as sulphur was not transported from Colombo by them in time and the sulphur for the balance group was not available in time for dusting this group. All the 14 groups that were dusted this year were in the Kegalla District.

Wintering occurred rather late in the season, and defoliation was observed to be fairly even. Dusting operations were started on 26.1.71 in Uduwa and Malwana dusting groups in Undugoda Range. Malwana and Higgoda dusting groups in Undugoda Range were the first to complete dusting, having completed the final round on 18.2.71. All dusting operations for the season were finally concluded on 27.3.71, when the Gampaha sulphur dusting group was given the final round of dusting. A number of groups had to start dusting as early as 1.00 a.m. in order to complete the day's dusting programme by 8.00 a.m.

It is proposed to dust 16 groups, covering an extent of 1,600 acres, during the 1972 dusting season.

Improvement of smallholders' sheet : Every possible effort has been made and the necessary advice and assistance given to smallholders by the field staff to improve their sheet to Grade 1 RSS. The attention of the Department was focussed on organising co-operative rubber processing centres.

Hataraliyadde, Kahagalle, Milleniya and Yatalamatta rubber co-operative societies have gone into production. Loans were given by the Institute to the following societies to build their smoke houses :—

Hataraliyadde, Govinna, Nugadanda-Ihalagama and Dangampola.

The smoke houses of Nugadanda-Ihalagama and Govinna societies were built as experimental models and their cost of building was met by the Institute.

Galatura, Palugama and Etnawala societies have been registered and are awaiting the assistance of the Institute to start work.

Preliminary surveys have been completed for organising co-operative processing centres in the following places :—

Maliduwa, Bamunugama, Kandana, Pussella, Teppanawa, Kehelowitigama, Pinnawala, Homagama, Kanangama, Mitirigala, Gantuna, Welangalla, Hinguralakanda, Ittapana and Haburugala.

A total of 1,293 visits to rubber co-operative societies and 677 visits to Commodity Purchase Depots were made by the field staff to advise smallholders on defects in their sheet. Altogether 1,292 sheet making demonstrations were given by the Rubber Instructors to smallholders as an inducement to produce better quality sheets.

Forty five ordinary smoke houses were started and 25 of them were completed by smallholders through the inducement of the Instructors during the year. Four demonstration smoke houses started last year were completed during the year. Payments amounting to Rs. 13,750/- were made to 45 demonstration smoke houses built under the " 1970 crash programme ". Instructors have paid 1,350 visits to demonstration smoke houses and 5,895 visists to ordinary smoke houses to advise smallholders on sheet making or improvement, and on construction and improvement of smoke houses.

A total of 108 strainers and 138 aluminium pans were sold to smallholders at subsidised rates to encourage them to produce better quality sheets.

Tapping training classes : No tapping training classes were conducted during the year.

Exhibitions : The Department did not take part in any exhibitions during the period under review.

Demonstrations : The following demonstrations were given by the field staff during the year :—

Sheet making	..	1,292
Tapping	..	508
Disease control	..	384
Miscellaneous	..	783

General assistance : Rubber Instructors gave necessary advice and assistance to smallholders on planting and maintaining their lands in keeping with the rubber control regulations.

Forty one reports on suggested locations for opening up of new Commodity Purchase Depots were submitted to the Department of Commodity Purchase for their attention.

Visitors : Mr. Austin Perera of the Ministry of Plantation Industries, visited the Kahagalla Rubber Co-operative Society with the Deputy Chief Advisory Officer Smallholdings and the Rubber Instructor, Polgahawela, in January.

Dr. Colin Barlow visited the Smallholdings Department and a few smallholdings in Matugama Division.

Mr. J. Greenwood, a member of the World Bank team which visited Ceylon in 1971, was taken round by the Deputy Chief Advisory Officer Smallholdings in October.

REVIEW OF THE ESTATE DEPARTMENT

By

S. de S. Daluwatta

SUMMARY

The extent of the Institute's group of estates, generally known as Dartonfield Group, comprising of Dartonfield Division at Agalawatta, Nivitigalakele Division at Matugama and Hedigalla Division at Lathpandura, is 1,548 acres 0 rood 30 perches. The planted acreage is 988¾ acres, of which, 788½ acres were tapped during the year. The extent of immature areas and nurseries is 167½ acres and 32¾ acres, respectively.

The weather conditions that prevailed during the year under review, were unfavourable for tapping and harvesting of crop. Heavy rainfall, recorded from May to October, interrupted normal tapping. The South-West and North-East monsoons merged, resulting in unusual wet weather, and causing a heavy short-fall in crop. Although the Government declared the plantation industry as an essential service, during the unrest in April, the introduction of the curfew curtailed the working hours in the estate. As a result, the output of work was greatly reduced, especially during April and May, and this had adverse effects on harvest.

