

**THE
RUBBER RESEARCH INSTITUTE OF CEYLON**

ANNUAL REVIEW FOR 1970

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THE RUBBER RESEARCH INSTITUTE OF CEYLON

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(As at 31st December, 1970)

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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, 1970)

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
G. R. 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 and Plant Pathologist* .. Mrs. V. Satchuthananthavale, B.A. (Madras), M.Sc. (Madras), Ph.D. (Sheffield)
- Assistant Plant Pathologist* .. *A. de S. Liyanage, B.Sc. Ag. (Cey.)
- Senior Technical Assistant* .. *H. L. Munasinghe, M. I. Biol.
- Technical Assistants* .. D. M. Dantanarayana
W. C. Dayaratne
T. M. Fernando
L. Halangoda
Z. E. Irugalbandara
S. S. Jayasuriya
S. K. Samaraweera
A. R. D. Sebastian

Soils Chemistry

- Acting Head of Department and Soils Chemist* .. C. G. Silva, B.Sc. (Cey.), M.S. (Hawaii)
- Soils Chemist* .. R. S. John, B.Sc. Ag. (Cey.), Ph.D. (Aberdeen)
- Assistant Soils Chemist* .. N. Yogaratnam, B.Sc. Ag. (Allhabad)
- 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. Abeyasinghe
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.R.I.C., A.I.R.I.
- Consultant in Polymer Science & Technology* .. Prof. Gerald Scott, M.Sc.
- Rubber Chemists* .. S. W. Karunaratne, B.Sc. (Cey.), M.Sc. (Aston), A.R.I.C., A.N.C.R.T., A.I.R.I.
Mrs. M. Rajasingham, B.Sc. (Madras), Ph.D. (Lond.)

<i>Assistant Rubber Chemists</i>	..	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.)
<i>Assistant Development Officers</i>	..	*A. Coomaraswamy, B.Sc. (Cey.) D. S. Muthukuda M. T. Veerabangsa
<i>Senior Technical Assistant</i>	..	E. G. Mendis
<i>Technical Assistants</i>	..	A. S. Dekumpitiya K. P. N. de Silva W. D. Dharmasena L. S. Goonawardena P. P. Jayasinghe S. Kasinathan J. Kirubakaran D. D. Medagama H. Narangoda K. A. Piyadasa

Rubber Processing Unit

<i>Industrial Adviser (Rubber)</i>	..	S. Hansen, M.Sc. (Chem. Eng.)
<i>Divisional Advisory Officer</i>	..	M. B. Dissanayake
<i>Rubber Instructors</i>	..	K. Ekanayake R. K. Gunatilake G. P. G. S. Hapugoda

Statistical Section

<i>Assistant Statistician</i>	..	G. A. J. P. R. Gunasekera, B.Sc. (Cey.), Dip. Stat. (Vidyodaya, Cey.)
<i>Technical Assistant</i>	..	L. T. Peiris

EXTENSION SERVICES

Estates Advisory Department

<i>Head of Department</i>	..	A. B. Dissanayake, B.Sc. Ag. (Cey.), B.A. (Cey.)
<i>Assistant Advisory Officers</i>	..	A. Dahanayake, B.Sc. Ag. (Cey.) D. E. F. Suraweera, B.Sc. Ag. (Cey.) H. T. Wickremasekera, B.Sc. Ag. (Cey.) R. A. Wijewansa, B.Sc. Ag. (Cey.)
<i>Assistant Agricultural Economist</i>	..	G. R. Chandrasiri, B.Sc. (Cey.)
<i>Technical Assistant</i>	..	S. L. Weerasinghe
<i>Junior Clerk/Typist</i>	..	H. B. de Silva

Smallholdings Department

<i>Chief Advisory Officer (Smallholdings)</i>	..	H. H. Peiris
<i>Deputy Chief Advisory Officer (Smallholdings)</i>	..	R. P. M. de Zoysa, B.Sc. (Cey.), M.Sc. (Oregon)
<i>Divisional Advisory Officers (Smallholdings)</i>	..	P. S. G. Cooray B. D. Pedrick D. R. Ranwala K. P. Siriwardena D. B. Weligodapola J. D. S. Wickremaratne L. A. Wijesinghe
<i>Office Assistant</i>	..	R. A. Somadasa
<i>Chief Clerk</i>	..	C. Jayasinghe
<i>Accounts Clerk</i>	..	K. J. L. Perera, F.S.A.A., A.C.B.I.
<i>Clerk-Translators</i>	..	W. A. A. Perera I. L. Sirisena
<i>Artist Clerk</i>	..	M. J. P. Lusena
<i>Cashier cum Stores Clerk</i>	..	A. L. Gunawardene
<i>Clerks</i>	..	R. E. Perera A. Wijesinghe
<i>Junior Clerk/Typists</i>	..	Mrs. N. K. Ekanayake Miss M. A. P. P. Seneviratne
<i>Rubber Instructors</i>	..	W. D. Abeysena D. L. Abeysinghe M. D. Albert H. A. D. Ariyaratne K. I. Ariyaratne S. D. Athukorale W. S. Dassanayake 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 G. Gunawardena B. A. Gurusinghe

<i>Rubber Instructors (contd.)</i>	..	R. B. Heendeniya T. B. Herath D. Hettiarachchi S. D. Hidellarachchi T. W. Jayalath A. K. Jayatissa W. D. Jayawardena L. S. Kasturiratne N. C. Katukurunda K. S. Kodikara D. D. Kotalawala E. N. Liyanage R. B. Madawala 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 G. Weeratunga C. Wickrematilake W. A. S. Wijesekera D. U. Wijesinghe V. Wijesinghe D. R. Wijesooriya W. M. D. Wijesundera R. P. D. J. Wijewardena
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<i>Rubber Instructors (Publicity Unit)</i>	..	A. Suriyaarachchi U. S. Wijeyapala
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<i>Mechanic</i>	..	K. A. Siripala
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ADMINISTRATION

Correspondence and Accounts Sections

<i>Chief Administrative Officer and Secretary to the Board</i>	..	K. M. U. Jayanetty, B.A. (Lond.)
<i>Accountant</i>	..	M. E. A. Peiris, Dip. Acc. (Cey.)
<i>Assistant Administrative Officer</i>	..	S. M. J. Neangoda, B.A. Econ. (Cey.)
<i>Office Assistant</i>	..	J. A. Attygalle

<i>Accounting Assistant</i>	.. E. P. D. Roberts, F.C.B.I. (Lond.)
<i>Personal Assistant to the Director</i>	.. P. Samarasinghe
<i>Confidential Clerk</i>	.. W. D. Jayawansa
<i>Establishment Clerk</i>	.. D. G. Udawatta
<i>Translator cum Typist</i>	.. J. A. A. R. I. St. R. Perera
<i>Clerk/Typists</i>	.. G. P. A. I. G. Pathirana T. H. Wijesena
<i>Junior Clerk/Typists</i>	.. Miss A. P. A. Amarasinghe Miss D. T. Baranasuriya Miss M. M. B. R. J. Cooray Miss G. R. H. de Alwis J. D. Gunaratne Miss L. J. C. Ranasinghe Miss W. Sellamuttu Miss R. S. Seneviratne Mrs. D. F. Thambawita
<i>Accounts Clerks</i>	.. M. J. Abeyasinghe A. K. D. Amaradasa L. W. S. C. de Silva N. de Silva K. G. A. K. Dharmawardena K. D. D. Navaratne J. H. C. S. Perera A. L. Ratnayake B. H. Withanachchi
<i>Junior Accounts Clerk</i>	.. R. L. Fernando
<i>Store-keeper</i>	.. D. P. W. Goonesekera
<i>Stores Assistant</i>	.. M. H. C. Ariyaratne
<i>Cashier</i>	.. D. C. A. D. B. de Silva
<i>Clerk cum Steno/Typist (Board Office)</i>	.. P. H. Seneviratne

Library

<i>Librarian & Publications Officer</i>	.. Miss S. M. Fernando, B.Sc. (Cey.)
<i>Library Assistant</i>	.. W. Ranasinghe
<i>Library Clerk</i>	.. D. C. Thambawita
<i>Junior Clerk/Typist</i>	.. Mrs. I. Swaris

Works Section

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

ESTATES

Dartonfield Group

<i>Estate Superintendent</i>	..	S. de S. Daluwatta
<i>Assistant Estate Superintendent</i>		M. R. T. Mendis
<i>Office Assistant</i>	..	T. S. J. Peiris
<i>Senior Accounts Clerk</i>	..	A. C. Swaris
<i>Accounts Clerks</i>	..	D. A. Rajapakse B. H. Rodrigo
<i>Junior Assistant Clerks</i>	..	G. S. Doolwela G. Kannangara
<i>Senior Field Assistant</i>	..	L. P. de Mel
<i>Factory Assistant</i>	..	O. de Alwis
<i>Apothecary</i>	..	M. C. Peiris
<i>Dispenser</i>	..	G. J. A. Silva
<i>Field Assistant</i>	..	H. A. Haramanis
<i>Field Officer</i>	..	A. Jayasena
<i>Assistant Rubber Maker</i>	..	S. Hettiarachchi
<i>School Teachers</i>	..	Mrs. K. P. Goonawardene D. L. W. Lionel S. Nadarajah
<i>Nursery Manager</i>	..	L. H. Samaranayake

Kuruwita Sub-station

<i>Visiting Superintendent</i>	..	Vacant
<i>Senior Field Assistant</i>	..	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 1970

By

O. S. PERIES

General

The "Ceylon Rubber Conference," held at the Savoy Cinema, Colombo, proved to be a stimulating meeting for both research workers and planters. The conference was declared open by the Hon. Dr. Colvin R. de Silva, Minister of Plantation Industries, and was undoubtedly the highlight of the year. It brought together many scientists from different disciplines, working in different parts of the world, and invited the planters to meet eminent research workers on rubber from overseas. The conference made it clear that many of the problems the natural rubber (NR) producing countries face are basically similar, and that it is essential to keep in constant contact with one another.

A handbook titled "A Handbook of Rubber Culture and Processing" was published by the Institute to commemorate the opening of the "Ceylon Rubber Conference." The handbook has been well received and bids fair to being a standard reference book on all aspects of NR production and processing.

Outlook: The commercial climate all-round was poor in certain areas at the end of the year, especially in the United States of America, where the last quarter of 1970 was perhaps the worst in four years. However, there are indications that the year will be reversed in 1971 and that modest improvements in commercial activity will prevail. Optimistic forecasts have been made for the rubber industry: automobile production in the U.S.A. may increase by as much as 25% and a possible increase of 13% in total new rubber consumption is forecast. Recovery however will take time; automobile production is still not back to normal and hundreds of employees have been retrenched at all the Big Five rubber companies. The demand for tyres and other automotive products is not expected to pick up for the first two to three months of 1971.

The low prices for NR at the end of the year were due to recessions in countries like U.S.A., Germany, Japan and Australia which reduced the production of cars, trucks and tractors. In Australia for example the low prices for wool, wheat and dairy products had an immediate effect on the production of passenger cars. In India labour troubles impeded the production of tyres.

In this context, it is useful to glance at the synthetic rubber (SR) industry, which appears to have its own troubles. The situation in the U.S.A., in the last quarter of 1970 was very serious for SR; consumption decreased markedly, partly due to the general recession and especially to the United Automobile Workers' strike. Low NR prices have also induced a number of users to replace some SR with NR. In most quarters it is assessed that it would be impossible to maintain the recent growth rate of synthetic polymers. Capital costs are rising rapidly and monomer prices will almost certainly rise, except perhaps in Japan. At the same time there is anxiety over various forecasts of low NR prices in the next two years, together with the uncertainty of how much NR will be available, possibly within a short space of time, as a result of current spectacular developments in yield stimulation.

The future prospects for the NR industry are still good. It is an industry in which prices are likely to fluctuate from time to time, but now with the prospect of injecting elasticity to supply, with Ethrel stimulation, price stabilization appears likely, and the future of the industry looks bright.

Research

General: It has been clear from the time that SR was first produced that NR producers all over the world will have to compete with the synthetic product, under quite open and ruthless conditions. Our battle is likely to be won only if we extend every effort to keep the image of NR ahead of SR both from the point of view of price and utility. Ours is primarily an applied research station, and we are vitally interested in increasing the competitiveness of NR. We are therefore expanding the work of the Rubber Chemistry Department in order to fulfil this mission. The other research departments will also be adequately manned and reorganised in order to undertake studies on the reduction of the cost of production. In this way we expect NR to keep its competitive capacity for many years to come.

Botany: On the basis of yields recorded in large scale trials, the local clones RRIC 13, 48, 50, 89 and 94 as well as the foreign clones AVROS 1734, PR 252, IRCI 2, 7 and 9 have yielded better than clone PB 86. The clones RRIC 100 and 101 are more recent selections from initial small scale trials and have yielded far in excess of clone PB 86. The clone RRIC 100 appears to be sensitive to high intensity tapping and may have to be tapped at 67% intensity for the first few years. The clone RRIC 52, though a comparatively low yielder in the first year of tapping, has given high yields in later years, both in experimental and commercial plantings. The results of full spiral tapping on this clone have been inconclusive, both in yield and girdling of the trees.

Results of stock-scion experiments have shown that there is no significant difference in the growth of the scion in the immature phase when grafted on to seedling stocks of most clones.

Trials on the intercropping of rubber with cacao have been started in Koslanda and Passara.

Several species of bacteria, isolated from different sources and cultured in pure coconut water have been tested for coagulating field latex. Some species have produced 99% coagulation in four to five hours, and the technical properties of the bacterially-coagulated rubber are in no way inferior to that coagulated by conventional methods.

Genetics & Plant Breeding: The oil content of cotyledons was examined and found to have high heritability, with an inverse relationship to growth and yield. This factor will therefore be used for early selection of clones. The analysis of a population of Tjir 1 seedlings revealed a strong correlation between germination period and growth characters such as height and diameter. This would facilitate selection of stocks on the basis of period of germination.

RRIC 102 was evaluated as satisfactory for planting above 1000 ft elevation. IAN 45—873 showed satisfactory yields in the Sabaragamuwa District, and is clearly tolerant to *Oidium* leaf disease.

Seedlings from 30 clonal sources were examined individually for growth, latex yield and cotyledonary oil content. Selection was effected for initial nursery establishment and further study.

Plant Pathology: It has been found that the causal fungus of White Root disease, *Fomes lignosus*, will survive for longer periods in dry soils than in moist. Treatment of dry or moist soils with sulphur would eliminate the fungus from wood pieces of small volume.

Studies on mould contamination of rubber have shown that sheet rubber can be stored at 60% relative humidity, at room temperature, for long periods without contamination. The conditions of storage at most buyers' depots at present promote mould growth.

An assessment of the incidence of *Oidium* leaf disease in smallholdings showed that incidence is low to negligible in areas lower than 300 ft above mean sea level, and that control measures are not warranted in such areas. Incidence increases with increasing elevation and sulphur dusting of clone PB 86 in such areas reduces leaf fall significantly. It has also been found that hot, dry periods with bright sunny days as well as continuous rains militate against the propagation of the fungus, and control measures against the disease should be adopted only during periods of dull, cool, humid weather.

Soils Chemistry: A detailed soil map was prepared of the Alutgama 1 in. map and the chemical properties of five important soil series were also determined. Soil surveys were carried out for planting oil palm at Nakiadeniya Group, Nakiadeniya.

- Six new field experiments were initiated during the year to test the effect of fertilization in relation to covers, frequency of fertilizer application in the immature phase and the fertilizer requirements of nursery plants.

Herbicide mixtures based on mono sodium methane arsonate (MSMA) have been found to be as effective as sodium arsenite in controlling most weed populations commonly found under rubber. The economics of the use of these mixtures will have to be studied in detail.

There has been a great deal of interest recently in intercropping rubber with various cash crops. Trials have been initiated on the cultivation of pineapples as an intercrop.

Rubber Chemistry: The smallholders form an important sector of the rubber industry in Ceylon, one-third of the acreage under rubber being owned by them. A project report was prepared to set up a new process rubber factory at Mawanella, to cater to smallholders in the area.

A micronised form of graphite was successfully incorporated into NR; this would prove useful in such applications as solid tyres. Full scale field experiments are under way, in collaboration with the Department of Highways, on the use of NR field latex for addition to bitumen for road surfacing. Oil-extended, ammonia-preserved NR latex has been found suitable for soil stabilization. Another use for preserved NR field latex is its use by the Ceylon Leather Corporation, in collaboration with the RRIC, for finishing leather.

A method has been devised for the production of dark factice from rubber seed oil. This is an important break-through as factice is now imported into the country.

Since the method of preparation of pale crepe affects its technological properties, proposals are being made for the grading of pale crepe on this basis. The Institute's suggestions have been well received by buyers of pale crepe.

Carbon fibre can be made from cyclised rubber but it has the defect of being brittle. The adhesion and degradation of cyclised rubber during fabrication is undesirable for moulding purposes and studies are being carried out to remedy this problem.

Extension: It is abundantly clear that the purpose of applied research is to elicit information, and that this is of no value unless it is made known and utilized. The Institute is very conscious of this fact and is expanding its advisory services to meet this need.

The extension services 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. In the field of agricultural economics, the available data on cost of production on large estates are being grouped for further study.

Staff

It is a real pleasure to record here and pay tribute to the dedicated service, the sense of purpose and the achievements of my colleagues on whose scientific ability this Institute depends. The year under review has been a hard year for us in many ways, but there is no gainsaying that the scientific image of the Institute was brighter at the end of it, the "Ceylon Rubber Conference" having highlighted our achievements.

The Director, the Heads of Departments and all the Senior and Intermediate staff officers of the Institute were on duty throughout the year. By the end of the year there were eight officers on post-graduate study leave abroad, an unprecedented number, indicating the rate of development and expansion taking place in the Institute.

The following Senior and Intermediate staff officers joined the services of the Institute during the year.

Mr. R. P. M. de Zoysa, Deputy Chief Advisory Officer Smallholdings—7th April
 Mr. G. R. Chandrasiri, Assistant Agricultural Economist—3rd August
 Mr. C. M. B. Ratnayake, Assistant in Genetics & Plant Breeding—3rd August
 Mr. G. Varathungarajan, Assistant Rubber Chemist—24th September
 Mr. M. R. N. Fernando, Assistant Rubber Chemist—1st October

Mr. A. I. R. Gunawardena, Assistant Agricultural Economist, resigned his post on 31st March 1970.

Mr. K. Wilson de Silva, retired from service as Estate Advisory Officer on 14th January, after twenty two years of service at the Institute. We wish him every happiness in his retired life.

Assistant and Minor staff changes in the various departments have been reported on by the respective departmental heads.

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

Senior Staff (Heads of Departments)	..	..	9
Senior Staff (Non-Heads of Departments)	..	..	6
Intermediate Staff	..	..	23
Assistant Staff	..	..	188
Minor Staff	..	..	102
			<hr/>
			328
			<hr/>

Visitors

Visitors to the Institute included:—

- Dr. C. Barlow, Australian National University, Canberra, and Prof. Gerald Scott, University of Aston in Birmingham, U.K., both of whom came over to help the Institute in new fields of study.
- Dr. E. C. Humpheries, Rothamsted Experimental Station, Harpenden, Herts, U.K.
- A delegation from the Chinese Embassy, Colombo.
- Mr. O. J. Podolecki of the Polish Embassy, Colombo.
- Dr. M. Gayewski of the Rubber Research Institute, Warsaw, Poland.
- Dr. Alan F. A. Lamb, Commonwealth Forestry Institute, Oxford, U.K.
- Mr. Lie Chun-tien, Commercial Councillor for the Embassy of the People's Republic of China.
- Mr. T. Pathmanathan, Commissioner of Commodity Purchase, Colombo.
- Mr. Al Jibouri, F.A.O. Regional Office, Bangkok, Thailand.
- Mr. Mathew H. Miller, Macalester College, St. Paul, Miniesota, U.S.A.
- Dr. D. R. Groenweld, Director, U.N.D.P. Crop Diversification Project.
- Mr. Ian C. Mackenzie, Ministry of External & Internal Trade, Colombo.
- Dr. D. R. Mekeladze (Chairman of the State Committee of Science and Technology of the Republic of Georgia of the U.S.S.R.) and his team advising the reorganisation of the C.I.S.I.R.
- Dr. S. Tokutome }
Dr. Mitsuo Ikeda } Japanese experts — C.A.R.I., Peradeniya.
- Mon. Jean Leveque, French Rubber Institute (I.F.C.), Paris, France.
- Mon. J. du Plessix, I.R.C.A., Africa.
- Dr. B. C. Sekhar, Director, Rubber Research Institute of Malaya.
- Dr. Leonard Mullins, Director, Natural Rubber Producers' Research Association, U.K.
- Dr. Gordon Cockbain, Natural Rubber Producers' Research Association, U.K.
- Mr. Tang Hong Tong, Chemara Research Station, Malaysia.
- Mr. C. R. Carlisle — UNCTAD, Geneva.
- Mr. Subah Mazunadar, Chief, U.N.D.P., Colombo.
- Hon. Dr. Colvin R. de Silva, Minister of Plantation Industries.
- Mr. Albert Kariyawasam, M.P., Junior Minister of Plantation Industries.
- Dr. Manfred Domros, South-East Asia Institute, Heidleberg University, Germany.
- Mr. Doric de Souza, Permanent Secretary, Ministry of Plantation Industries.
- Mr. V. A. Kalarin, Economic Councillor, U.S.S.R. Embassy, Colombo.
- Mr. J. S. Lemeschenko and other Soviet specialists from the Ceylon Tyre Corporation.
- Mr. John Parsons, Queen Elizabeth College, University of London, Advisor to the Physics Department, University of Ceylon, Colombo.
- Enche Haji Mohd. Yusof bin Mohamed, M.P., and Chairman of the Malayan Rubber Smallholders' Association.
- Drs. M. A. V. Devanathan and L. Wijeratne and Messrs L. P. Mendis and A. Rajapakse, C.I.S.I.R., Colombo.
- Mr. Gamini Seneviratne, Senior Assistant Secretary, Ministry of Plantation Industries.
- Mr. K. Austin Perera, Assistant Secretary, Ministry of Plantation Industries.

Visits

The Director, Dr. O. S. Peries, attended the IRRDB meeting held in Kuala Lumpur from 26—30 September, the International Rubber Study Group meetings

held in Singapore from 4—9 October, and also the meeting of the Association of Natural Rubber Producing Countries, held in Kuala Lumpur, Malaysia, from 10—17 October.

In addition the Director and research officers of the Institute attended the following conferences and seminars:—

Annual Sessions of the Ceylon Association for the Advancement of Science,
Planters' Association,
Low Country Products Association,
District Planters' Associations,
I.R.I. Committee Meetings,
Seminars organised by the Chemical Society of Ceylon,
Meetings of the Rubber Replanting Advisory Board,
Meetings of the panels convened by the Industrial Development Board,
Standing Committee meetings on agro-chemicals and fertilizers,
Ad hoc meetings of the Ministry of Trade & Commerce.

Research scholars

Mr. L. Weerakoon, who worked under the supervision of Dr. O. S. Peries, Director, has completed his studies on the control of *Eupatorium odoratum*, a noxious weed in the wet low country areas of Ceylon. He is now writing his thesis for the degree of M.Sc.

Mr. K. J. Wanasinghe, whose work is being supervised by Dr. O. S. Peries, Director, is studying the problem of the effect of nitrogen fertilization on the yield and flavour of pineapples. He is expected to complete his studies for the degree of M.Sc. in September 1971.

Miss L. Fernando, Vidyalankara University of Ceylon, continued her work in soil microbiology in collaboration with the officers of the Plant Pathology Department.

Mr. S. D. Wimalaratne, was awarded a studentship by the Rubber Research Board, and is reading for the degree of M.Sc. under the supervision of Mr. L. B. Chandrasekera, Head of the Botany Department. He is working on the subject of the optimum tapping system for *Hevea*.

Mr. K. G. S. Kalyananda, Miss K. G. Lily Nona and Miss S. Karunanayake, final year Chemistry Honours students from the University of Ceylon, Peradeniya, worked for short periods in the Rubber Chemistry Department.

In addition to the above, a number of students from the four universities in Ceylon visited the Institute on several occasions to familiarize themselves with the various techniques adopted in the different scientific departments of the Institute.

Workers from overseas

Prof. Gerald Scott, University of Aston in Birmingham, worked for two months in the Rubber Chemistry Department. Prof. Scott continues to be our consultant in polymer science and technology.

Dr. Colin Barlow, Australian National University, worked for six weeks with the Agricultural Economics Unit. It is expected that Dr. Barlow will visit Ceylon at regular intervals to continue his studies and help the Institute in this new discipline.

Mr. S. Hansen, who was seconded for service at the Institute was in charge of the organisation of the New Process Rubber Unit at Mawanella.

Lectures

Dr. O. S. Peries, Director, delivered a series of six lectures and gave practical demonstrations to post-graduate students, reading for the degree of M.Sc. in food science at the Vidyodaya University of Ceylon. He also gave a lecture entitled "The control of plant diseases" to the final year Botany Honours students at the University of Ceylon, Colombo.

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

Visiting officers

Mr. V. Abeywardena, Biometrician, Coconut Research Institute, continued to visit the Rubber Research Institute regularly throughout the year to help us with statistical studies. We are very grateful to the Coconut Research Institute for the services rendered to us by this officer.

Award

It is a pleasure to record here that Mr. S. D. Wimalaratne, research student attached to the Botany Department, was awarded the first prize in an international contest for the design for a tie for the Institute of Statisticians, London.

Publications

General:

Annual Review for 1969 (English)

Annual Report of the Rubber Research Board for 1968 (trilingual) Part II (in press)

Quarterly Journal Vol. 46, Parts 1 - 2

— do — 46, Parts 3 - 4 (in press)

R.R.I.C. Bulletin (New Series) Vol. 5, Nos. 1 & 2

— do — „ 5, Nos. 3 & 4 (in press)

“Rubber News”— a new Sinhala Bulletin — Vol. 1, Nos. 1 & 2 (in press)

Books:

A Handbook of Rubber Culture and Processing

Papers:

BARLOW, C. Some improvements to the Ceylon rubber industry. *RRIC Bull.* (New Series) 5, 1—14.

*FERNANDO, D. M. Breeding for multiple characters of economic importance in *Hevea*—preliminary assessment of recent selections. *Q. Jl. Rubb. Res. Inst. Ceylon* 46, 7—19.

FERNANDO, D. M. AND TAMBIAH, M. S. A study of the significance of latex in *Hevea* spp. *Q. Jl. Rubb. Res. Inst. Ceylon* 46, 69—77.

- FERNANDO, D. M. AND TAMBIAH, M. S. Sieve tube diameters and yields in *Hevea* spp.—a preliminary study. *Q. Jl. Rubb. Res. Inst. Ceylon* **46**, 78—87.
- FERNANDO, D. M. AND WIJESINGHE, W. A. C. Some features of the growth and yields of RRIC 100. *Q. Jl. Rubb. Res. Inst. Ceylon* **46**, 88—92.
- *FERNANDO, M. J. AND NADARAJAH, M. Use of natural rubber latex in road construction. *Q. Jl. Rubb. Res. Inst. Ceylon* **46**, 39—51.
- *JEEVARATNAM, A. J. Relative importance of fertiliser application during pre- and post-tapping phases of *Hevea*. *Q. Jl. Rubb. Res. Inst. Ceylon*, **46**, 52—60.
- *NADARAJAH, M. AND GANESHASUNDARAM, S. Use of natural rubber latex in paints. *Q. Jl. Rubb. Res. Inst. Ceylon* **46**, 30—38.
- *PERIES, O. S. Studies on epidemiology of *Phytophthora* leaf disease of *Hevea brasiliensis* in Ceylon. *Q. Jl. Rubb. Res. Inst. Ceylon*. **46**, 1—6.
- PERIES, O. S. AND WIMALAJEWA, D. L. S. (1970). The control of *Gloeosporium* leaf disease of *Hevea* in Ceylon. *Trop. Agriculture Trin.* **47**, 221—228.
- SENANAYAKE, Y. D. A. AND SAMARANAYAKE, P. Intraspecific variation of stomatal density in *Hevea brasiliensis* Muell. Arg. *Q. Jl. Rubb. Res. Inst. Ceylon* **46**, 61—68.
- *SILVA, C. G. Provisional classification of rubber soils of Ceylon and their relationship to Malayan Soils. *Q. Jl. Rubb. Res. Inst. Ceylon* **46**, 20—29.
- SCOTT, G. The polymer scene. *RRIC Bull.* (New Series) **5**, 15—19.

* These papers presented at the Natural Rubber Conference 1968, Kuala Lumpur, and subsequently published in the Journal of the Rubber Research Institute of Malaya were published in our Quarterly Journal with the courtesy of the Rubber Research Institute of Malaya.

Sports activities

The year under review was not a very successful one for the staff club in the field of sport. In Government Service Tournaments our teams did not live up to expectations. However, our badminton team won the All-Island Inter-Club D-Division Championship, which was mainly due to the keenness of the younger members, and the flood-lit court that was provided at the end of 1969.

The cricket team was runners-up in the Kalutara District Cricket Tournament, a tournament which we have won twice in previous years. In the Six-a-side Cricket Tournament organised by the Kalutara District Cricket Association, we ended up runners-up to Kalutara Town Club, after defeating three other teams. Our failures can be attributed to lack of practice, and want of a playing field.

In the annual encounter against the Tea Research Institute Sports Club, we beat them convincingly to annex the "Gunn Trophy".

As the membership has increased considerably, it was decided to enter a second team into competition cricket.

REVIEW OF THE BOTANY DEPARTMENT

By •

L. B. CHANDRASEKERA

SUMMARY

No adverse effects either on growth or yield have been recorded during six years of tapping of clones Nab 12 and PB 86 without the usual rest during wintering time.

The results of full spiral tapping compared with the double-four system on clone RRIC 52 for a period of four years has been inconclusive. In one trial full spiral fourth-daily tapping has resulted in an average increase of 7.6 g dry rubber per tree per tapping over the four-year period as compared with double cuts tapped fourth-daily. In the second trial, over the same period, an average increase of 2.8 g dry rubber per tree per tapping has been recorded in favour of the double cut fourth-daily tapping system. In both trials, the differences in girthing rates for the two tapping systems were not significant.

Yield stimulation of virgin bark of clones Nab 12 and PB 86 have not shown a positive response to stimulation with preparations based on 2, 4, 5-T.

The clone RRIC 45, recommended for large scale planting in Ceylon, continues to show the expected yield increases during successive tapping years. During the early tapping years its yields have been slightly below that of clone PB 86. No major outbreaks of diseases or wind damage have been recorded so far. Observation plots of clone RRIC 45 planted at elevations of over 1500 ft have shown satisfactory growth and freedom from *Oidium* leaf disease. The clone RRIC 36 has maintained high yields in all experimental plantings. The survival and growth of this clone in the dry planting districts had been very satisfactory. Under these conditions no panel diseases have been recorded. On the basis of yields recorded in large scale trials, the following clones have yielded better than clone PB 86 and at the same time show a high degree of resistance to diseases and wind damage :—

RRIC 13, 48, 50, 89, 94, AVROS 1734, PR 252,
IRCI 2, 7, 9.

The clones RRIC 100 and 101 are recent selections, from small scale trials, which have yielded far in excess of clone PB 86. They are now recommended for small scale experimental planting in Ceylon. The clone RRIC 52, though a low yielder during the early tapping years, has shown steady yield improvements in both experimental and commercial plantings. No wind damage during the immature phase has been reported for this clone, when planted in districts with an average annual rainfall of around 100 in. per year. The planting of clone RRIC 41 may have to be discontinued owing to its susceptibility to wind damage.

Buddings of clones RRIC 45 and PB 86 made on seedling stocks of clones RRIC 5, 7, 41, 52, 86, 88, 89, RRIM 623, G1 1, Wagga 6278 and Tjir 1 have not shown significant differences in growth rate during the immature phase. The growth of buddings on *Hevea spruceana* however continues to be poor.

The three clones RRIC 41, 45 and 52 planted at spacings of 8' × 30' and 12' × 30' on comparatively flat terrain show the same average growth rates at the end of five years from planting.

Cacao seedlings were successfully established in a 15-acre trial plot at Rosebury Estate, Koslanda. In this trial the clones RRIC 45, 52 and PR 107 were planted at spacings of 8' × 30'. Cacao was planted five years later between the rubber rows. Another 34 acres were planted at Vykumbra Estate, Passara, with clone RRIC 45 at spacings of 12' × 20' and 20' × 20' for interplanting with cacao at a later stage.

Experiments were carried out on laboratory culture of apical meristems and pollen grains of *Hevea*.

Analysis of polyphenols in leaf extracts by means of thin-layer chromatography shows clonal variations in phenolic pattern.

Several species of bacteria, isolated from different sources and cultured in a pure coconut water medium were used for coagulating field latex. With some species, more than 99% coagulation was achieved in four to five hours. In technical properties, bacterially-coagulated rubbers compared favourably with autocoagulated and acid-coagulated rubbers at initial concentration.

DETAILED REVIEW

Staff

Mr. L. B. Chandrasekera, Head of Botany Department and Dr. R. Satchuthanathavale, 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 was appointed research student with effect from 1.10.70.

Visits

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

Meetings, conferences, etc.

The Head of the Department addressed the Kegalle District Planters' Association, the Kalutara District Planters' Association, the Sabaragamuwa District Planters' Association and the Kelani Valley District Planters' Association, on tapping.

The following papers were read at the Ceylon Rubber Conference held in Colombo in September 1970:—

1. Developments in *Hevea* planting material in Ceylon.
L. B. Chandrasekera
2. Bacterial coagulation of latex.
R. Satchuthanathavale and V. Satchuthanathavale
3. Possibilities of bacterial coagulation in raw rubber manufacture.
R. Satchuthanathavale, V. Satchuthanathavale, M. Nadarajah and I. Amarasinghe
4. Studies on latex flow patterns and plugging indices of clones.
U. P. de S. Waidyanatha and L. S. S. Pathiratne.