The crop harvested, 485,930 lb, represented an average yield of 612 lb per acre and fell short of the estimate by 20·99%.

The 'wintering' was uneven this year and the attack of *Oidium heveae* was very heavy. Early symptoms of the disease were visible from the last week in February. Sulphur dusting operations, though carried out at regular intervals, were not effective, due to evening showers that prevailed. 'Spot' dusting had to be continued on late winterers even up to the end of April, owing to the heavy incidence of the disease.

Phytophthora leaf fall in mature areas and the incidence of *Gloeosporium* in young clearings were negligible this year. Although a few scattered Bark Rot trees in clone RRIC 36 were treated at Hedigalla during February, the occurrence of Bark Rot was greatly reduced, in spite of the heavy rains experienced. Applications of fungicides were reduced, especially in commercial areas.

Budwood of RRIC clones continued to be in demand and issues were made to estates and smallholdings on request.

Routine weeding, manuring, disease control and other agricultural operations were carried out in both mature and immature areas of the Group.

Estimates for 1972, both capital and revenue, in connection with the working of the Group, were prepared and submitted to the Rubber Research Board for approval.

Staff

The Estate Superintendent, Mr. S. de S. Daluwatta, and the Assistant Estate Superintendent at Hedigalla Sub-station, Mr. M. R. T. Mendis, were on duty throughout the year.

The Office Assistant, Mr. T. S. J. Peiris and the K. P. attached to Hedigalla Division, Mr. K. D. Simon, retired on 8.4.71 and 5.7.71, respectively, after long periods of service in the Institute.

Mr. G. D. A. Weerasooriya, K.P. at Nivitigalakele Division, was promoted as Assistant Field Officer with effect from 1.1.71, but reverted to his former post on 14.2.71 at his request, as he had reported that the work entrusted to him was too onerous. This post was suppressed later as a new proposal was made to appoint two Assistant K.Ps.

Mr. N. L. D. Piyadasa, Factory Attendant, was transferred to Nivitigalakele Sub-station on 1.1.71 in the same capacity and Mr. G. S. Doolwela, Junior Clerk stationed at Hedigalla, was transferred to Dartonfield on 1.4.71.

The Senior Accounts Clerk, Mr. A. C. Swaris and the Accounts Clerk, Mr. B. H. Rodrigo, were upgraded as Office Assistant and Chief Clerk with effect from 8.4.71 and 1.5.71 respectively. The post of Accounts Clerk remained vacant.

The following new appointments were made on 16.11.71 :—

Messrs. K. Peter Silva and M. Silton Perera as Assistant K.Ps. at Hedigalla. The salary scales attached to these posts are based on the Collective Agreement between C.E.E.F./C.E.S.U.

After obtaining approval from the Rubber Research Board, the salary scale of the two K.Ps., *viz.* Messrs S. K. S. de Silva and S. Abeywarna, was increased on 1.8.71 from Rs. 50 — 5 of 5 — 75 p.m. to Rs. 75 — 6 of 5 — 105 p.m.

The Assistant Nursery Manager, Mr. L. Samaranayake, was under interdiction until the end of the year, pending the verdict of a court case.

Designations of " Estate Apothecary " and " Estate Dispenser " were changed to read as " Estate Medical Assistant " with effect from 20.9.71, by a Board ruling.

The Estate Department cadre stood at 27 at the end of the year, made up as follows :—

Senior staff	..	1
Intermediate staff	..	1
Assistant staff	..	15
Minor staff	..	10
Total	..	27

Correspondence

Inward	..	695
Outward	..	1,537

Acreage summary

	Dartonfield				Nivitigalakele				Hedigalla				Total			
	A.	R.	P.	Hectares	A.	R.	P.	Hectares	A.	R.	P.	Hectares	A.	R.	P.	Hectares
Mature ..	101	1	07	40·99	76	0	00	30·76	611	0	13	247·30	788	1	20	319·05
Immature ..	11	2	12	4·68	59	3	23	24·24	96	1	04	38·96	167	2	39	67·88
Nurseries ..	3	2	00	1·42	9	1	07	3·76	20	0	00	8·09	32	3	07	13·27
Total ..	116	1	19	47·09	145	0	30	58·76	727	1	17	294·35	988	3	26	400·20
Abandoned ..	14	2	00	5·87	10	0	36	4·14	59	2	30	24·15	84	1	26	34·16
Building sites etc. ..	40	2	36	16·48	15	1	33	6·25	8	1	18	3·39	64	2	07	26·12
Pinewood plantation ..	—	—	—	—	—	—	—	—	1	0	34	·49	1	0	34	·49
Roads ..	6	2	22	2·69	0	3	27	·37	9	0	04	3·65	16	2	13	6·71
Swamp areas ..	—	—	—	—	0	2	08	·23	0	2	20	·25	1	0	28	·48
Streams and reservations	0	0	29	·07	—	—	—	—	13	0	29	5·34	13	1	18	5·41
Jungles etc. ..	—	—	—	—	1	3	38	·80	376	0	00	152·17	377	3	38	152·97
	178	1	26	72·20	174	1	12	70·55	1195	1	32	483·79	1548	0	30	626·54