Tapping experiments

*Field experiment No. 4 — 1964 “winter” tapping cum yield stimulation trial—
Dartonfield (L. B. Chandrasekera & D. R. Colònne)*

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

- (A) Yield stimulation on virgin bark/tapping without “winter” rest
- (B) Yield stimulation on virgin bark/tapping with a “winter” rest
- (C) No stimulation and tapped without “winter” rest
- (D) No stimulation and tapped with a “winter” rest

The average girth and yield data for the past seven years are presented in Table 1.

TABLE 1

Yield in g dry rubber per tree per tapping averaged
over a seven-year period

Clone	Treatments	Yield	Average girth in in.	
			Before treatments	After treatments (1970)
PB 86	A	38.5	27.0	32.0
	B	36.5	27.1	31.9
	C	38.2	27.0	32.4
	D	38.6	27.9	33.6
Nab 12	A	42.9	27.5	32.3
	B	42.7	27.9	32.9
	C	42.5	27.5	31.8
	D	38.3	27.4	31.9

Field experiment No. 50—Small scale tapping experiment (L. B. Chandrasekera & I. H. Stephen)

The clone RRIC 52 was tapped on the S/2, d/2, 100% system from 1963 to 1966. In 1967 the two tapping systems 2S/2, d/4, 100% and S/1, d/4, 100% were introduced on a plot size of 150 trees replicated twice. The average yields recorded for the two tapping systems during the past four years are summarized in Table 2A.

TABLE 2A

Average yield of dry rubber in g/tree/tapping

Block	Tapping system	1967	1968	1969	1970	Mean yield
A	2S/2, d/4, 100%	49.5	43.8	54.2	55.3	50.7
	S/1, d/4, 100%	53.4	57.0	56.4	68.4	58.8
B	2S/2, d/4, 100%	52.4	44.9	46.8	58.0	50.5
	S/1, d/4, 100%	45.8	44.4	43.7	57.0	47.7

The average rate of girdling of trees since introducing the double-four and the full spiral tapping systems are summarized in Table 2B.

TABLE 2B

Rate of girdling of trees in in.

Block	Tapping system	1967—68	1968—69	1969—70	Mean
A	2S/2, d/4, 100%	0.7	0.5	0.6	0.6
	S/1, d/4, 100%	1.0	0.5	0.8	0.8
B	2S/2, d/4, 100%	0.4	0.6	0.7	0.6
	S/1, d/4, 100%	0.5	0.5	0.5	0.5

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

This experiment compares the efficiency of two tapping knives, the Michie-Golledge and the Jebong, and two tapping systems, S/2, d/2, 100% and 2S/2, d/4 100%, on clone RRIC 52. The tapping cuts are marked at 62" above the graft union for the S/2, d/2, 100% tapping system and at 62" and 31" above the union, for the two-cut system. The average yields recorded over a two-month period are summarized in Table 3.

TABLE 3

Average yield in g dry rubber/tree/tapping

Knife	S/2, d/2, 100%		2S/2, d/4, 100%	
	Total trees	Yield	Total trees	Yield
Michie-Golledge	375	11.3	192	26.5
Jebong	375	8.7	200	26.5

Clone evaluation trials

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

The clones are planted in 40-tree plots replicated five times. The yields of the best selections compared with clone RRIM 501 are presented in Table 4.

TABLE 4

Yield in lb dry rubber per tree per year
(Tapped on S/2, d/2, 100% from March 1960)

Year of tapping	IRCI 7	PB 28/59	RRIM 501
Yield in 1961	10.2	14.2	9.7
" " 1962	9.2	15.3	11.9
" " 1963	8.8	14.2	12.6
" " 1964	9.5	15.1	13.6
" " 1965	10.6	16.3	13.1
" " 1966	13.1	19.5	13.9
" " 1967	15.4	18.6	13.3
" " 1968	14.8	17.2	12.5
" " 1969	12.7	15.0	11.1
" " 1970	10.9	13.7	10.0
No. of trees tapped in 1970	139—138	109—108	94—93
Mean girth in inches in 1970	31.3	31.7	28.0
Brown Bast cases in 1970	1	—	—
Wind damage cases in 1970	2	1	1
Total casualties in 1970	3	1	1
Bark thickness in mm (1970):			
Virgin bark	10.6	11.1	10.3
Renewed bark	7.4	7.3	7.9

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 five acres. Test tapping yields for the past nine years are presented in Table 5.

TABLE 5

Yield in lb dry rubber per tree per year
(Tapped on S/2, d/2, 100%)

Year of tapping	RRIC 45
Yield in 1962	8.9
" " 1963	10.2
" " 1964	10.6
" " 1965	10.5
" " 1966	11.0
" " 1967	12.1
" " 1968	13.2
" " 1969	11.9
" " 1970	9.5
No. of trees tapped in 1970	556—549
Brown Bast cases in 1970	10
Wind damage cases in 1970	1
Mean girth in inches, 1970	28.2
Bark thickness in mm :	
Virgin bark	8.9
Renewed bark	6.3

The depressed yields in 1970 are due mainly to tapping close to the graft union.

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

All clones are planted in plots of 150 trees per clone. The test tapping yields during the first two years are summarized in Table 6.

TABLE 6
Yield in g dry rubber per tree per tapping

Clone	No. of trees tapped	Average girth in in.				Yield		Brown Bast cases	Bark Rot & Canker cases	Wind damage cases
		1970	1967	1968	1969	1970	1969				1970
RRIM 628	72—80	16.0	18.9	19.3	21.3	51.8	48.9	9	—	—
RRIC 94	82—99	16.8	19.2	19.6	21.2	44.7	39.0	6	—	1
RRIC 90*	67	14.1	16.9	17.5	20.8	—	36.8	—	—	—
RRIC 92	79—99	16.3	19.1	19.6	22.4	34.6	36.2	—	—	—
RRIC 5	109—110	18.9	22.0	22.4	25.2	25.3	31.5	3	—	—
RRIM 701	100—134	17.9	20.2	20.6	23.3	31.0	31.0	—	—	—
RRIC 91	111—115	20.3	23.0	23.5	24.3	25.2	29.6	—	—	—
RRIC 39	108—109	18.7	22.1	22.5	24.4	28.1	28.3	6	—	—
RRIC 93	67—90	16.6	19.2	19.7	22.5	33.7	28.2	1	—	1
RRIM 623	73—76	17.6	20.0	20.6	23.2	33.5	28.1	—	—	—
IAN 45—717	116—127	17.7	21.0	21.6	23.5	29.2	28.0	1	—	—
PB 86	67—104	15.5	18.6	19.3	22.5	29.9	27.1	—	—	—
RRIC 95	95—98	20.5	23.4	24.1	27.4	34.5	26.2	2	—	—
RRIC 97*	80	14.1	17.1	17.5	20.6	—	22.2	—	—	—
RRIC 86	100—110	17.9	20.4	20.8	23.4	26.4	20.3	—	—	—
RRIC 96	86—107	17.4	20.0	20.4	23.0	22.8	20.3	—	—	—
RRIC 51	70—93	15.6	18.3	18.8	21.9	19.8	18.0	—	—	—

* first tapped in 1970

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

This trial was set down in 1964 in order to assess the comparative yields of four clones RRIC 41, 45, 52 and 86. Each clone is planted in 106-tree plots replicated three times. The test tapping yields during the first year are summarized in Table 7.

TABLE 7
Yield in g dry rubber per tree per tapping
(Tapped on S/2, d/2, 100% in 1970)

Clone	No. of trees tapped 1970	Average girth in inches 1970	Yield	Wind damage
RRIC 41	146—145	20.9	27.2	—
RRIC 45	155	20.0	26.7	—
RRIC 86	136—132	20.1	21.2	2
RRIC 52	228—227	23.9	17.2	—

Field experiment No. 18—1961 large scale clone trial—Dartonfield (L. B. Chandrasekera & D. R. Colonne)

All clones are planted in monoclonal blocks of 500—600 trees per clone. The test tapping results for the first three years in tapping are presented in Table 8.

TABLE 8

Yield in g dry rubber per tree per tapping
(Tapped on S/2, d/2, 100% from March 1968)

Clone	Girth in in.		Increase. 1969/70	No. of trees tapped in 1970	Yield in g		
	1969	1970			1968	1969	1970
PB 28/59	20.6	21.5	0.9	251—388	29.1	47.9	46.7
RRIC 89	20.2	21.3	1.1	170—346	26.7	34.9	31.8
RRIC 7	22.0	23.3	1.3	280—426	27.3	25.8	25.7
RRIM 513	21.7	23.4	1.7	342—475	21.3	23.5	24.7
PB 86	20.9	22.3	1.4	305—401	21.5	25.9	23.2
RRIC 45	21.7	22.4	0.7	340—368	17.6	18.7	20.0
RRIC 52	27.4	29.3	1.9	467—506	10.9	14.4	18.7
RRIC 88	25.1	26.4	1.3	396—390	15.4	16.9	15.6

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

The clones in this trial are planted in 25-tree plots replicated three times. The test tapping results of the final selection RRIC 99 are compared with clone PB 86 in Table 9.

TABLE 9

Yield in lb dry rubber per tree per year
(Tapped on S/2, d/3, 67% from 1958; tapped on S/2, d/2, 100% from 1960)

Year of tapping	RRIC 99	PB 86
Yield in 1961	14.2	13.3
" " 1962	19.4	16.3
" " 1963	17.7	15.9
" " 1964	20.4	17.0
" " 1965	17.9	16.9
" " 1966	18.2	17.7
" " 1967	15.7	19.4
" " 1968	15.0	18.9
" " 1969	16.3	16.6
" " 1970	12.9	12.9
Girth in inches in 1970	32.9	32.8
No. of trees tapped in 1970	56—45	55—52
Brown Bast cases in 1970	5	3
Bark Rot and Canker cases in 1970	1	—

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

Twelve RRIC clones were originally planted in monoclonal blocks of 750 trees per clone. Test tapping yields of the best selections are summarized in Table 10.

TABLE 10
Yield in g dry rubber per tree per tapping
(Tapped on S/2, d/2, 100%)

Year of tapping	RRIC 50	RRIC 41	RRIC 13
Yield in 1962	17.7	30.3	30.3
" " 1963	33.2	31.3	33.1
" " 1964	38.4	35.0	34.8
" " 1965	40.3	40.1	45.5
" " 1966	59.5	46.2	48.3
" " 1967	58.5	45.4	54.1
" " 1968	49.9	47.6	59.1
" " 1969	49.9	36.1	49.1
" " 1970	49.6	52.6	62.2
No. of trees tapped in 1970	456	504—552	489—515
Girth in inches, 1970	28.8	27.8	28.3
Brown Bast cases, 1970	9	6	—
Bark Rot and Canker cases, 1970	—	1	—
Wind damage cases, 1970	15	5	7
Other casualties (<i>Fomes lignosus</i>)	3	—	2

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

In this trial 18 local and foreign clones were initially planted in monoclonal blocks of 300 trees per clone. The yields of the best selections now recommended for small scale planting in commercial estates are presented in Table 11.

TABLE 11
Yield in g dry rubber per tree per tapping
(Tapped on S/2, d/2, 100% from July 1963)

Clone	No. of trees tapped in 1970	Girth in in. 1970	Yield						
			1964	1965	1966	1967	1968	1969	1970
PR 252	205—236	26.2	24.5	35.3	33.0	34.5	32.3	27.7	46.8
IRCI 9	200—216	29.4	23.7	31.7	38.8	36.5	38.9	33.6	45.9
RRIC 48*	201—217	25.4	26.0	28.4	39.7	41.5	35.0	37.0	40.0
AVROS 1447*	152—162	26.7	17.3	22.8	35.2	35.3	31.9	38.9	37.2
PB 86	228—242	29.8	20.6	23.1	28.1	29.5	25.8	26.8	36.3

* first tapped in March 1964

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

All clones are planted in unreplicated plots of 300 trees per clone. Of the clones IRCI 2, 3, AVROS 529, TR 1406 and RRIM 607 planted in this trial, clone IRCI 2 has been the best yielder with good secondary characters. Test tapping results of this clone compared with clone PB 86 are presented in Table 12.

TABLE 12
Yield in g dry rubber per tree per tapping
(Test tapped from March 1964)

Clone	Girth in in. 1970	No. of trees tapped 1970	Yield						
			1964	1965	1966	1967	1968	1969	1970
IRCI 2	26.9	250—245	21.0	27.1	26.8	40.2	40.8	47.8	47.6
PB 86	25.7	260—250	17.5	17.3	16.4	23.1	25.8	27.3	26.6

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

In this clone trial, planted in two blocks of 10 acres and 20 acres, the test tapping yields of the more promising selections are compared with clone PB 86 in Tables 13 and 14.

TABLE 13
Yield in g dry rubber per tree per tapping
(Tapped from April 1964)

Clone	Girth in in. 1970	No. of trees tapped 1970	Yield						
			1964	1965	1966	1967	1968	1969	1970
AVROS 1734	29.3	198—192	35.6	40.5	39.7	36.7	46.6	53.1	41.0
PB 86	26.9	205	23.9	23.6	29.1	33.6	32.1	28.3	30.9

TABLE 14
Yield in g dry rubber per tree per tapping
(Tapped on S/2, d/2, 100%; first tapped in March 1964)

Clone	Girth in in. 1970	No. of trees tapped 1970	Yield						
			1964	1965	1966	1967	1968	1969	1970
RRIM 623	28.7	230—250	29.8	33.3	39.3	32.1	38.9	38.7	39.2
WR 101	27.9	178—195	22.0	19.1	28.2	37.0	32.4	33.0	29.8
PB 86 (1)	26.5	254—260	18.0	19.9	23.4	25.7	27.2	27.6	27.7
„ (2)		255—258							
„ (3)		220—228							

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. The test tapping yields of the better selections are summarized in Table 15.

TABLE 15

Yield in g dry rubber per tree per tapping
(Tapped on S/2, d/2, 100% from April 1965)

Clone	Girth in in. 1970	No. of trees tapped 1970	Yield					
			1965	1966	1967	1968	1969	1970
RRIC 36	28.4	204—206	24.1	27.9	27.6	29.4	30.6	44.3
IRCI 2	24.2	240—250	19.0	21.7	26.2	27.9	24.0	38.8
RRIC 55	25.0	182—185	—	32.7	31.7	27.4	25.2	30.8
RRIM 605	24.6	250—263	21.7	22.5	27.9	23.9	24.0	23.6
RRIC 45	24.4	250—260	17.1	22.1	28.1	28.3	24.5	22.2
RRIC 52	30.0	240—249	13.8	15.0	15.1	16.0	18.6	19.3
PB 86 (1)		215—216						
„ (2)	25.5	240—242	17.6	22.9	22.9	22.6	22.9	26.4
„ (3)		230—232						
„ (4)		235—236						

Field experiment No. 28—1957/58 clone trial—estate C—Kalutara District (L. B. Chandrasekera & I. H. Stephen)

The test tapping results of a selection of clones planted in a commercial estate in the Kalutara District are presented in Table 16.

TABLE 16

Yield in g dry rubber per tree per tapping
(Tapped on S/2, d/2, 100% from September 1963)

Clone	Girth in in. 1970	No. of trees tapped 1970	Yield						
			1964	1965	1966	1967	1968	1969	1970
RRIC 36*	27.3	185—190	31.9	34.5	36.6	44.6	52.5	53.4	54.8
IRCI 7	28.4	205—215	28.1	33.8	35.7	40.9	38.3	38.2	41.6
RRIC 45	24.1	250—260	23.6	24.5	29.5	34.0	31.8	28.7	28.8
RRIC 7	25.6	170—175	29.7	27.7	38.4	39.4	33.5	26.1	27.1
RRIC 5	26.0	200—210	22.8	26.1	28.7	40.8	27.9	32.2	18.5

* tapped S/2, d/3, 67%.

The clone RRIC 36 is being tapped on an intensity of 67% owing to extensive bark damage resulting from *Phytophthora* infections.

Immature areas

Field experiment No. 23—1965 small scale clone trial—Dartonfield (L. B. Chandrasekera & D. R. Colonne)

Clones RRIC 45, 88, 89, 90, 91 and RRIM 600 are planted in plots of 50 trees per clone replicated three times. The average girth of clones at the end of fourth and fifth years of growth are presented in Table 17.

TABLE 17
Average girth in inches

Clone	No. of trees	Girth in 1969	Girth in 1970
RRIC 91	121	16.4	17.1
„ 45	132	15.7	17.5
„ 89	134	14.2	14.6
„ 88	137	16.6	17.4
RRIM 600	140	14.2	14.6
RRIC 90	133	12.6	13.1

Field experiment No. 22—1965 replanting—Nivitigalakele (L. B. Chandrasekera & W. T. Silva)

Ten acres of RRIC 45 were planted in 1965 to be used in tapping experiments at a later stage. The trees have reached an average girth of 17.8 in. in 1969.

Field experiment No. 56—1970 replanting—Nivitigalakele (L. B. Chandrasekera & W. T. Silva)

The clones RRIC 13, 45, 100, 101, WR 101, IRCI 2, PR 252 and AVROS 1734 were planted in 50-tree plots replicated five times for introducing different tapping systems at a later stage.