Visiting Agent

The Visiting Agent, Mr. M. W. Thompson, paid two visits to Dartonfield Group on 26th and 27th April 1971 and also on 29th and 30th September 1971.

Weather (estate gauge)

Comparative rainfall figures (in inches) for 1971 and 1970 are given below :—

Month	Dartonfield				Nivitigalakele				Hedigalla			
	1971		1970		1971		1970		1971		1970	
January ..	**53·14**	5·17	**89·43**	8·70	**48·00**	4·67	**92·20**	8·97	**118·21**	11·50	**147·30**	14·33
February ..	**54·48**	5·30	**87·58**	8·52	**43·07**	4·19	**79·56**	7·74	**78·33**	7·62	**80·38**	7·82
March ..	**124·38**	12·10	**123·25**	11·99	**107·62**	10·47	**91·69**	8·92	**216·27**	21·04	**87·99**	8·56
April ..	**196·12**	19·08	**161·07**	15·67	**148·63**	14·46	**155·21**	15·10	**157·89**	15·36	**215·35**	20·95
May ..	**183·17**	17·82	**232·72**	22·64	**142·88**	13·90	**258·62**	25·16	**193·66**	18·84	**118·11**	11·49
June ..	**155·52**	15·13	**138·56**	13·48	**142·47**	13·86	**121·70**	11·84	**161·89**	15·75	**211·54**	20·58
July ..	**113·07**	11·00	**166·83**	16·23	**110·60**	10·76	**166·93**	16·24	**137·74**	13·40	**197·05**	19·17
August ..	**220·07**	21·41	**79·05**	7·69	**186·56**	18·15	**70·31**	6·84	**182·35**	17·74	**122·94**	11·96
September ..	**238·58**	23·21	**106·49**	10·36	**219·87**	21·39	**85·93**	8·36	**223·67**	21·76	**149·15**	14·51
October ..	**264·99**	25·78	**200·65**	19·52	**266·12**	25·89	**190·06**	18·49	**325·54**	31·67	**258·52**	25·15
November ..	**138·36**	13·46	**194·07**	18·88	**82·03**	7·98	**265·71**	25·85	**142·88**	13·90	**197·25**	19·19
December ..	**77·81**	7·57	**66·81**	6·50	**81·51**	7·93	**47·28**	4·60	**119·03**	11·58	**143·80**	13·99
	1819·70	177·03	**1646·49**	160·18	**1579·37**	153·65	**1625·22**	158·11	**2057·45**	200·16	**1929·37**	187·70
Average (five-year period) ..			176·03r				159·25r				173·45r	
			1809·42				**1639·93**				**1782·90**	
Total No. of wet days ..		228		227		232		225		235		255

Heavy type denotes metric equivalents in mm.

The rainfall for the year at Dartonfield, Nivitigalakele and Hedigalla Divisions amounted to 177·03 in., 153·65 in. and 200·16 in. on 228, 232 and 235 days respectively. The second, third and fourth quarters of the year received heavier rainfalls. The wettest month was October in all the three divisions. The rainfall recorded at Hedigalla in October was the highest and was 31·67 in.

Crop

The weather conditions were not conducive for tapping and collection of crop. The main factors that contributed to the deficit in crop this year are as follows :—

(a) heavy and uneven distribution of rainfall from May to October including a few cropping months,

(b) poor foliage due to heavy incidence of *Oidium heveae*,

(c) labour unrest at Hedigalla Division due to union activities,

(d) curtailment of working hours, owing to insurgent activities and declaration of curfew by the Government,

(e) poor out-turn of tappers at Hedigalla, specially during paddy cultivation periods and on late tapping days.

	1971		1970	
Estimated	615,000 lb	**278,957·85**	625,000 lb	**283,493·75**
Harvested	485,930 lb	**220,412·99**	559,905 lb	**253,967·31**
Deficit	129,070 lb	**58,544·86**	65,095 lb	**29,526·44**

Heavy type denotes metric equivalents in kg.

The crop harvested for the year 1971 was 79·01% of the season's estimate.

Comparative yield records of individual fields

	Acreage in tapping Hectares	Acres	Total yield in lb 1971		1970		Yield in lb per acre 1971		1970	
Dartonfield										
1950/51 replanted area ..	9·21	22¾	**4,055**	8,940	**4,830**	10,649	**404·5**	393·0	**482·3**	430·3
1952 ,, ,, ..	10·93	27	**7,078**	15,603	**8,021**	17,683	**647·7**	577·9	**734·0**	654·9
1953 ,, ,, ..	3·24	8	**2,141**	4,721	**2,261**	4,996	**661·4**	590·1	**700·0**	624·5
1954 ,, ,, ..	1·01	2½	**753**	1,659	**975**	2,149	**743·2**	663·1	**963·5**	859·6
1955 ,, ,, ..	2·02	5	**1,339**	2,925	**1,636**	3,606	**655·7**	585·0	**808·4**	721·2
1955/56 ,, ,, ..	1·92	4¾	**1,171**	2,581	**1,191**	2,625	**609·1**	543·4	**619·5**	552·7
1960/61 ,, ,, ..	12·75	31½	**7,846**	17,298	**9,106**	20,075	**615·5**	549·1	**714·3**	637·3
1965 ,, ,, ..	1·21	3	**168**	370	—	—	**138·2**	123·3	—	—
	42·29	104½	**24,538**	54,097	**28,025**	61,783	**580·3**	517·7	**669·0**	596·9
Nivitigalakele										
1944 clearing ..	—	—	—	—	**720**	1,587	—	—	**395·3**	352·7
1946 ,, ..	4·05	10	**6,243**	13,763	**9,140**	20,151	**1542·6**	1,376·3	**1077·6**	959·6
1953 ,, ..	4·05	10	**3,303**	7,282	**3,843**	8,472	**816·2**	728·2	**949·6**	847·2
1954 ,, ..	4·05	10	**3,141**	6,924	**3,625**	7,992	**776·1**	692·4	**895·8**	799·2
1962 replanted area ..	6·78	16¾	**7,820**	17,239	**5,900**	13,006	**1153·6**	1,029·2	**870·3**	776·5
1963 ,, ,, ..	4·05	10	**3,717**	8,194	**1,106**	2,438	**918·4**	819·4	**683·2**	609·5
1964 ,, ,, ..	3·24	8	**2,424**	5,345	**1,534**	3,382	**749·0**	668·2	**473·9**	422·8
1966 ,, ,, ..	0·81	2	**455**	1,022	—	—	**572·8**	511·0	—	—
	27·03	66¾	**27,111**	59,769	**25,868**	57,028	**1003·6**	895·4	**860·9**	768·1
Hedigalla										
1947 clearing ..	8·09	20	**621**	1,368	**5,391**	13,076	**76·7**	68·4	**418·7**	373·6
1949 ,, ..	14·06	34¾	**122,79**	27,069	**10,101**	22,268	**873·1**	779·0	**718·2**	640·8
1950/51 ,, ..	7·28	18	**4,708**	10,379	**4,262**	9,395	**646·3**	576·6	**585·0**	521·9
1952 ,, ..	32·17	79½	**24,809**	54,694	**29,634**	65,331	**771·1**	688·0	**921·1**	821·8
1953 ,, ..	53·62	132½	**32,170**	70,921	**41,030**	90,455	**600·0**	535·3	**765·2**	682·7
1954 ,, ..	69·20	171	**43,747**	96,444	**54,221**	119,535	**632·2**	564·0	**783·5**	699·0
1955 ,, ..	31·57	78	**26,580**	58,597	**29,996**	66,128	**842·0**	751·2	**950·3**	847·8
1956 ,, ..	24·28	60	**17,884**	39,426	**20,123**	44,362	**736·5**	657·1	**828·8**	739·4
1957 ,, ..	6·98	17¼	**5,545**	12,225	**4,783**	10,544	**794·3**	708·7	**685·2**	611·3
1965 replanted area ..	4·65	11½	**427**	941	—	—	**91·7**	81·8	—	—
	251·93	622¼	**168,768**	372,064	**20,080**	441,094	**794·2**	708·6	**789·8**	704·6
Total for the Group ..	321·23	793¾	**220,418**	485,930	**253,973**	559,905	**686·2**	612·2	**780·8**	696·6
Other sources ..			**58,077**	128,036	**296**	652				
Total ..			**278,495**	613,966	**254,269**	560,557				

Heavy type denotes metric equivalents in kg.