Field experiment No. 46—1967 polyclone trial—2½ acres—Hedigalla (L. B. Chandrasekera & S. Wilbert)

Clones RRIC 41, 45, 86, 88 and 89 are planted at random in order to study the effects of clonal competition on growth and yield.

Field experiment No. 24—spacing trial—Kuruwita (L. B. Chandrasekera & J. D. Karunatillake)

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. The average girth and the percentage of trees over 20 in. in girth at approximately six years of age for the various clones and spacings are summarized in Table 18.

TABLE 18

Average girth in in. 1970

Clone	Spacing	Average girth in in.	Percentage of trees over 20 in. girth
RRIC 45	12' × 20'	17.49	59.4
	8' × 30'	17.42	49.6
RRIC 52	12' × 20'	19.67	75.2
	8' × 30'	19.09	70.3
RRIC 41	12' × 20'	18.98	74.2
	8' × 30'	18.59	74.1

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

The clones RRIC 45, 86, 88 and Nab 15 are planted in 150-tree plots replicated three times. The average girth measurements of the various clones are summarized in Table 19.

TABLE 19

Average girth in in.

Year	Clone			
	Nab 15	RRIC 45	RRIC 86	RRIC 88
1967	11.2	11.7	10.5	10.4
1968	15.6	15.6	14.5	14.1
1969	19.5	18.1	17.6	17.1
1970	21.5	20.3	19.7	19.2

Field experiment No. 38—1966 yield trial—10 acres—Kiribatgalla Group (L. B. Chandrasekera & U. K. D. Lewis)

Clones RRIC 45, 88, 91 and AVROS 427 are planted at 134 trees per plot replicated three times.

Average girth :- RRIC 45 — 13.8" RRIC 88 — 12.7"
(1970) RRIC 91 — 14.1" AVROS 427 — 11.7"

Field experiment No. 39—1966 yield trial—15 acres—Halgolle Group (L. B. Chandrasekera & U. K. D. Lewis)

Clones RRIC 45, RRIM 605 and RRIM 701 are planted at 250 trees per plot replicated three times.

Average girth :- RRIC 45 — 13.3" RRIM 605 — 13.4"
(1970) RRIM 701 — 11.0"

Field experiment No. 40—10 acres—Biddescar Group (L. B. Chandrasekera & U. K. D. Lewis)

Clones RRIC 36, 41, 45 and RRIM 605 are planted at 150 trees per plot replicated three times.

Average girth :- RRIC 36 — 16.3" RRIC 41 — 13.7"
(1970) RRIC 45 — 12.6" RRIM 605 — 14.1"

Field experiment No. 48—1969 yield trial—10 acres—Salawa Estate (L. B. Chandrasekera & U. K. D. Lewis)

Clones RRIC 45, 100, 101 and AVROS 1734 were planted in October 1969 at 135 trees per plot replicated three times.

Field experiment No. 51—1966 yield trial—10 acres—Dalkeith Group (L. B. Chandrasekera & U. K. D. Lewis)

Clones RRIC 45, 75, 88 and 89 are planted at 150 trees per plot replicated three times.

Average girth :- RRIC 45 — 10.1" RRIC 88 — 9.4"
(1970) RRIC 89 — 10.1" RRIC 75 — 10.3"

Field experiment No. 36—1966 yield trial—10 acres—Malaboda Estate (L. B. Chandrasekera & D. R. Colonne)

Clones RRIC 45, 86, 88 and RRIM 701 are planted at 135 trees per plot replicated three times.

Average girth :- RRIC 45 — 14.0" RRIC 86 — 14.9"
(1970) RRIC 88 — 14.8" RRIM 701 — 15.0"

Field experiment No. 37—1966 yield trial—10 acres—Udapolla Group (L. B. Chandrasekera & D. R. Colonne)

Clones RRIC 5, 45, Nab 15 and RRIM 701 are planted at 150 trees per plot replicated three times.

Average girth :- RRIC 5 — 11.7" RRIC 45 — 10.2"
(1970) RRIM 701 — 9.3" Nab 15 — 12.3"

Field experiment No. 41—1966 yield trial—20 acres—Yatawatta Estate (L. B. Chandrasekera & D. R. Colonne)

Clones RRIC 36, 41, 86 and PB 86 are planted at 265 trees per plot replicated three times.

Average girth :- RRIC 36 — 11.4" RRIC 41 — 13.6"
(1970) RRIC 86 — 12.4" PB 86 — 12.2"

Field experiment No. 44—1967 yield trial—10 acres—Udapolla Group (L. B. Chandrasekera & D. R. Colonne)

Clones RRIC 36, 45, 89 and RRIM 600 are planted in 135-tree plots replicated three times.

Average girth :- RRIC 45 — 9.4" RRIC 36 — 8.6"
(1970) RRIC 89 — 9.0" RRIM 600 — 9.4"

Field experiment No. 45—1967 yield trial—10 acres—Zion Estate (L. B. Chandrasekera & D. R. Colonne)

Clones RRIC 36, 45, 89 and PB 86 are planted in 175-tree plots replicated three times.

Field experiment No. 49—1969 yield trial—27 acres—Vogan Group (L. B. Chandrasekera & D. R. Colonne)

Clones RRIC 45, 88, 89, 90, 91, 100, 101, RRIM 600 and PB 86 are planted at 165 trees per plot replicated three times.

Field experiment No. 57—1970 yield trial—10 acres—Govinna Estate (L. B. Chandrasekera & D. R. Colonne)

Clones RRIC 45, 100, 101 and AVROS 1734 are planted in May 1970 at 150 trees per plot replicated three times.

Intercropping trials

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

Clones RRIC 45, 52 and PR 107 were 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. Cacao was planted in a single row between the rubber rows at a spacing of 12 ft within the row when the rubber was four years old. Under the dry climate of this district better establishment of cacao was obtained when the rubber was five years old.

The average girth of rubber at six years of age are given below :—

Average girth :-	RRIC 52 — 13.9"
(1970)	RRIC 45 — 11.7"
	PR 107 — 11.1"

The slow growth rate of rubber is characteristic of the climatic conditions of this district.

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

The clone RRIC 45 was planted in replicated plots of 250 trees per plot at spacings of 12' × 20' and 20' × 20'. The plots with reduced stands of rubber 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 in the field. The average girth of these buddings, at 4½ years of age, is summarized in Table 20.

TABLE 20
Average girth in in.

Seedling stock/clone	Scion/clone	Average girth in in.
RRIC 7	PB 86	18.4
RRIC 88	"	18.0
RRIC 86	"	17.9
RRIC 52	"	17.9
RRIC 41	"	17.9
Tjir 1	"	17.0
RRIC 89	"	16.2
<i>H. spruceana</i>	"	13.8

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

In this trial, seedling stocks of clones RRIC 7, 41, 52, 86, GI 1, Wagga 6278 and Tjir 1 were budded with clone RRIC 45 and planted in May 1968 as randomized single tree plots. The average girth of the trees, at 2½ years of age, is presented in Table 21.

TABLE 21
Average girth in in.

Seedling stock/clone	Scion/clone	Average girth in in.
GI 1	RRIC 45	6.1
RRIC 7	"	5.9
RRIC 41	"	5.9
RRIC 52	"	5.9
Tjir 1	"	5.9
RRIC 86	"	5.7
Wagga 6278	"	5.6

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

Clone RRIC 45 is 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 1½ years of age, is summarized in Table 22.

TABLE 22
Average girth in in.

Seedling stock/clone	Scion/clone	Average girth in in.
RRIC 5	RRIC 45	3.9
RRIC 41	"	3.9
RRIC 89	"	3.9
RRIC 52	"	3.8
RRIM 623	"	3.8
Tjir 1	"	3.8

Other investigations

Tissue culture (R. Satchuthananthavale, I. Amarasinghe & G. de Mel):- Experiments were initiated to culture *Hevea* pollen grains in artificial media in order to explore the possibilities of raising haploid plants. Pollen grains were aseptically removed from *Hevea* flower buds and inoculated on an agar medium similar to that recommended by Nitsch (1969).● No cell divisions were observed in this medium.

On White's medium (White, 1954) meristems of apical and axillary buds remained viable for over six weeks, but failed to develop further.

Analysis of polyphenols in leaf extracts (R. Satchuthananthavale, V. Satchuthananthavale & D. M. Dantanarayana):- Methanoloic extracts of leaves of clones PB 86, RRIC 52, Mil 3/2, Wagga 6278 and Tjir 1 were analysed by thin-layer chromatography on cellulose-coated plates for polyphenols. Variations in phenolic pattern of the leaf extracts were noted among the clones tested.

Bacterial coagulation of latex (R. Satchuthananthavale & I. Amarasinghe in collaboration with V. Satchuthananthavale & M. Nadarajah):- Twelve species of bacteria were isolated from (a) rubber serum, (b) pre-coagulated field latex, and (c) coconut water exposed to natural contamination.

Selections based on their ability to coagulate latex were cultured on a pure coconut water medium and used to coagulate field latex at initial concentration. The time of coagulation was controlled by seeding field latex with specific strains of bacteria. More than 99% coagulation was achieved in four to five hours with three of the twelve species tested. These bacteria, being both acid and gas producers, the coagula obtained were spongy and porous.

In technological properties the bacterially-coagulated rubbers compared favourably with auto-coagulated and acid-coagulated rubbers at initial concentration. The bacterially-coagulated rubber was of a lighter colour and was not malodorous like the auto-coagulated rubber.

In a small scale experiment carried out in Dartonfield it was observed that coagulation of latex in collecting cups could be achieved by adding a sufficient quantity of bacterial culture (10—20 ml per cup) into the cups at the time of tapping. Near complete coagulation was observed by 4 p.m. the same day, with the result that tapping and collection of cup coagula could be carried out the same day. The use of expanded polystyrene rainguards, fixed above the tapping cuts, gave fairly good protection from rain washout during light showers.

Experiments are in progress in collaboration with the Rubber Chemistry Department and the Ceylon Institute of Scientific & Industrial Research to develop a cheap rubber rainguard.

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 summarizing and analysing of all data from field experiments.

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REVIEW OF THE GENETICS & PLANT BREEDING DEPARTMENT

BY
D. M. FERNANDO

SUMMARY

Analysis of a population of Tjir 1 seedlings revealed a strong correlation between germination period and growth.

A major advance in early selection was effected by the discovery of cotyledonary oil content as an inverse early index of yield : this is the first statistically significant parameter in this connection; preliminary findings were described at the Ceylon Rubber Conference.

Clone RRIC 102 was brought into tapping in replicated 30-tree blocks at Kuruwita and Matale and confirmed earlier observations of high yield, vigour, and resistance to *Oidium* leaf disease.

Adverse weather conditions lowered the fruit-set in the hand pollination programme: this was countered this year by a collection of 3000 seed from 30 sources for selection of " elite " plants.

Progeny of *Microcylus*-resistant introductions crossed to Eastern parents showed satisfactory yields.

DETAILED REVIEW

General

The first larger scale plots of one of the new clones, viz. RRIC 102, showed satisfactory yields and foliage at Matale at an elevation above 1000 ft: the second year yields of the large scale plots at Kuruwita were also satisfactory. Some of the first replanting permits for plantings over 1000 ft were issued on the basis of this clone. Reversion of the plots of RRIC 100 and RRIC 101 to S/2, d/3, 67% showed improved yields in 1970.

A major break-through in the early evaluation of rubber seedlings was achieved by the discovery of the high heritability of the oil content of cotyledons of young seedlings and its statistically significant inverse relationships to growth and yield. As an initial development of this technique 3000 clonal seedlings from 30 different sources were collected and arranged for individual measurement of oil content of cotyledons, growth and final selections: the possibility of establishing a statistically significant stock suitability by this method is also being examined. Other parameters in a population of Tjir 1 seedlings were studied and preliminary criteria of stock suitability were determined.

Staff

The Head of the Department, Mr. D. M. Fernando and the Research Assistant, Mr. N. E. M. Jayasekera, were on duty throughout the year. Mr. C. M. B. Ratnayake was appointed Research Assistant and commenced duties from 1st July.

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.

Technical Assistant, Mr. P. Munasinghe resigned with effect from 6.10.70 to join the teaching profession.

Visits

The Head of the Department made 41 visits and the rest of the staff made 231 visits in connection with experimental work.

Meetings

The writer attended one Kelani Valley District Planters' Association meeting and spoke on new *Hevea* clones. One Sabaragamuwa District Planters' Association and one Kalutara District Planters' Association were also attended.

Publications

The following publications were contributed by the Department :—

- (i) Annual Review of the Department for 1969
- (ii) Annual Report of the Department for 1969
- (iii) Fernando, D. M. (1970). Breeding for multiple characters of economic importance in *Hevea*—preliminary assessment of recent selections. *Q. Jl. Rubb. Res. Inst. Ceylon* **46**, 7—19. (Reprinted from *J. Rubb. Res. Inst. Malaya* **21**, 27—37.
- (iv) Fernando, D. M. and Wijesinghe, W. A. C. (1970). Some features of the growth and yields of RRIC 100. *Q. Jl. Rubb. Res. Inst. Ceylon*, **46**, 78—87.
- (v) Fernando, D. M. and Tambiala, M. S. (1970). A study of the significance of latex in *Hevea*. *Q. Jl. Rubb. Res. Inst. Ceylon* **46**, 69—77.
- (vi) Fernando, D. M. and Tambiah, M. S. (1970). Sieve tube diameters and yields in *Hevea* spp. — a preliminary study. *Q. Jl. Rubb. Res. Inst. Ceylon* **46**, 88—92.
- (vii) Fernando, D. M. (1970). The growth and yields of RRIC 102. (Read at the Ceylon Rubber Conference).
- (viii) Fernando, D. M. and De Silva, M.S.C. (1970). A new basis for the selection of *Hevea* seedlings. (Read at the Ceylon Rubber Conference).
- (ix) Jayasekera, N. E. M. and Senanayake, Y. D. A. (1970). A study of growth parameters of a population of nursery rootstock seedlings of *Hevea brasiliensis*, cv. Tjir 1. (Read at the Ceylon Rubber Conference).
- (x) Senanayake, Y. D. A. and Samaranayake, P. (1970). Intraspecific variation of stomatal density in *Hevea brasiliensis* (Muell. Arg.). *Q. Jl. Rubb. Res. Inst. Ceylon* **46**, 61—68.

Buildings and facilities

Equipment was moved in and installed in the new set of rooms at Nivitigalakele. Considerable progress was made in studies which had slowed down owing to previous lack of space and mains current.

Clone evaluation

The adoption of a lowered tapping intensity on RRIC 100 and RRIC 101 in 1970 resulted in an improvement of per tapping yields: it would appear that clones yielding over 70 g per tree per tapping in the first five years of tapping (*i.e.*, with an expectancy over 1400 lb per acre on d/3) should preferably be maintained on this system unless further large scale trials show otherwise.

Clone 1103 was registered as RRIC 102. Substantial confirmation of satisfactory growth and yields was obtained from 30-tree plots of this clone which came into tapping; satisfactory yields were also obtained from 30-tree plots at 1400 ft elevation in the Matale District. After a lapse of nearly thirty years this constitutes the first success in establishing a clone at the higher elevations, with adequate resistance to *Oidium* leaf disease, and satisfactory growth and yields on twin 30-tree plots, parallel with high yields from similar large scale plots in the low country. Nucleus budwood was released to a number of commercial estates towards the end of the year from experimental budwood nurseries. The yields of some clones in some of the plots and the corresponding controls are shown in Fig. 1 (D. M. Fernando).

Laboratory studies

In view of the unusual inverse relationships of rubber seed oil to growth and yield, attention was directed towards fractionation of this oil by paper chromatography and screening of its components for stimulatory or inhibitory activity (D. M. Fernando & C. M. B. Ratnayake).

Seedling variability trials

Tjir 1 seedlings (N. E. M. Jayasekera & Y. D. A. Senanayake)

The first year's findings on the variability of a large population of Tjir 1 seedlings were analysed and presented at the Ceylon Rubber Conference. A strong correlation was detected between germination period and growth: this would facilitate selection of stocks.