Tapping

Tapping was continued throughout the 'wintering' period.

All tapping panels in experimental areas were treated with Antimucin, while commercial areas were treated occasionally. Tapping cuts were also marked with appropriate guide lines for bark consumption in keeping with the systems of tapping adopted in various experimental areas.

The following new fields, apart from those estimated, were brought under tapping during the year :—

Dartonfield : 3 acres in 1965 replanted area,

Nivitigalakele : 6 acres in 1963 replanted area and 2 acres in 1966 replanted area,

Hedigalla : 11½ acres in 1965 replanted area.

Grooming of trees was done in a few experimental areas at Nivitigalakele and Hedigalla Divisions.

Analysis of tapping rounds on Dartonfield Group for 1971 (1970 figures in brackets)

Dartonfield	Early tapping	Late tapping	Winter rest	No tapping: Rain	No tapping: Holidays
1st quarter	63 (54)	25 (22)	— (8)	1 (5)	1 (1)
2nd ,,	37 (41)	15 (16)	— (—)	33 (27)	6 (7)
3rd ,,	52 (52)	6 (11)	— (—)	34 (28)	— (1)
4th ,,	60 (56)	18 (16)	— (—)	13 (19)	1 (1)
	212 (203)	64 (65)	— (8)	81 (79)	8 (10)

Nivitigalakele	Early tapping	Late tapping	Winter rest	No tapping: Rain	No tapping: Holidays
1st quarter	65 (59)	23 (16)	— (8)	2 (6)	— (1)
2nd ,,	28 (41)	23 (16)	— (—)	34 (27)	6 (7)
3rd ,,	42 (45)	17 (19)	— (—)	33 (27)	— (1)
4th ,,	52 (53)	26 (15)	— (—)	14 (24)	— (—)
	187 (198)	89 (66)	— (8)	83 (84)	6 (9)

Hedigalla	Early tapping	Late tapping	Winter rest	No tapping: Rain	No tapping: Holidays
1st quarter	63 (64)	16 (14)	— (6)	11 (6)	— (—)
2nd ,,	34 (40)	8 (9)	— (—)	44 (35)	5 (7)
3rd ,,	52 (43)	5 (17)	— (—)	35 (30)	— (2)
4th ,,	47 (57)	27 (17)	— (—)	18 (18)	— (—)
	196 (204)	56 (57)	— (6)	108 (89)	5 (9)

Manufacture

A summary of the various forms of manufacture during the year is given below :

Latex grades		Total lb		Percentage
Pale crepe No. 1	..	341,577	**154,939**	70·29
Pale crepe No. 2	..	10,583	**4,800**	2·18
Pale crepe No. 3	..	73,634	**33,400**	15·15
Sole crepe No. 1	..	840	**381**	0·17
Latex for experiments	..	2,643	**1,199**	0·55
		429,277	**194,720**	88·34
Scrap grades				
Scrap crepe No. 1	..	19,990	**9,067**	4·11
Scrap crepe No. 2	..	18,986	**8,612**	3·91
Scrap crepe No. 3	..	17,657	**8,009**	3·63
Scrap for experiments	..	20	**9**	0·01
		56,653	**25,698**	11·66
Total	..	485,930	**220,418**	100·00
Outside sources	..	128,036	**58,077**	
		613,966	**278,495**	

Heavy type denotes metric equivalents in kg.

Smallholders' latex, collected by Palinda Nuwara Multi-Purpose Co-operative Union Ltd., was accepted for pale crepe manufacture, at an average intake of 1,500 lb per day.

Difficulties' were encountered in the manufacture of No. 1 crepe, due to the multiplicity of clones under test, planted in close proximity to one another, with different types of latices. Frequent breakdowns in factory machinery also aggravated the position.

An attempt was made to produce sole crepe, but was discontinued due to the following reasons :—

(a) unsuitability of coagulum transported from Hedigalla for manufacture of sole crepe laces,

(b) non-availability of properly co-ordinated milling machinery,

(c) reduction of drying space, as coagulum from outside sources was accepted for processing.

Factory Machinery

Mill No. 2—26" × 14" (Brown's grooved and shallow spiral mill) : One control bush was replaced. Later, the mill was sent for re-grooving and for making necessary alterations for A.C. conversion. The work had not been completed at the end of the year.

Mill No. 8—26" × 14" (Brown's smooth mill) : This mill was fitted with a new water cooling gland and a new polly-V drive equipment.

Mill No. 9—26" × 14" (Brown's grooved mill) : Necessary repairs to the starter were effected.

Field and technological experiments

The Rubber Chemistry, Botany, Genetics & Plant Breeding, Plant Pathology and Soils Chemistry Departments were given required labour and necessary assistance for carrying out their field and technological experiments.

'Motex' latex stimulant was tested at Hedigalla by applying on 577 trees of clone LCB series.

Estimates

Estimates for 1972, both capital and revenue, in respect of Dartonfield Group, were prepared and submitted to the Rubber Research Board for approval.

Roads

All motorable roads within the estate, including main approach roads to outlying divisions, were maintained in good order, effecting surface repairs where necessary.

A culvert on the main approach road at Hedigalla Division collapsed in October. As heavy vehicles, belonging to the Timber Corporation, the Forest Department, the Ceylon Transport Board and some timber contractors constantly ply on this road, the Timber Corporation constructed a new wooden bridge without any financial commitments to the estate.

Pests and diseases

Oidium heveae

A very heavy incidence of *Oidium* leaf disease was recorded throughout the whole Group. Early symptoms of the disease appeared in the third week of February. Regular dusting operations were carried out, but the evening showers experienced during the period, rendered dusting entirely ineffective. The uneven wintering necessitated the continuation of 'spot' dusting even up to the end of April.

The most affected areas were the following :—

Dartonfield

1950/51 replanting — five-point budding area ; 1952 replanting — clones Nab 12 and RRIM 501 ; 1955/56 replanting — clones AVROS 385, 427, WR 101 and GT 1 ; 1960/61 replanting — clones RRIC 7, 45, 88 and PB 28/59.

Nivitigalakele

1953 clearing — some patches of clones IRCI 7, 10, RRIM 501 and PB series ; 1964 replanting — some patches of RRIC clones (RRIC 86 very severely affected) ; 1962, 1963 and 1965 replanting — isolated blocks of clones RRIC and RRIM series IAN 45 - 717 and PB 86.

Hedigalla

New foliage in 1951, 1952, 1953, 1954, 1955 and 1956 clearings.

Gloeosporium alborubrum

The incidence was negligible.

Phytophthora spp.

No noticeable attack was experienced.

Bark-Rot

Although a few scattered cases in clone RRIC 36 were treated in 1954 and 1955 clearings at Hedigalla, the occurrence of Bark Rot was greatly reduced.

Root diseases

Some cases of *Fomes lignosus* and *Ustulina zonata* were detected in mature areas and remedial measures adopted.

Storm damage

The number of trees uprooted due to wind damage at Dartonfield, Nivitigalakele and Hedigalla Divisions totalled 58, 61 and 540 trees, respectively.

Capital account — agricultural development

Dartonfield Division — immature areas

1965	replanted area	..	11½	.. 11½ acres

Nivitigalakele Division — immature areas

1963	replanted area	..	10
1965	,, ,,	..	3¾
1966	,, ,,	..	5¾
1967	,, ,,	..	8¾
1969	,, ,,	..	21½
1970	,, ,,	..	17½
1971	,, ,,	..	11½ .. 59¾ acres

Hedigalla Division — immature areas

1965	replanted area		11½
1967	,, ,,	..	10
1968	,, ,,	..	9¼
1969	,, ,,	..	22¼
1970	,, ,,	..	26¼
1971	,, ,,	..	17 .. 96¼ acres

1963 replanted area (10 acres) at Nivitigalakele : The growth in this area, though uneven, is improving rapidly and is expected to reach the required girth for tapping in 1972. Some areas were brought under experimental tapping in 1971.

1965 replanted areas

11½ acres at Dartonfield, 3¾ acres at Nivitigalakele and 11½ acres at Hedigalla

Plants are coming up well. Approximately 3 acres at Dartonfield and some areas at Hedigalla were brought into tapping in 1971. It is hoped that at least 75% of trees in the balance areas would be ready for tapping in 1972.

1966 replanted area (5¾ acres) at Nivitigalakele

Growth is vigorous and tapping will commence in 1972. Two acres were taken into experimental tapping in 1971.

1967 replanted areas

(*a*) *8¾ acres at Nivitigalakele :* The plants in this area are growing satisfactorily and consist of clones Nos. 815, 1103, 1174 and RRIM 623.

(*b*) *10 acres at Hedigalla :* Plants of clones RRIC 41, 45, 86, 88, 89, 101, Nos. 451, 1004, 1010, 1108 and 1174 are planted in this area. Growth is quite satisfactory.

1968 replanted area (9¼ acres) at Hedigalla

Growth is vigorous and ground covers are satisfactory. Clones of RRIC 45, 101, Nos. 135, 451, 1004, 1152, 1174 and 1305 are planted in this area.