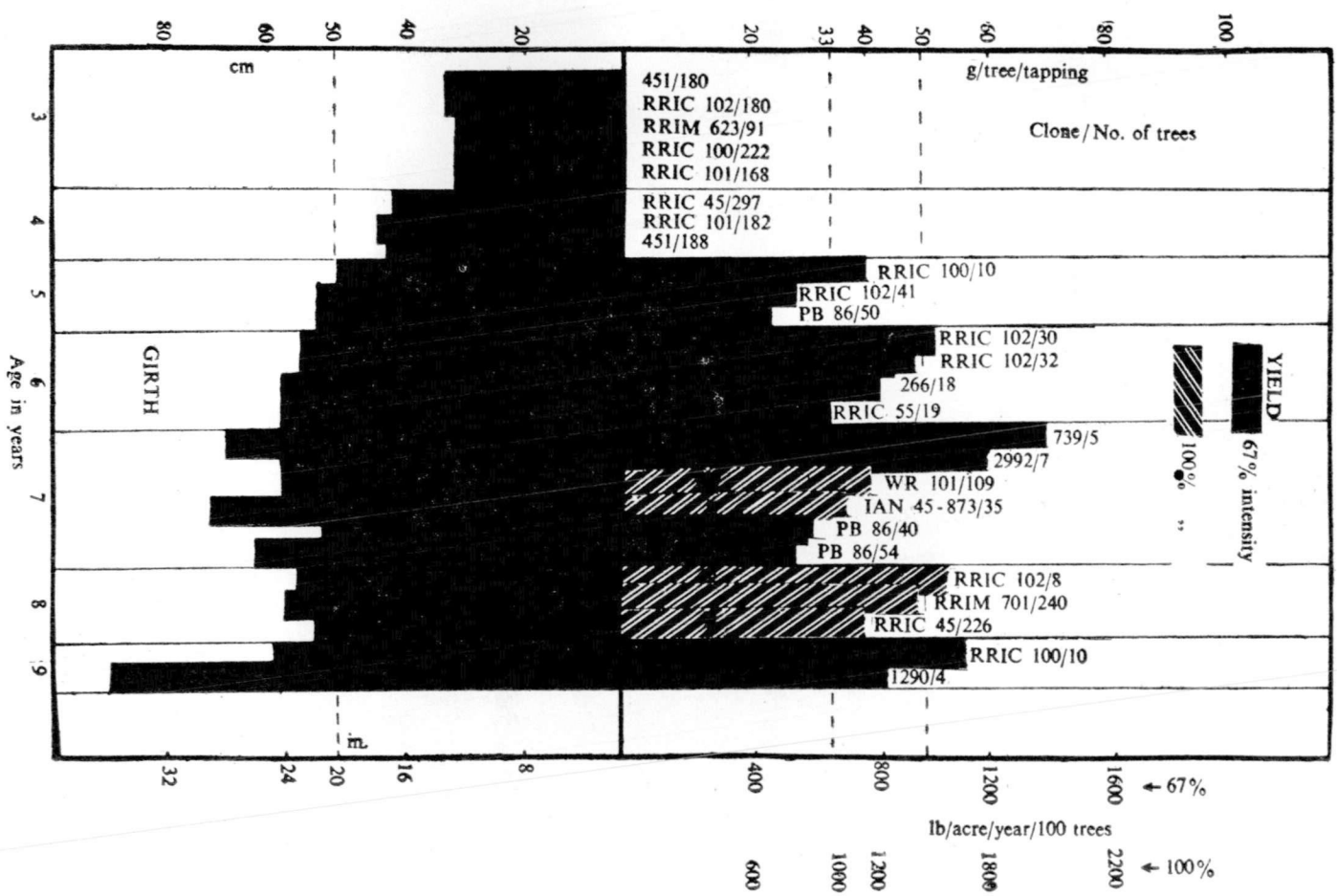
Early yield indices (D. M. Fernando, M.S.C. de Silva & P. Samaranayake)

Studies on the variability of seedlings from RRIC 52, RRIC 36, Tjir 1, RRIM 513 and PB 86 were completed for the first year of growth and also presented at the Ceylon Rubber Conference. The discovery of the high heritability of cotyledonary oil and its inverse relationship to growth and yield constitutes a major advance in improvement of the crop. The first results from the progeny of seven clones were followed up by seed collection from thirty known sources for an initial development of 'elite' seedling material from which rigid selection for later budgrafting could be effected.

Artificial pollination programme

Recently developed clones are now used in the hand pollination programmes. As these clones are subject to early opening of tapping cuts and are still below ten

Fig. 1 YIELDS AND GIRTHS OF SOME OF THE NEWER CLONES



years of age the formation of flowers is much less than in older trees. As selection for yield also tends to move towards lower fertility the number of successful pollinations achieved tends to lessen each year. On the other hand much more detailed study is now possible for selection. Ideal weather for *Phytophthora* attack also lowered fruit-set in 1970. Viable seedlings of only two families viz. 506 × IAN 45—710 yielding 34 seedlings and 506 × IAN 45—873 yielding three seedlings were obtained. A total of 5703 hand pollinations were carried out during the season (D. S. Gamage & B. M. S. G. Peiris).

Releases to estates

Budwood of RRIC 100, 101 and 102 was supplied to supplement Estate Department releases (S. S. Senaratne & W. A. C. Wijesinghe).

Plot size and yield

In view of the increased uniformity of growth and yield observed in modern clones an experiment was carried out to estimate possible error in our plot sizes. Individual yield records of six 25-tree blocks, three blocks per clone, were utilized to obtain the result given in Table 1 (Y. D. A. Senanayake, D. M. Fernando & G. A. J. P. R. Gunasekera).

TABLE I
MINIMUM PLOT SIZE
(Tapped 2S/2, d/4, 100%; yield in g/tree/tapping both cuts)

	RRIC 45	RRIC 36	PB 5/51
Mean yield in g	55.6	38.5	32.9
Standard error	2.55	1.52	1.16
Coefficient of variation %	39.78	34.34	30.51
Error on average yield	Number of trees		
2%	1561	1153	930
4%	390	288	233
5%	249	185	149
8%	98	72	58
10%	63	47	37
12%	43	32	26
15%	28	20	17
17%	21	16	13
20%	16	12	9
25%	10	7	6
30%	7	5	
35%	5		

Earlier measurements of the coefficient of variation of RRIC 100 and RRIC 102 have shown relatively low values: an error of only 10% can therefore be reasonably expected from the 30 to 100-tree plots coming into tapping. An error of 10 to 20% could similarly be attached to ten and fifteen-tree plots of clones on test which are relatively uniform in growth and yield.

Disease resistance

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

The yields of RRIC 102 (Table 2) at Matale compared satisfactorily with those obtained at Dartonfield and Kuruwita: the foliage was satisfactory and growth was superior to the adjacent PB 86 trees planted in the same area. The yields of the area were low as a whole, as tapping cuts were newly opened and are expected to improve considerably in 1971.

TABLE 2
1963 CLONE TRIAL—MATALE
(Tapped S/2, d/3, 67% from May 1970)

Clone	Parentage	Trees tapped	Girth in cm	Yield in g/tree/tapping
RRIC 102	RRIC 52 × RRIC 7	34	47.4	15.4
1108	„ × „	23	45.8	10.6
815	PB 5/139 × RRIC 52	22	50.8	11.3

Colletotrichum (formerly *Gloeosporium*) (*N. E. M. Jayasekera & H. B. H. de Silva*)

Some leaf fall was observed on PB 86 trees. The test clones were free of *Colletotrichum* except RRIC 50. Some branch canker was noted on clone 79. The yields for the first year of tapping are given in Table 3. A very symmetrical distribution of leader branches was observed on clone 3229.

TABLE 3
1964 CLONE TRIAL—NAKIADENIYA GROUP
(Tapped S/2, d/2, 100% from May 1970)

Clone	Trees tapped	Girth in cm	Yield in g/tree/tapping		
IAN	6505	2	47.3	26.4	
	1923	19	54.3	22.5	
	3221	10	55.8	22.5	
	6338	5	49.5	22.1	
	815	10	57.3	21.7	
	79	21	51.8	21.0	
	1108	10	53.8	20.8	
	3202	20	60.3	20.8	
	3229	4	51.5	20.0	
	PB	86	2	41.8	19.8
		50	7	43.8	17.7
RRIC	2018	20	56.5	17.5	
	3189	8	53.5	16.0	
	687	4	51.5	15.6	
	2040	15	54.5	15.5	
IAN	6585	9	71.3	15.0	
	864	9	49.8	14.1	

Phytophthora (*D. M. Fernando*)

Selfed progeny of RRIC 52 in the 1963 clearing at Kuruwita showed lowered yields this year. RRIC 101 showed a very poor fruit-set indicating suitability for wet areas. Not much leaf fall was detected on the relatively large scale plots of RRIC 102.

Microcyclus (*formerly Dothidella*) (*D. M. Fernando, D. S. Gamage & W. D. Armon*)

IAN 45—873 showed satisfactory yields and girth as shown in Table 4.

TABLE 4
1960 CLONE TRIAL—PEENKANDE
(Tapped 2S/2, d/4, 100%)

Clone	Trees tapped	Girth in cm		Yield per average cut in g/tree/tapping			
		1969	1970	1967	1968	1969	1970
IRCI 7	37	67.5	69.2	32.1	46.4	48.6	39.8
PR 228	32	62.9	64.9	35.5	33.7	36.3	33.4
AVROS 385	25	68.3	71.2	19.2	24.0	27.6	33.0
IAN 45—873	35	72.6	73.8	33.2	38.5	38.5	33.4
C 695	35	60.9	61.9	27.2	29.9	38.5	32.7
AVROS 427	26	55.8	56.5	47.3	34.6	28.3	30.9
FX 2261	36	63.5	64.0	22.4	36.3	37.2	30.5
PB 86	40	63.2	65.4	26.1	28.3	26.4	29.8
RRIC 86	17	60.9	63.5	16.2	22.7	25.4	29.5
IAN 45—710	37	65.2	66.5	23.4	25.9	32.1	28.8
IAN 45—717	36	65.0	67.9	23.6	30.2	33.0	29.9
TR 1548	31	65.2	67.1	21.3	22.9	24.4	26.4
FX 3810	38	70.3	74.9	19.1	22.2	25.4	22.5
Harbel 1	29	57.9	58.4	24.2	15.3	21.3	22.1
IRCI 10	31	56.8	57.9	15.5	21.9	26.6	21.8
ST 71	34	59.4	59.9	21.6	23.2	19.8	17.9
OY 1	26	55.6	57.3	8.7	12.0	12.0	9.6

The long awaited answer to the question of economic cultivars stemming from the low-yielding SALB-resistant trees was answered in the 1965 small scale trial at Dartonfield. Three replications of five plants each were planted in this trial with 30 distributed plots of RRIC 45 as a control. As shown in Table 5a F₁ hybrid, 5326, showed yields similar to RRIM 623. FX 4098 and FX 516 progeny, 2417 and 6306, showed yields and vigour close to that of the higher-yielding newer clones such as RRIC 102 planted in the same area. It is expected that the yields would improve considerably in the second and third years of tapping on these clones.

TABLE 5
1965 SMALL SCALE CLONE TRIAL—DARTONFIELD
(Tapped S/2, d/3, 67% from April 1970)

Clone	Parentage	Trees tapped	Girth in cm	Yield in g/tree/tapping
RRIC 102	RRIC 52 × RRIC 7	4	49.7	25.8
6306	RRIC 36 × FX 516	7	47.9	23.9
3164	LCB 1320 × RRIC 51	4	55.4	22.0
2417	RRIC 45 × FX 4098	5	49.8	21.7
1461	RRIC 52 × T 792	10	55.0	20.0
RRIC 45	RRIC 8 × Tjir 1	80	48.0	18.7
1330	RRIC 52 × PB 86	12	54.4	17.0
2416	RRIC 45 × FX 4098	13	54.6	16.7
RRIM 623	PB 49 × PIB 84	9	48.9	16.2
5326	RRIC 51 × F 4542	11	48.8	16.2
788	PB 5/139 × RRIC 52	13	54.9	16.0
2473	RRIC 45 × IAN 45/873	11	48.8	14.8
6182	PB 28/59 × IAN 45/873	11	50.8	14.7
2885	Ch 26 × RRIC 52	10	56.8	14.6
IAN 45—710	PB 86 × F 409	4	44.9	13.7
5352	RRIC 52 × IAN 45—710	13	52.6	13.6
691	PB 86 × RRIC 52	4	50.6	13.1

One or two trees of the three-tree plots planted at Matale at an elevation of 1400 ft, under environmental conditions very different to Kalutara, were also opened in 1970. Clones showing promise of satisfactory yields are listed in Table 6. Yields of 1108 are similar to those of PB 86 in the low country and has been shown as the control. Of these clones three 25-tree plots of clone 2427 have been planted in the same location in 1965 and would be expected to come into tapping in 1972.

TABLE 6
1963 CLEARING—HAPUGASPITIYA
(Tapped S/2, d/3, 67% from May 1970)

Clone	Parentage	Trees tapped	Girth in cm	Yield in g/tree/tapping
2418	RRIC 45 × FX 4098	1	44.8	16.0
2464	RRIC 88 × FX 4098	1	47.0	13.2
2425	RRIC 45 × FX 4098	1	47.0	10.0
2458	RRIC 88 × FX 4098	1	42.0	11.0
2427	RRIC 45 × FX 4098	1	45.4	17.4
2414	RRIC 45 × FX 4098	1	42.5	10.7
1108	RRIC 52 × RRIC 7	23	45.8	10.6
2483	RRIC 45 × IAN 45—873	2	46.4	10.2

Clone trials

Field experiment No. 1—1961 small scale clone trial—Kuruwita (W. A. C. Wijesinghe & B. M. S. G. Peiris)

This clearing was reverted to S/2, d/3 tapping in 1970 and yields per tapping showed improvement. Clones 734 and 1290 showed a very satisfactory increase of girth combined with high yields. Considering the increased profitability achieved by early opening the yields of the selected clones as shown in Table 7 are promising. Initially higher-yielding clones such as RRIC 100 and 101 showed slower rates of recovery and third-daily tapping is clearly indicated for the first five years of tapping of high-yielding material.

Towards the middle of the year some trees which were too low-yielding for test tapping were increased to 133% intensity if sufficiently well grown. The yields on this basis improved but it is too early to assess the value of this material.

TABLE 7
(Tapped 67% in 1966 and 1967, 100% in 1968 and 1969, 67% in 1970)

Clone	Trees tapped	Girth in cm		Yield in g/tree/tapping				
		1969	1970	1966	1967	1968	1969	1970
RRIC 100	10	61.8	64.9	34.0	66.5	91.2	63.7	58.6
RRIC 100	4	61.5	65.3	39.5	75.5	87.3	67.3	78.5
RRIC 101	7	64.1	65.6	64.4	76.3	47.9	56.5	46.1
734	9	74.8	80.2	28.8	42.9	58.7	52.6	68.4
1152	7	65.7	70.4	35.8	61.9	67.4	49.6	66.6
1152	5	64.4	70.1	33.3	61.8	47.8	48.7	55.9
1305	6	73.1	77.5	44.2	48.6	64.7	73.8	51.4
1305	3	80.1	85.3	57.5	70.9	62.6	66.1	104.9
1290	4	81.4	87.1	28.9	38.4	53.8	62.2	44.1
1290	4	79.2	83.3	33.6	54.7	53.8	58.1	62.6
1222	4	66.3	70.4	41.4	47.1	66.0	63.4	50.7
82	9	71.8	73.0	27.5	45.9	46.3	40.6	52.2
1157	7	68.0	71.3	38.8	78.1	76.2	63.3	86.9
1167	7	56.5	58.4	—	52.4	58.2	33.0	42.0
1167	3	71.9	75.9	62.0	66.5	45.8	58.2	72.4
1177	5	67.0	69.4	35.3	45.7	68.9	54.0	53.8
1177	4	64.2	67.5	—	52.9	52.5	45.3	54.4
724	10	76.3	80.8	32.4	37.8	50.3	46.2	54.5
724	4	58.0	58.8	29.6	44.2	50.5	49.1	47.7
266	9	70.6	72.5	30.3	55.3	63.7	53.7	38.9
266	5	68.0	68.5	47.7	60.8	81.8	69.8	63.6
254	7	76.3	80.8	33.0	43.1	45.4	41.3	66.3
254	3	79.2	86.8	46.4	31.7	58.1	61.0	83.3
359	6	69.9	73.7	30.6	42.5	88.8	79.0	70.8
359	2	75.4	80.3	—	—	67.0	76.0	75.9
708	4	63.7	68.5	43.8	57.9	68.1	64.6	87.4
PB 86	74	66.0	67.8	26.0	30.1	35.0	37.8	40.2

Field experiment No. 3—1962 clone trial—Kuruwita (W. A. C. Wijesinghe)

This clearing was tapped on S/2, d/2, 100% in 1970 and the yields are shown in Table 8. RRIC 701 showed the best yield but was found susceptible to *Colletotrichum* leaf fall. RRIC 623 showed branch break. WR 101 and RRIC 45 exhibited the best combination of yields and secondary characters up to the second year of tapping in this trial.

TABLE 8
(Tapped S/2, d/2, 100%)

Clone	Plot size	Trees tapped	Girth in cm		Yield in g/tree/tapping	
			1969	1970	1969	1970
RRIM 701	300	240	60.5	62.6	32.1	51.7
RRIM 623	300	237	58.0	63.2	46.5	49.7
RRIM 707	300	228	53.4	60.3	—	47.6
PR 228	150	116	53.4	56.2	37.8	46.9
WR 101	150	109	58.1	59.9	40.9	45.6
RRIC 45	300	226	54.0	56.7	36.9	39.6
RRIC 37	150	108	55.9	58.6	27.5	38.7
TR 3702	300	221	54.3	57.9	38.0	38.5
RRIM 628	150	138	45.2	57.3	52.2	38.0
RRIC 36	300	200	52.8	55.7	35.3	37.3
RRIC 7	150	112	50.9	57.8	43.7	37.0
IRCI 7	150	113	53.4	56.3	39.5	36.9
PR 259	150	92	47.7	51.1	35.0	36.3
IRCI 9	150	103	50.6	54.3	35.8	34.5
RRIC 41	150	116	60.0	63.1	34.1	32.0
PB 86	300	185	50.9	56.7	30.0	31.9
RRIM 607	300	210	52.7	57.3	24.9	31.4
RRIC 14	300	202	51.5	48.3	31.4	29.3
PR 251	150	113	52.2	55.5	39.3	26.6
IAN 45—717	300	229	53.0	55.8	21.0	25.1
TR 1548	300	239	54.3	57.8	25.0	22.4
AVROS 529	150	111	57.0	60.2	35.2	21.8
AVROS 2037	300	218	56.8	61.6	24.1	20.7
Harbel 1	300	230	49.4	54.0	30.8	20.6
IAN 6497	150	123	48.6	52.1	21.4	16.3
RRIC 52	300	269	61.9	53.7	10.2	14.8
RRIC 51	300	217	53.7	58.5	17.3	12.8

Field experiment No. 4—1962 small scale clone trial—Kuruwita (W. A. C. Wijesinghe)

This clearing was tapped on S/2, d/2, 100% in 1970. The yields of RRIC 102 continued to be very satisfactory as shown in Table 9.

TABLE 9
(Tapped S/2, d/2, 100%)

Clone	Parentage	Trees tapped	Girth in cm		Yield in g/tree/tapping		
			1969	1970	1968	1969	1970
RRIC 102	RRIC 52 × RRIC 7	8	57.6	60.3	58.3	48.5	55.3
2031	RRIC 52 × RRIC 7	10	62.5	67.2	36.5	31.3	43.8
2005	PR 107 × LCB 1320	10	55.6	56.2	51.7	39.5	43.7
1458	LCB 1320 × RRIC 7	10	58.1	60.9	48.6	38.9	42.8
PB 28/59	—	8	—	53.1	—	39.3	34.9
2028	RRIC 52 × RRIC 7	8	59.3	64.6	37.1	25.4	32.2
1317	RRIC 45 × LCB 1320	8	59.3	64.6	30.4	29.7	31.8
815	PB 5/139 × RRIC 52	10	62.3	66.7	28.0	27.9	31.1

Field experiment No. 5—1962 small scale clone trial—Nivitigalakele (D. S. Gamage)

The yields of RRIC 102 were satisfactory in this area. The yields are given in Table 10.

TABLE 10
(Tapped S/2, d/2, 100% from 1970)

Clone	Parentage	Trees tapped	Girth in cm		Yield in g/tree/tapping		
			1969	1970	1968	1969	1970
RRIC 82	RRIC 45 × RRIC 10	7	66.0	72.2	45.4	42.2	33.2
RRIC 102	RRIC 52 × RRIC 7	10	54.6	57.1	40.1	41.4	32.7
RRIM 607	Tjir 1 × PB 49	8	—	64.3	—	—	30.7
RRIC 45	RRIC 8 × Tjir 1	6	54.6	56.1	36.3	32.5	29.0
RRIC 7	—	7	—	53.8	—	—	26.8
1458	LCB 1320 × RRIC 7	8	54.9	54.4	38.6	39.3	23.3
815	PB 5/139 × RRIC 52	3	57.2	58.4	—	37.2	23.1
1317	RRIC 45 × LCB 1320	10	60.6	63.5	31.2	28.8	22.4
IAN 6497	IAN 2848 × PB 86	3	—	57.8	—	—	22.2
RRIM 707	RRIM 632 × Tjir 1	3	—	54.3	—	—	21.8
1009	T 170 × RRIC 52	10	—	61.3	—	—	21.1
RRIC 52	—	7	61.8	65.0	20.5	24.1	19.6
Harbel 1	—	5	—	50.5	—	—	19.1
566	RRIC 52 × PB 86	—	—	64.1	—	—	18.5
759	RRIC 52 × Tjir 1	—	—	67.4	—	—	13.5

Field experiment No. 6—1963 small scale clone trial—Kuruwita (W. A. C. Wijesinghe)

Clone 739 showed satisfactory yields and girth in 1970. The control clone PB 86 shows low yield on third-daily tapping but this intensity which would yield over 1000 lb/acre on 50 g per tree per tapping appears to be very necessary for high-yielding material brought early into tapping. The yields of all the clones are given in Table 11.

TABLE 11
(Tapped S/2, d/3, 67% all years)

Clone	Parentage	Trees tapped	Girth in cm		Yield in g/tree/tapping ⁷		
			1969	1970	1968	1969	1970
739	RRIC 52 × Tjir 1	5	62.6	68.2	21.0	44.3	70.8
2992	RRIC 36 × Ch 26	7	54.2	57.3	32.4	42.7	62.2
3279	Tjir 1 × LCB 1320	6	56.9	65.8	—	37.0	58.7
1620	Tjir 1 × LCB 1320	5	60.2	62.9	29.9	38.1	57.2
3076	RRIC 45 × Wagga 6278	6	52.2	55.8	—	36.2	56.7
2231	RRIM 513 × LCB 1320	10	55.0	57.3	25.2	42.1	53.6
3606	RRIC 45 × LCB 1320	2	65.3	72.9	—	39.2	50.4
3333	Ch 26 × RRIC 36	6	58.9	64.0	—	45.8	49.9
2284	RRIM 513 × RRIC 36	8	56.2	60.4	28.2	37.7	48.3
4011	RRIC 52 × RRIC 51	7	55.6	59.8	—low	—low	47.5
2228	RRIM 513 × LCB 1320	10	60.3	63.4	20.8	45.2	44.7
2053	RRIC 52 × RRIC 7	9	54.9	59.2	33.5	35.0	43.6
2994	RRIC 36 × Ch 26	8	57.6	62.0	32.7	35.6	42.0
T 132	RRIC 37 × Wagga 6278	7	54.4	60.1	31.7	37.8	41.1
GT 711	—	8	53.6	57.6	28.5	43.4	40.9
T 57	PR 107 × LCB 1320	9	48.4	50.2	—	34.5	40.4
1729	RRIC 51 × PR 107	8	51.4	52.8	—	36.0	38.5
4008	RRIC 52 × RRIC 52	10	59.7	64.9	20.8	24.3	32.8
PB 86	—	54	52.1	55.1	24.2	26.2	28.5
1501	RRIC 45 × GPM 1	10	50.7	55.4	19.4	36.5	28.0
3060	Ch 26 × Wagga 6278	7	60.0	66.4	33.1	38.3	18.7

Field experiment No. 7—1964 clone trial—Kuruwita (W. A. C. Wijesinghe)

RRIC 102 was tapped on a larger scale in this trial and the yields compared favourably with other selections established from the 1961 trial as shown in Table 12. The control PB 86 trees could not be brought into tapping at the same time except for two trees: but these yields and those of another established clone RRIC 55 were far below the newer selections.

TABLE 12
(Tapped S/2, d/3, 67%)

Clone	Parentage	Trees tapped	Girth in cm		Yield in g/tree/tapping	
			1969	1970	1969	1970
6333	LCB 1320 × RRIC 7	9	57.2	62.2	27.3	61.9
RRIC 102	RRIC 52 × RRIC 7	30	55.8	58.5	26.8	45.3
RRIC 102	„ × „	32	—	58.5	—	43.4
6323	LCB 1320 × RRIC 7	27	—	53.3	—	44.5
266	Mil 3/2 × Tjir 1	18	54.0	60.5	20.3	41.6
6328	LCB 1320 × RRIC 7	27	50.7	53.4	23.8	39.6
6326	„ × „	25	52.3	54.3	23.5	39.2
6310	„ × „	26	50.6	52.9	20.0	36.2
1152	RRIC 45 × RRIC 13	18	55.3	58.4	21.6	32.5
PB 86	—	2	—	48.8	—	25.3
RRIC 55	—	19	—	57.5	—	29.4

Field experiment No. 9—1965 small scale clone trial—Moneragala (S. S. Senaratne)

Clones 451 and 1305 maintained the best growth in this area.

Field experiments Nos. 11 and 12—1966 clone trials—Kuruwita and Nivitigalakele (W. A. C. Wijesinghe & D. S. Gamage)

A Morris-Mann test carried out in this area showed that clone 451 had a significantly higher yield potential than RRIC 101 or RRIC 45. The first year yields expected in 1971 on a 300-tree plot basis should be of great interest as the first of the new series to come into tapping on a relatively large scale. The girth of RRIC 45 compared well with the test clones and the response of the clones to early tapping should be interesting. The girths are given in Table 13.

TABLE 13
KURUWITA

Clone	Trees	Replic. plots	Girth in cm	
			1969	1970
RRIC 45	297	4	29.8	40.2
RRIC 101	182	3	33.9	42.3
451	188	3	31.3	40.9
828	250	3	31.7	38.6
1004	220	4	28.8	34.3

NIVITIGALAKELE

Clone	Trees	Replic. plots	Girth in cm	
			1969	1970
RRIC 45	195	3	—	32.2
451	250	3	—	37.7
1004	202	3	—	33.2

Field experiment No. 15—1967 small scale clone trial—Kuruwita (B. M. S. G. Peiris)

A Morris-Mann test was also carried out in this area with RRIM 623 as a relatively rigorous control. Two clones, 8501 (RRIC 52 × FX 360) and 7281 (IAN 45—873 × RRIC 52), appeared amongst the first five selections. A relatively high level of yield was also shown by 5682 (FX 25 × Ch 26), 8926 (RRIC 45 × IAN 6167), 10570 (RRIC 45 × PB 28/59) and 10727 (RRIC 52 × PB 86). More profuse flowering in the course of the next few years should make it possible to effect a suitable double-cross for possibly polygenic SALB resistance at a high level of yield. In Table 14 the girths of the three best plots of the control clone RRIM 623 are given for comparison.

TABLE 14

Clone	Parentage	Trees	Girth in cm
7281	IAN 45-783 × RRIC 52	6	29.9
7281	„ × „	5	25.6
7281	„ × „	10	21.0
8501	RRIC 52 × FX 360	7	29.9
8501	„ × „	6	30.9
10570	RRIC 45 × PB 28/59	10	27.3
10570	„ × „	9	33.3
10570	„ × „	10	35.1
10727	RRIC 52 × PB 86	6	33.5
10727	„ × „	8	28.2
10727	„ × „	2	36.0
RRIM 623	—	6	28.6
RRIM 623	—	7	26.6
RRIM 623	—	7	25.7
5682	FX 25 × Ch 26	8	30.2
5682	„ × „	6	29.3
8926	RRIC 45 × IAN 6167	9	24.3
8926	„ × „	6	24.0
8926	„ × „	10	26.7

Appreciable reduction of the proportion of wintered leaf was observed in 8501.

Field experiment No. 16—1967 clone trial—Gikiyanakande (S. Dedduvakumara)

The growth was satisfactory and clone 451 showed the best growth. RRIC 102 was slightly less vigorous than the control RRIM 623. The results are shown in Table 15.

TABLE 15

Clone	Trees	Plot No.	Girth in cm
RRIM 623	91	1	31.0
RRIM 623	134	6	30.5
RRIM 623	123	8	32.2
RRIC 102	101	2	29.4
RRIC 102	180	10	32.4
451	153	3	33.5
451	168	5	31.9
451	180	11	32.4
1004	126	4	30.8
1004	108	7	30.2
1004	137	9	33.1

Field experiment No. 17—1967 clone trial—Peenkande Group (W. D. Armon)

Relatively large scale replicated plots of RRIC 100 and RRIC 101 showed growth equivalent to the control RRIM 623 and superior to RRIC 45. The girths of the different plots are given in Table 16.

TABLE 16

Clone	Trees	Plot No.	Girth in cm
RRIC 100	146	3	20.3
RRIC 100	222	13	20.1
RRIC 100	175	17	18.1
RRIC 101	168	5	20.2
RRIC 101	181	14	22.6
RRIC 101	154	16	19.1
RRIC 101	74	18	22.9
815	156	6	23.2
815	214	10	24.2
815	119	12	25.2
RRIC 45	167	2	15.4
RRIC 45	64	7	13.7
RRIC 45	180	11	16.6
1004	213	1	21.4
1004	151	8	17.7
1004	154	19	23.2
RRIM 623	168	4	20.0
RRIM 623	121	9	17.7
RRIM 623	220	15	18.5

Field experiment No. 19—1967 N. E. planting—Hedigalla (W. D. Armon)

RRIC 101 and clone 451 showed satisfactory growth in this experiment planted as a fill-in series of observation plots. The girth measurements are given in Table 17.

TABLE 17

Clone		Trees	Plot No.	Girth in cm
RRIC	101	118	2	18.0
	451	117	1	20.0
	451	135	6	18.1
	1108	120	3	17.6
	1108	135	5	18.9
RRIC	45	114	4	16.4
RRIC	45	134	7	17.0
	1010	122	9	15.9

New trials

A fully randomized single tree plot trial was planted in 12 acres in the Sabaragamuwa District. A major portion of the area was damaged by cattle towards the end of the year but a small fenced area of 360 plants was retained for observations. A five-acre area in the Kalutara District was planted with clone 451 and budwood was released towards the end of the year for a second observation area of the same clone in the Kelani Valley District. Twenty yards of budwood of clone RRIC 102 were released for planting at Gampola.

Index to field experiments

<i>Field experiment No.</i>	<i>Description</i>	<i>Site</i>
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. & 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 clone trial	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

REVIEW OF THE PLANT PATHOLOGY DEPARTMENT

By

(MRS.) V. SATCHUTHANANTHAVALÉ

SUMMARY

Studies on the physiology of disease resistance indicate quantitative and qualitative differences in the phenolic pattern of the clones, susceptible and resistant to *Phytophthora* diseases.

Studies on the biology of *Phytophthora* spp. indicate that the two forms occurring on rubber appear to be the same, though variation is noted in their cultural characteristics and in their ability to produce oospores in single culture.

Studies on the survival of *Fomes lignosus* under different moisture levels show that the fungus would survive longer in wood pieces buried in dry soils than in moist soils. Treatment of dry, moist or wet soils with sulphur would eliminate the fungus from wood pieces of small volume. The action of sulphur could be attributed to its fungicidal effect. Roots with bark intact would harbour the fungus longer than roots devoid of bark in sulphur-treated soils.

Studies on mould contamination of rubber show that 60% relative humidity at room temperature would give good storage conditions for rubber sheets and under these conditions sheets would remain free of contamination for a long period. The conditions prevailing in most places where smoked sheets are stored are conducive to mould growth.

Three field experiments carried out for the control of *Oidium* leaf disease have confirmed the results of the previous year. Dusting of the tolerant clone PB 86 with sulphur, significantly reduced the disease while on the susceptible clone Tjir 1, the effect of sulphur dusting was not significant.

The results of the study of conidial concentration of *Oidium heveae* in the atmosphere, during the refoliation season were that hot, dry periods with bright sunny days are inimical to the fungus and continuous rains decrease the spore concentration in the atmosphere. It is suggested that the control of the disease be confined to periods of dull, cool, humid weather.

Three new field experiments were laid out for the control of *Fomes* root disease to study the effectiveness of collar protectant fungicides in the control of the establishment of *Fomes* patches in fields where sulphur was initially used to reduce the incidence in the early years of the replanting.

The incidence of all leaf diseases and of Bark Rot was mild during the period under review.

Phytophthora leaf disease incidence in Dartonfield is shown to follow the intensity of rainfall during the period when mature pods are available in the field.

An assessment of the incidence of *Oidium* leaf disease in the smallholdings showed that incidence is low or negligible in holdings situated at elevations under

300 ft above mean sea level and that control measures are not warranted in these areas. Disease incidence increases with the increase in elevation and sulphur dusting of clone PB 86 in these areas significantly reduces the disease.

An assessment of the use of fungicides for the control of Bark Rot in the Kalutara District shows that most estates indiscriminately use both watermiscible fungicides and waterproof panel dressings and such use for the control of Bark Rot is not justified.

DETAILED REVIEW

Staff

The Acting Head of the Department, Dr. (Mrs.) V. Satchuthananthavale, Technical Assistants, Messrs T. M. Fernando, W. C. Dayaratne, D. M. Dantanarayana, Z. E. Irugalbandara, L. Halangoda, R. D. Sebastian and S. S. Jayasooriya were on duty throughout the year.

Mr. A. de S. Liyanage, Assistant Plant Pathologist and Mr. H. L. Munasinghe, Senior Technical Assistant were on duty until they proceeded to England for post-graduate studies. Mr. Liyanage joined Wye College, University of London, for post-graduate research leading to a Ph.D. Mr. H. L. Munasinghe was successful in the M.I. Biology examination and joined the University of Exeter to follow the M.Sc. course in Plant Pathology.

In the absence of the Senior Technical Assistant, his duties were carried out by Mr. T. M. Fernando.

Mr. S. K. Samaraweera, Technical Assistant, was transferred to the Rubber Chemistry Department with effect from 2nd December, 1970.

Visits

Advisory	55
Experimental	483
Others	28

Following every advisory visit, a full report giving our observations and recommendations was sent to the estate concerned.

Meetings

The writer addressed one meeting of the Kelani Valley Planters' Association on White Root disease in young clearings. The Assistant Plant Pathologist, Mr. A. de S. Liyanage, addressed one meeting of the Sabaragamuwa Planters' Association on *Oidium* leaf disease.