1969 replanted areas

(*a*) *2½ acres at Nivitigalakele :* This area includes plants of clones RRIC 5, 41, 52, 89, RRIM 623 and Tjir 1. Growth is good.

(*b*) *22¼ acres at Hedigalla :* Clones of RRIC 45, 100, 101, Nos. 451, 1103, 1173 and 1458 are planted in this area. Plants are coming up well.

1970 replanted areas

(*a*) *17½ acres at Nivitigalakele :* Two acres in this area are stump-budded with clone RRIC 45 while the balance acreage is planted with budded stumps of clones RRIC 13, 45, 100, 101, PR 252, IRCI 2, WR 101 and AVROS 1734. Growth is vigorous.

(*b*) *26¼ acres at Hedigalla :* Approximately 8 acres in this replanting are planted with stumped buddings of clone RRIC 45, while the balance area is planted with budded stumps of clones RRIC 100 and 101. Plants are growing well.

1971 replanted area

(*a*) *11½ acres at Nivitigalakele :* Budded stumps of clone RRIC 50 totalling 712 were planted in the 4½-acre block, while the 7-acre block was planted according to the requirements of Botany Department with 1112 budded stumps of experimental clones. Growth is satisfactory.

(*b*) *17 acres at Hedigalla :* A total of 2,948 budded stumps of clones RRIC 15, 48, 50, 101 and PR 252 are planted in this area. Growth is fairly satisfactory.

Nurseries

Budwood multiplication nurseries — 3½ acres at Dartonfield, 7¼ acres at Nivitigalakele and 14 acres at Hedigalla

(*a*) Routine weeding, manuring, clearing of drains and other agricultural operations were carried out.

(*b*) All over-matured budwood points were lopped off for fresh budwood.

(*c*) Special attention was paid to disease control work at Nivitigalakele nurseries, as the total number of budwood points uprooted due to *Fomes lignosus* was 71. 195 new budwood points were planted in November at Nivitigalakele nurseries.

(*d*) The 7-acre nursery, established at Hedigalla in 1967, was thinned out during September to a tappable stand. After supplying 235 vacancies, the total stand stood at 1,370 plants. The average girth taken at that time was 7·2 in.

Seedling stock nurseries — 2 acres at Nivitigalakele and 6 acres at Hedigalla

(*a*) The seedling stock nurseries were satisfactorily maintained throughout the year. Routine work was carried out.

(*b*) Stocks were budded to meet both experimental and commercial requirements.

(*c*) Establishment of seedling nurseries at Hedigalla was abandoned. Instead, two nurseries were established at Dartonfield and Nivitigalakele.

Budwood issues

(a)	To outside estates ..	1,344 yards
(b)	For Nivitigalakele budgraftings ..	195 ,,
(c)	For Botany Department experiments ..	155 ,,
(d)	For Genetics & Plant Breeding Department experiments ..	57 ,,
		1,751 yards

Budded stumps issues

(a)	For Botany Department budwood nursery plantings	385 budded stumps
(b)	For Estate Department replantings, including supply of vacancies ..	6,039 ,, ,,
		6,424 ,, ,,

Labour and health

Labour force : Most of the old labourers were retired and gratituies were paid. As the permanent labour force was inadequate, especially during paddy cultivation periods, some labourers were registered and taken into the permanent cadre. Since the new Employees' Provident Fund regulations came into force, the temporary/casual workers employed too, had to be registered, in order to pay contributions of Employees' Provident Fund to them.

Applications for refund of E.P.F. dues, in respect of 112 individuals were made during the year, out of which, 83 cases were settled in full.

Union rivalry generally interfered with work during the early part of the year and reduced the output of work, especially at Hedigalla Division.

The total number of Labour Tribunal cases reported during the year was eight.

Line rooms : Line room accommodation remained satisfactory. Repairs to lines and labour cottages were carried out where necessary. New additional double-roomed latrines were built at Dartonfield and Hedigalla Divisions for the convenience of labourers.

Wages : Wages were paid during the year in accordance with the Wages Board's Ordinances in force. Besides the minimum wage, incentives were paid to supervisory kanganies.

Dartonfield Group

Working Ceylonese		Resident	Non-resident	Total
Men	..	95	157	252
Women	..	90	120	210
Children	..	—	—	—
Working immigrants				
Men	..	34	—	34
Women	..	25	—	25
Children	..	1	—	1
		245	277	522

Annual holidays : Annual holidays with pay were given to all labourers who were entitled to these in accordance with the labour ordinance.

Festival advances : Substantial festival advances were given to all labourers to be deducted over a period of a few months.