Publications

The following papers were prepared by the members of the staff and presented at the Ceylon Rubber Conference held in September, 1970.

1. Black stripe or Bark Rot of *Hevea*.
V. Satchuthananthavale
2. Sulphur in the control of White Root disease.
V. Satchuthananthavale and L. Halangoda

3. Assessment of the incidence of *Oidium* leaf disease and economics of its control in smallholdings.
A. de S. Liyanage, O. S. Peries and R. D. Sebastian
 4. Black root disease of *Hevea* caused by *Xylaria thwaitesii*, diagnosis and control.
H. L. Munasinghe
 5. *Oidium* leaf disease—the effect of environment and control measures on incidence of disease and atmospheric spore concentration.
T. M. Fernando
 6. Mould contamination of rubber.
W. C. Dayaratne and H. L. Munasinghe
 7. * Bacterial coagulation of latex.
R. Satchuthananthavale and V. Satchuthananthavale
 8. * Possibilities of bacterial coagulation in raw rubber manufacture.
R. Satchuthananthavale, V. Satchuthananthavale, M. Nadarajah and I. Amarasinghe
- * These studies were carried out in collaboration with the Botany Department and the Rubber Chemistry Department.

Routine laboratory work

Diseased specimens: The following diseases and pests were identified on the plant parts of *Hevea* sent to the Institute for diagnosis:—

A. On <i>Hevea</i>	<i>No. of cases</i>
(a) <i>Fungi</i>	
<i>Oidium heveae</i> on leaves	1
<i>Fomes lignosus</i> on budded stumps	1
<i>Gloeosporium</i> spp. on leaves	1
<i>Phytophthora</i> spp. on bark	1
(b) <i>Other causes</i>	
Sun scorch	1
B. <i>Anacardium occidentale</i> (cashew)	
Leaf spot and dieback of shoots	1
C. <i>Elaeis guineensis</i> (oil palm)	
Young palm basal rot	1

Moulds (W. C. Dayaratne): The fungicide KM 9 was tested *in vitro* for fungitoxicity against four species of moulds isolated from prepared rubber. Spore germination of three species was completely inhibited at 0.5% level and that of *Aspergillus niger* was inhibited at 1% level.

Bark Rot (D. M. Dantanarayana): HOE 6006 was not toxic to *Phytophthora* spp. at the recommended strength but at a higher strength it inhibited the fungus. Trials are to be continued with a fresh sample of this product.

Laboratory investigations

Physiology of disease resistance (V. Satchuthananthavale & D. M. Dantanarayana): The studies on resistance of *Hevea* to diseases caused by *Phytophthora* spp. were carried out in collaboration with the Botanist, Dr. R. Satchuthananthavale.

Phenolic pattern of tissue samples of five different clones of *Hevea* is being studied using thin-layer chromatography. Quantitative and qualitative differences in the phenolic pattern of these clones were noted.

Survival of Phytophthora spp. in soil (A. de S. Liyanage & R. D. Sebastian): Soil samples were collected at monthly intervals at three different depths from three locations in Dartonfield, from July 1969 to June 1970, and were introduced into cacao pods for the isolation of *Phytophthora* spp. A total of six isolates was obtained for the whole period; two isolates in July, one in August and three in September and none during the rest of the period.

Nutritional requirements of Gloeosporium alborubrum (A. de S. Liyanage & R. D. Sebastian): Vitamin and carbon nutrition of one isolate of *G. alborubrum* was studied on glucose asparagine medium which was found to be the best of a number of basal media tested. This isolate did not require an external supply of the vitamins tested for growth. Ten monosaccharides and four disaccharides were tested as carbon sources.

Biology of Phytophthora spp. (V. Satchuthananthavale, D. M. Dantanarayana & S. S. Jayasooriya): In order to confirm the nomenclature of the species of *Phytophthora* occurring on rubber, a study of the single zoospore isolates of type culture 60 and its progeny was initiated to determine whether the type culture 62 was a variation of type culture 60 or a species by itself.

The results of the present study show that single zoospore isolates of culture 60 resembling culture 62 in their cultural characteristics do exist and the ratio of occurrence of 60: 62 types in three successive generations was 99: 1, 25: 1 and 11: 1, indicating an increase in 62 types in successive progenies of type culture 60. Compatibility and production of oospores in single culture by these isolates will be tested to confirm the variability among the type cultures.

Ten isolates of *Phytophthora* spp. occurring on *Hevea* which differed in cultural characteristics and in the production of sporangia and oospores were studied on solid media.

On lima bean agar, eight isolates of Group I and Group II produced sporangia in abundance at room temperature within a week of incubation. Two isolates produced very few sporangia later. Four of these isolates of Group II produced oospores in single culture. On malt agar, except one isolate the others did not produce any sporangia.

The length and breadth of sporangia, produced on lima bean agar by nine isolates; at room temperature, were measured. One isolate did not produce sufficient sporangia. The ratio of the range of breadth to length with the maximum is given in Table 1.

TABLE I

Number of isolates	First crop of sporangia produced	Range of ratio b : 1	Maximum number at
7	6 - 8 days of incubation	1 : 1.4 - 1.6	1 : 1.5
1	after the 8th day	1 : 1.2 - 1.4	1 : 1.3 - 1.4
1	before the 5th day	1 : 1.7 - 1.9	1 : 1.7

From these studies it is doubtful whether *Phytophthora* spp. occurring on rubber in Ceylon are two different species. With a view to confirming this, studies are being continued. For the present, *Phytophthora* occurring on rubber in Ceylon will be referred to as *Phytophthora* spp.

Studies on F. lignosus (V. Satchuthananthavale & L. Halangoda): The survival of *F. lignosus* on wood pieces in soils adjusted to three different moisture levels and amended with sulphur or lime was studied. Untreated soil served as controls for all levels of moisture. Results indicate that the fungus would survive longer in untreated dry soils followed by wet soils. In moist soils, it may not remain viable for very long periods. The fungus failed to survive at all moisture levels in soils treated with sulphur but it did survive at all moisture levels in soils treated with lime.

F. lignosus would remain viable for longer periods within pieces of roots with bark intact. It disappears rather quickly in roots without bark. This is due to colonization of wood by saprophytic wood-decaying fungi. Moisture is an essential requisite for initiation of rhizomorphs and rhizomorphs lysed rather quickly in fertile soils.

In studies on the effect of sulphur on the control of White Root disease, it was found that the addition of sulphur to planting holes reduces the incidence of White Root disease. This result was attributed to the increase in the antagonistic fungi, especially *Trichoderma* spp., resulting from the pH changes effected by the sulphur. The present studies however indicate that sulphur is toxic to *F. lignosus* and hence fungicidal in action.

The results of these experiments were discussed in the paper entitled "Sulphur in the control of White Root disease" presented at the Ceylon Rubber Conference.

Mould contamination of prepared rubber (W. C. Dayaratne): Work carried out to control mould contamination showed that it could be checked by controlling temperature and humidity in the storage compartments. A relative humidity of 60% at room temperature gives sufficiently dry conditions for the storage of sheet rubber for long periods. Lower temperatures, at which mould growth could be checked, are rather difficult to maintain and therefore not feasible.

In general it was observed that conditions conducive to mould growth prevailed in most of the places where smoked sheets were stored.

A paper was presented on this subject at the Ceylon Rubber Conference.

Field investigations

Leaf diseases

Oidium leaf disease: Four *Oidium* leaf disease control experiments were carried out on commercial estates. Two of these experiments were to compare the rates of dusting on the incidence of the disease on a tolerant and a susceptible clone.

(a) *Yatadola Estate—clone PB 86 (A. de S. Liyanage & R. D. Sebastian)*: The effect of different dosages of sulphur on the control of *Oidium* leaf disease was tested. The results are presented in Table 2.

TABLE 2

Treatments	Total leaf fall
1 Control	4406
2 8 lb per acre/round	1242
3 10 lb " " "	422
4 12 lb " " "	250

The incidence of leaf fall due to *O. heveae* was low and the effect of treatments was not significant.

(b) *Culloden Estate—clone Tjir 1 (A. de S. Liyanage & S. K. Samaraweera)*: This experiment was a repetition of the above, on a susceptible clone. The results are tabulated below:—

TABLE 3

Treatments	Total leaf fall
1 Control	124,049
2 8 lb per acre per round	89,545
3 10 " " " "	104,226
4 12 " " " "	101,692

Clone Tjir 1 is an uneven winterer. The treatment effects are not significant.

(c) *Weather and incidence of Oidium leaf disease (T. M. Fernando)*: A 'Burkard' volumetric spore trap was used to study the number of conidia present in the air over a field planted with clone Wagga 6278 at Malaboda Estate during the refoliation season 1970. Meteorological data were collected for this period. Leaf counts were taken during the peak period of leaf fall.

The results of this study show that spore concentration in the atmosphere reaches a peak at 1300 hours following the "afternoon" pattern of spore dispersed. High temperature, low humidity and air turbulence at this time help in the release of spores, increase the number of spores in the atmosphere. Continuous rain decreased the spore concentration in the air, so did leaf wetness.

Hot, dry periods with bright sunny days are inimical to the propagation of the fungus. High humidities and low temperatures accompanied by mist during the night time were conducive to the propagation of the fungus.

These results were discussed in a paper presented at the Ceylon Rubber Conference.

(d) *Leaf disease control and yield (V. Satchuthananthavale, Z. E. Irugalbandara & W. C. Dayaratne)*: The effect of controlling leaf diseases on the yield of clone PB 86 was tested at Eladuwa Estate. *Oidium* control experimental plots were dusted at 10 lb per acre per round. Results are presented in Table 4.

TABLE 4

Treatments	Total leaf fall
A Control for both leaf diseases	7,014
B Control for <i>Oidium</i> leaf disease	26,951
C Treated for <i>Oidium</i> leaf disease, 10 lb sulphur per acre per round	5,848
D Treated for <i>Oidium</i> leaf disease as in treatment B and <i>Phytophthora</i> leaf disease	2,528
1 Total leaf fall in control plots A and B	33,965
2 Total leaf fall in treated plots C and D	8,376

The treatment effects are statistically significant.

Monthly yield data were collected for the whole year. This experiment has been discontinued since December 1970. Results are being analysed.

Phytophthora leaf disease (W. C. Dayaratne): Arrangements were made to dust the *Phytophthora* control experimental plots. Incidence was negligible and dusting was not carried out.

Root diseases

Root disease control experiments (V. Satchuthananthavale, T. M. Fernando & L. Halangoda): Three experiments on the control of White Root disease were laid out on two commercial estates in May—June 1970.

(a) An experiment was set down to study the effect of sulphur and collar protectants when used separately and together on the incidence of White Root disease in the first five years of the new replanting. The following treatments were replicated five times in a twelve-acre field at Malaboda Estate.

Treatments

1. Control,
2. Sulphur applied twice (i) at the time of planting, (ii) when the plants are about one year old,
3. Collar protectant to be used only after the plants are about 18 months old and only on diseased trees and those adjacent to it,
4. Treatments 2 and 3 combined.

This area was cleared in the usual manner. The presence of *F. lignosus* was not reported on the old stand.

The first census was taken in November 1970. The incidence of *Fomes* in the different treatments is given in Table 5.

TABLE 5

Treatments	Number of plants diseased
1 Control	11
2 Sulphur	3
3 Collar protectant only	9
4 Sulphur and collar protectant	2

(b) The above experiment was repeated at Milleniya Estate on a small scale comprising a total of 360 plants. This area was cleared in the usual manner but was ploughed twice using a tractor and most of the small roots were removed. The area between rows was left undisturbed. Prior to the second ploughing sulphur was sprinkled on the surface. The first census was taken in December 1970, and the results are tabulated in Table 6.

TABLE 6

Treatments	Number of plants diseased
1 Control	6
2 Sulphur sprinkled in the field	9
3 Collar protectant	3
4 Treatments 2 and 3 combined	0

In this experiment it should be noted that sulphur was not added to the planting holes but was sprinkled on the surface of the field and ploughed. The clearing and treatment with sulphur was carried out by the management and the Department took over at the time of replanting to make observations on these areas as a high percentage of trees in the old stand had harboured the fungus and a tractor had been used to plough the field to remove the small roots.

(c) This experiment was initiated to study the effect of collar protectant on the spread of disease in an area where the surface soil in planting holes was amended with sulphur.

Sulphur amendment reduces the incidence in the first two years but is ineffective in preventing the establishment of *Fomes* patches. This experiment was laid down to test the effectiveness of collar protectants on reducing the spread of *Fomes* root disease in a field where sulphur was used to control the incidence in the first two years.

The field was cleared in the usual manner but one section was ploughed once with a tractor. The small roots were not removed. The other section was not ploughed. Sulphur was added to the surface soil of planting holes.

Clearing, ploughing and treatment with sulphur were carried out by the management. The Department took over at the time of planting.

The first census was taken in December 1970. The incidence of the disease in the entire field totalled only 13 plants.

Methods of identification of Fomes (S. K. Samaraweera): An experiment on the methods of identification of *Fomes* infection and the effect of the treatment of soil with sulphur on disease incidence, was conducted on Galawatte Estate, in a 1963 replanting. A census was taken twice and the incidence was negligible in all treatments.

Methods of clearing (V. Satchuthananthavale, T. M. Fernando & L. Halangoda): The correlation between the methods of clearing and the incidence of White Root disease is being assessed in an experiment at Glenesk Estate, in a 1967 replanting. A census was taken twice in 1970, as tabulated in Table 7.

TABLE 7

Treatments	Number of trees affected by <i>Fomes</i> root rot					
	May		December		May	December
	Infected	Dead	Infected	Dead	Total	Total
1. Stumps uprooted, timber and stumps burnt	0	5	1	0	5	1
2. Stumps uprooted, not burnt, timber stacked in the field	1	2	2	4	3	6
3. Stumps uprooted and burnt, timber stacked	0	0	2	2	0	4
4. Stumps uprooted, not burnt, timber stacked. Sulphur used to amend surface soil of planting holes	0	0	2	3	0	5
Total	1	7	7	9	8	16

There is an increase in the number of trees affected by the incidence of *Fomes*, from 8 to 16 trees; this may be considered negligible. The important factor that should be noted here is that in all the diseased trees detected in the December census, the food base had been old timber or a stump lying four to eight feet from the infected tree. In the process of growing, the roots had come in contact with these sources of infection and become infected. ●

Small scale field trials

Observations were made on (i) the effectiveness of Fomac as a collar protectant at Farnham Estate (S. K. Samaraweera), (ii) *Xylaria* root disease control at Hatbawe Estate (H. L. Munasinghe).

Meteorological data

Thermohygrographs were maintained from May to October at Dartonfield, Eladuwa and Yatadola Estates. Rainfall figures were obtained from the estate records for this period (V. Satchuthananthavale & D. M. Dantanarayana).

TABLE 8
Average rainfall and number of wet days

	May	June	July	August
Dartonfield	22.64 (23)	13.48 (23)*	16.23 (21)	7.69 (18)
Eladuwa	23.22 (25)	7.73 (23)	10.57 (21)	5.71 (17)
Yatadola	28.30 (17)	7.93 (14)	9.12 (15)	3.78 (6)

* Average rainfall for 23 days only, wet days in brackets.

Rainfall and leaf fall pattern for Dartonfield is given in Table 9.

TABLE 9
Rainfall (in.) and leaf fall at Dartonfield

Month	Period	Rainfall (in.) for the period	Incidence
June	8th - 15th	2.59	Nil
"	16th - 21st	5.94	"
"	22nd - 30th	3.52	Leaf fall first observed on 22.6.71 and was mild
July	1st - 7th	0.08	Dry period, no leaf fall
"	8th - 14th	5.18	Leaf fall observed again, mild
"	15th - 21st	8.59	Very heavy leaf fall
"	22nd - 28th	1.60	Leaf fall on the decline

A rainfall of 4.34 in. was recorded for 20th and 21st June. Mature pods were available in the field and leaf fall due to *Phytophthora* was first observed on 22nd June in a few areas where the disease had been prevalent in the previous years. During the wet period of the second and third weeks of July with 13.77 in. of rainfall there was very heavy leaf fall in these fields.

In May, 10 in. of rainfall was recorded for 1st, 2nd and 3rd May; leaf fall due to *Phytophthora* was not recorded then.

Rainfall and leaf fall pattern for Eladuwa and Yatadola Estates is given in Table 10.

TABLE 10
Rainfall (in.) and leaf fall at Eladuwa and Yatadola Estates

Month	Period	Eladuwa		Yatadola	
		Rainfall	Incidence	Rainfall	Incidence
June	8 - 15	1.72	Nil	1.34	Nil
"	16 - 21	1.80	"	2.08	"
"	22 - 30	2.23	"	1.49	"
July	1 - 7	0.02	"	0.12	"
"	8 - 14	4.46	"	3.93	"
"	15 - 21	4.63	Leaf fall first observed	3.44	Leaf fall first observed
"	22 - 28	0.96	—	0.60	—
July/August	29 - 3	2.97	mild	3.41	very mild
August	4 - 10	3.71	decline	0.94	decline

Leaf fall was first observed on both estates in the third week of July. The incidence was light and declined after the first week of August.