Maternity benefits : In all twenty two full and three alternative maternity benefit payments were made.

Workmen's compensation : Twelve accidents, sustained to workers during working hours, were reported during the year.

Feeding children : Free rations and $\frac{1}{4}$ lb bread were issued to each non-working child over one year of age. Free milk foods were issued to infants under one year at the rate of 1 lb per fortnight, when their mothers were incapable of breast feeding.

Health : The health of the members of the Institute's staff and of the estate labourers was satisfactory during the year. No outbreak of epidemic diseases was reported.

Immunisation against polio and vaccination against small pox were carried out on the estate. The Anti-T.B. Unit of the Health Department carried out a round of B.C.G. vaccination for pre-school children. The Family Planning Association of Ceylon conducted two family planning and mother and child clinics in the estate during the year and entertained the attendance with an educational film show.

Anti-mosquito measures : DDT spraying was carried out in and around bungalows and lines during the first few months of the year, under the supervision of the Estate Medical Assistant. This programme was discontinued owing to non-availability of DDT powder in the open market.

Births : Twenty three infants were born during the year on the Group.

Deaths : There were four deaths on the Group this year.

A list of diseases treated by the Institute's Estate Medical Assistants is given below :—

Influenza	..	1,378
Ulcers	..	1,245
Roundworm	..	779
Diarrhoea and enteritis	..	404
Eye and ear diseases	..	368
Other diseases	..	8,323
Total	..	12,497

The number of cases treated during the year was very high as it included non-resident cases too. The Rubber Research Board, as a social service had approved treating of non-residents, who are relations of workers employed in the Institute.

REVIEW OF THE KURUWITA SUB-STATION

By

S. M. Dias

Acreage statement

	A.	R.	P.	Hectares
Mature rubber				
1961 replanting	83	0	0	33·59
1962 ,, ...	38	3	0	15·68
1963 ,, ...	22	2	0	9·11
1964 ,, ...	18	0	0	7·28
Total mature acreage	162	1	0	65·66
Immature rubber				
1965 replanting	19	2	0	7·89
1966 ,, ...	10	0	0	4·05
1967 ,, ...	10	0	0	4·05
1968 ,, ...	10	0	0	4·05
1969 ,, ...	10	0	0	4·05
Total immature acreage	59	2	0	24·09
Total rubber acreage	221	3	0	89·74
Nurseries	2	0	20	0·86
Paddy	5	2	0	2·23
Roads, buildings etc.	17	1	10	7·01
Grand total	246	2	30	99·84

1965 and 1966 clearings comprising 29 acres 2 roods were brought into tapping during the course of the year.

Weather

	Rainfall		*Wet days*
1970	160·43 in.	1006·93 mm	55
1971	184·93 ,,	1160·71 ,,	210

Weather conditions were not altogether satisfactory for tapping. Tapping was further upset due to insurgent activities and the curfew.

Crop

		1970		1971	
Estimate	..	106,000 lb	48,081 kg	133,975 lb	60,770 kg
Secured	..	91,700 lb	41,594 kg	130,264 lb	59,087 kg
Decrease	..	14,325 lb	6,498 kg		
Increase	..			38,564 lb	17,492 kg

The crop fell short of the increased estimate by only 3,711 lb but recorded a very substantial increase of 38,564 lb over the year 1970. Large crops were harvested during the last four months of the year.

The 67% intensity tapping on a large area of the 64 acres of the 1961 replanting together with no recovery tapping, in a very wet district, does not assist the harvesting of the full potential crop.

Machinery and electricity

The Guthrie Cadet mill was defective for a long period and was finally put right by Messrs. Colombo Commercial Co. (Engineers) Ltd., in September/October 1971.

The standby Harrison Lister engine has received a complete workshop overhaul at Colombo.

The Sub-station was connected to the National Grid since June 1971.

Buildings

Both scientific department bungalows had additions and renovations carried out under the supervision of the Works Section.

The No. 2 bungalow was occupied by the Soils Department Fied Assistant after the renovation.

Routine attention on the maintenance of labour quarters was carried out.

Staff

A Power House Attendant was transferred back to Dartonfield as there was not sufficient work at the Sub-station to keep him occupied.

General

Mr. E. F. Jinadasa assumed duties as Visiting Superintendent in March 1971 and relinquished his services from mid-August 1971. Mr. Salie M. Dias assumed duties as Visiting Superintendent from mid-August 1971.

I place on record my appreciation of the advice given by Mr. M. W. Thompson, the Visiting Agent, and the assistance and co-operation received from the Director and the scientific staff in re-organising the work on this property.