If continuous wet weather coincided with the presence of mature infected pods, then leaf fall would occur in areas where the disease had been prevalent in the previous years. The intensity of the disease appears to be governed by the subsequent wet or dry periods. This is clearly seen in the rainfall and leaf fall pattern for Dartonfield. Leaf fall that occurred in June was curtailed by the dry weather that prevailed in the first week of July and subsequent leaf fall that began in the second week of July continued to be very heavy due to the very wet weather in the second and third weeks of July.

Surveys

Oidium leaf disease in the smallholdings (A. de S. Liyanage & R. D. Sebastian): A survey was conducted to assess the incidence of *Oidium* leaf disease in the smallholdings which functioned under the state-aided sulphur dusting scheme. Forty-three sulphur dusting groups were selected in Colombo, Galle, Kalutara, Kegalle, Matale and Matara Districts for the survey. The survey included 220 PB 86 and 25 Tjir 1 holdings. The results of this survey were presented in a paper read at the Ceylon Rubber Conference.

Fungicides and incidence of Bark Rot (V. Satchuthananthavale, T. M. Fernando & D. M. Dantanarayana): Data were collected from 52 estates in the Kalutara District on the application of watermiscible and waterproof panel dressings, tapping of wet trees, incidence of Bark Rot and annual average rainfall.

The data are summarized below:—

(a) *Watermiscible fungicides*

Total number of estates	52
Number of estates using watermiscible fungicides throughout the year	50
Fungicides applied before tapping	28
" " day after tapping	18
" " at the time of collection	4
	—
	50
	—
Number of estates not using watermiscible fungicides	2

It is not necessary to apply fungicides right through the year; the use of fungicides could be restricted to the period when inoculum is present in the field and the weather conditions are conducive for propagation, spread and infection. For estates experiencing the South-West monsoon rains, this period would be from mid-June to early September.

The best time for application of fungicides for effective protection of the tapping cut will be at the time of collection of latex. It should be noted that application of specially mercurial fungicides may depress yield and none of the fungicides applied at this time will afford protection to the susceptible site of the host, namely the tapping cut.

In the two estates which do not use fungicides regularly, there is no incidence of Bark Rot. With the cessation of tapping of wet bark and adoption of cultural practices to facilitate drying of the bark and the panels, Bark Rot has been reported to be completely eliminated in these two estates.

(b) *Waterproof panel dressings*

Total number of estates	52
Once a year	14 estates
Twice a year	4 "
Thrice a year	2 "
Once in three months	6 "
Once in two months	6 "
Once a month	7 "
	—
	39 "
	—
Not used	13

Waterproof panel dressings do not serve any purpose in either protecting the panel from Bark Rot or in hastening the renewal of bark and hence these can be dispensed with in the treatment of panels.

The incidence of Bark Rot in the above estates was as follows:—

Bark Rot — nil — 2 estates

Incidence negligible 15 estates

„ 1 — 2% 10 „

„ 3 — 5% 6 „

„ 6 — 10% 5 „

„ 20% 1 estate

„ 25% 1 „

Incidence not known — 9 estates.

The regular use of fungicides had not completely eradicated the disease in these estates. This was discussed in the paper entitled “Black Stripe or Bark Rot of *Hevea*” presented at the Ceylon Rubber Conference.

Bacterial coagulation of latex (R. Satchuthananthavale & V. Satchuthananthavale):

Species of bacteria were isolated from (i) coconut water exposed to natural contamination, (ii) rubber serum, and (iii) pre-coagulated field latex and were tested for their ability to coagulate latex. These bacteria were cultured on sterile coconut water and used for coagulation of field latex at initial concentration. The time taken for coagulation of latex by species of bacteria and the time taken for coagulation in assisted and auto-coagulation were studied. With three species of bacteria near complete coagulation could be obtained in four to five hours. Technical properties of bacterially-coagulated rubber compared favourably with acid-coagulated rubbers and auto-coagulated rubbers at initial concentration.

Two papers on bacterial coagulation of latex were presented at the Ceylon Rubber Conference.

REVIEW OF THE SOILS CHEMISTRY DEPARTMENT

BY

C. G. SILVA

SUMMARY

With the increase in staff of the Department and the return of Dr. R. S. John after successfully completing his studies abroad, it was possible to initiate new work and devote more time to projects that were being continued.

Most of the work in the Department during a greater part of the year was in connection with the Ceylon Rubber Conference held in September. Two papers were presented at this conference by the staff of the Department and everyone in the Department contributed to the success of this conference.

The analysis of soil samples of the different soil series revealed that the Boralu series soil is the poorest in nutrients, the Parambe and Matale series are the richest while the Homagama and Agalawatta series are intermediate in nature.

Steps were also taken to standardize the methods of soil and leaf analysis and in this connection the Soils Chemist conducted instruction classes for the benefit of the Technical Assistants.

The data available of the detailed soil survey of the Alutgama one-inch map was collected in the form of a detailed soil map where 12 soil series were identifiable.

Out of the field experiments in progress the experiments at Kuruwita continued to show responses to the various nutrients. Of the diagnostic physiologique (DP) experiments, one showed response.

Work on the urease activity of the rubber soils and the survey of the incidence of wind damage, was completed.

A new nursery experiment was initiated. This as well as the other nursery experiments started last year did not indicate any significant responses. Three experiments on manuring in relation to covers were started and one experiment on the frequency of fertilizer application was also initiated.

MSMA-based herbicide mixtures were shown to be as effective as sodium arsenite on most weed populations, but appear to be more expensive than sodium arsenite.

DETAILED REVIEW

Staff

Mr. C. G. Silva was in charge of the Department as Acting Head throughout the year.

Dr. R. S. John returned after completing his post-graduate studies and was appointed Soils Chemist.

The officers who joined the Department during the year were Messrs. L. J. Wickramasinghe and B. P. M. Arsecularatne, Technical Assistants. Messrs.

K. S. A. C. Peiris and J. W. Wijenayake were promoted as Field Assistants. Mr. P. P. Jayasinghe was transferred to the Rubber Chemistry Department at his request.

Mr. M. U. J. de Silva, Technical Assistant, was awarded a scholarship to study at the Lumumba University, Moscow, and left the services of the Institute on 31st August 1970.

Visits

	<i>Advisory</i>	<i>Experimental</i>	<i>Others</i>	<i>Total</i>
Acting Head of Department	14	16	12	42
Soils Chemist	2	29	12	43
Assistant Soils Chemist	2	227	16	245

Meetings and conferences etc.

The Acting Head of the Department attended the following meetings:—

1. Standing Committee on Agro-chemicals and Fertilizers (3)
2. Rubber Research Board Scientific Committee (3)
3. Annual sessions of the Ceylon Association for the Advancement of Science (15th and 16th December)
4. Miscellaneous meetings at ministries etc. (4)

Publications

(a) *For restricted circulation*

1. Annual Report of the Soils Chemistry Department for 1969
2. Progress Reports of the Soils Chemistry Department for the 1st, 2nd and 3rd quarters of 1970

(b) *Papers*

1. An evaluation of the nutrient status of the rubber soils of Ceylon.
C. G. Silva. (Read at the Ceylon Rubber Conference)
2. Weed control under *Hevea* in Ceylon using herbicide mixtures based on MSMA.
N. Yogaratnam. (Read at the Ceylon Rubber Conference)
3. Use of natural rubber latex to improve seepage resistance of soils.
S. W. Karunaratne, R. S. John and K. A. Piyadasa. (Read at the 26th sessions of the CAAS 1970)
4. The cultivation of oil palm in Ceylon.
C. G. Silva. (Read at the Annual sessions of the CAAS 1970).
5. The urease activity of the rubber soils of Ceylon.
C. G. Silva and A. M. A. Perera.
Q.Jl. Rubb. Res. Inst. Ceylon 47, 30—36.

Advisory work

Certain modifications were made in the advisory circular on manuring, the most important of which was the use of urea as the source of nitrogen in rubber fertilizer mixtures. These modifications have been included in the Handbook of

Rubber Culture and Processing and a new advisory circular on manuring will be issued shortly.

Advice on matters leading to improved growth or increased yields as a result of proper management was rendered to many producers either by visits or through correspondence.

Data were collected this year too on the performance of rubber in areas previously planted with tea.

A few visits of an advisory nature were made to Nakiadeniya Group, Nakiadeniya and Perth Estate, Horana, in connection with the cultivation of oil palm at these two places.

Research investigations

Soil surveys (C. G. Silva & F. P. W. Silva): A few modal profiles of the Matala, Parambe, Agalawatta, Homagama and Boralu soil series were selected and from each site soil samples were removed from depths of 0" — 6" and 6" — 18" for chemical analysis. A total of 30 such sites were sampled of each of the four soil series. From the Matala soil series only 15 sites were sampled.

A detailed soil map of the Alutgama one-inch map was prepared and in this area it was possible to differentiate 12 soil series based mostly on the morphological properties of the soil as a result of probable differences in parent material.

A detailed soil survey of 100 acres of old rubber land at Nakiadeniya Group was completed and oil palm was planted.

Soil analysis (A. M. A. Perera, G. N. de Silva, L. J. Wickramasinghe, T. Kanthasamy & F. P. W. Silva): The following soil estimations were done and the data so collected were used in presenting the paper entitled "An evaluation of the nutrient status of the rubber soils of Ceylon".

Total potassium	260 samples
Total phosphorus	260 "
Exchangeable calcium	260 "
Exchangeable magnesium	260 "
Total nitrogen	260 "
Organic carbon	260 "
Cation exchange capacity	128 "
Soil reaction	260 "
Mechanical analysis	72 "

Leaf nutrient studies (R. S. John, H. A. Seemon & B. Arsecularatne)

Reorganization of laboratories: The laboratories in the plant nutrition section were reorganized with a view to the allocation of more laboratory space to technical and field staff; the leaf sample preparation room was redesigned and repairs were carried out on the fume cupboards prior to installation of new sample digestion units.

Laboratory classes: Classes on the fundamental principles of soil chemistry/chemical analytical methods were conducted for some Technical Assistants and this would be continued as a regular feature to maintain a high standard of chemical analysis.

Seepage from irrigation channels: Investigations into soil characteristics at a depth of 2 ft of Dartonfield soil were made in connection with the possible use of natural rubber latex to prevent seepage losses in irrigation channels. This work was carried out in collaboration with the Rubber Chemist, at the request of the latter, and was the subject of a paper read at the 26th sessions of the CAAS.

Foliar analysis (R. S. John, T. Kanthasamy, H. A. Seemon & B. Arsecularatne)

Methods for rapid chemical analysis: Standardization of methods for rapid chemical analysis of leaf material for N, P, K, Ca and Mg in a single digestate, initiated in mid 1970 is in progress.

Leaf nutrient status: Leaf samples collected from the Department's experimental areas and during the course of advisory visits were as follows:—

Experimental	88
Advisory	20

The following analyses were carried out and include samples collected in late 1969.

N	P	K	Ca	Mg
91	225	94	165	201

Volatilization of ammonia from urea (A. M. A. Perera)

These studies initiated in 1969 were continued. There appears to be a direct correlation between the ammonia lost and the cation exchange capacity of the soil. The volatilization also varies between soil series, being low in the Ratnapura series and higher in the Parambe and Matale series. These studies are being continued.

Field experiments (An index of field experiments is given at the end of this review)

In order to determine the overall treatment effects for the entire duration of these trials and whether their continuation would provide further useful information, a complete assessment of all available data from these trials was initiated. With the exception of experiments Nos. 4, 5 and 17 which were to be terminated, the rest were continued to be serviced with respect to fertilizer application, routine test tapping and girth measurements. Leaf samples from all "DP" trials were collected during the fourth quarter.

Field experiment No. 1—Effect of N and K in presence of P

This trial is laid down in a 1952 clearing at Hedigalla Division. The clones are PB 86, AVROS 225, LCB 870 and PB 86 crown budded with LCB 870.

The girth and yield data for 1970 show that apart from the significant responses shown due to fertilizers applied during the pre-tapping period, the fertilizers applied during the mature phase have had no significant effect on girth and yield. This is so for all clones.

Field experiment No. 2—Effect of K in the presence of N and P

Four levels of K in the presence of N and P (six clones): Analysis of the girth and yield data for 1970 does not show any significant difference between treatments.

Field experiments Nos. 6 to 9—Physiological diagnosis

Of these experiments comparing the effects of fertilizer application based on physiological diagnosis with different amounts of standard fertilizer mixture, experiment No. 8 showed statistically significant (5% level) treatment effects for yield but not for girth. There was no significant difference in treatment effects with respect to yield or girth in experiments Nos. 6, 7 and 9.

The mean yield for different treatments and the least significant difference for experiment No. 8 are as follows :—

TABLE 1

Treatment	Mean yield (g)	L.S.D.
Control	33.16	6.47
'DP' complete	34.35	
'DP' partial	36.01	
R. 4 : 6 : 3 + Mg special	43.84	
R. 4 : 6 : 3 + Mg normal	38.45	

Field experiment No. 11—Forms of magnesium (K. S. A. C. Peiris): This experiment is of a split-plot, randomized block design, the NPK treatments randomized between plots and the two forms of magnesium randomized within plots.

The yield data do not show any statistically significant difference. A positive significant response to potassium is indicated when the girth data are analysed. No significant differences in either yield or girth are observed, when the different forms of magnesium are considered. The interaction $K \times Mg$ is significant indicating that the response to K is different with the two forms of magnesium.

TABLE 2

Mean girths of trees for the different treatments

Treatment	Mean girth in in.	Critical difference
N ₀	22.08	0.93
N ₁	22.29	
P ₀	21.84	
P ₁	22.53	
K ₀	21.40	
K ₁	22.97	

Field experiments Nos. 12 and 13—Cultivation trials

These two experiments are of a $3 \times 3 \times 3$ design, laid down in a 1961 replanted area at the Kuruwita Sub-station where the soil is of the Boralu series. In one experiment there are three levels of N and P with K and Mg as a basal application. In the other there are three levels of K and Mg with basal applications of N and P. Three different cultivation practices in both experiments have been discontinued.

The analysis of the yield data of the experiment No. 12 as shown in (Table 3) indicates that the quadratic effect of nitrogen is on the border line of significance and that there is a significant response to phosphorus. The analysis of girth data shows a quadratic response to phosphorus and the response to nitrogen is on the border line of significance.

TABLE 3
Mean values for girth and yield with the respective critical differences

Treatment	Mean girth in in.	Critical difference	Mean yield (in g)	Critical difference
N ₀	21.44	0.94	28.77	3.78
N ₁	22.36			
N ₂	21.76			
P ₀	21.34			
P ₁	22.29			
P ₂	21.93			

The analysis of yield and girth data of experiment No. 13 (Table 4) shows that there is a response to potassium when yield as well as girth data are considered. The girth data also indicate a possible depressing effect due to magnesium.

TABLE 4
Mean values for girths and yields with the critical differences

Treatment	Mean girth in in.	Critical difference	Mean yield (in g.)	Critical difference
K ₀	21.00	0.92	23.81	3.58
K ₁	22.40			
K ₂	21.86			
Mg ₀	22.41			
Mg ₁	21.45			
Mg ₂	21.55			

Field experiment No. 14—Assessment of different fertilizer materials

This experiment designed to assess the growth response of N, P and Mg, each from three different fertilizer materials, is sited at Gallewatta Estate in a 1961 replanted area. The different forms of fertilizer do not give any significant differences in growth.

Field experiment No. 15—Use of concentrated compound fertilizers (M. A. Mendis)

The girth measurements (Table 5) indicate that all three brands of compound fertilizer are superior to the standard mixture R. 4 : 6 : 2 + Mg.

TABLE 5
Girth responses to compound fertilizers

Treatment up to 1968	Treatment from 1969	Mean girths	Critical difference
R. 4 : 6 : 2 + Mg	R. 4 : 6 : 2 + Mg	19.78	1.11
Dam Trio (8 : 8 : 5)	Dam Trio	22.13	
Sincat (14 : 14 : 5)	Nil	21.82	
Granumix (15 : 15 : 6 : 3)	Kampka (15 : 15 : 15)	22.27	

Field experiment No. 18—Response to fertilizer of different clones (K. S. A. C. Peiris)

The effect of eight levels of the standard fertilizer mixtures R. 4 : 6 : 3 + Mg on four clones, RRIC 7, RRIC 45, RRIC 52 and PB 86, are being tested in a 1963 replanted area at the Kuruwita Sub-station.

The girth data show that there is a linear significant effect due to the higher levels of fertilizer and this effect decreases as the fertilizer levels increase beyond the third level. Table 6 gives the detailed girth data for the different clones.

TABLE 6
Mean girth (in.) of the different clones at different levels of fertilizer

Level of fertilizer	RRIC 7	RRIC 45	RRIC 52	PB 86
0	16.12	18.03	19.57	14.18
1	17.33	21.35	22.42	16.91
2	18.91	21.03	21.21	17.27
3	18.32	20.46	22.88	16.43
4	19.33	21.35	23.32	17.74
5	19.45	20.62	22.59	17.14
6	19.60	21.10	23.85	17.84
7	20.52	22.45	22.25	18.36

Field experiment No. 21—Frequency of fertilizer application (N. Yogaratnam & A. D. M. Karunaratne)

Diameter measurements taken in July 1970 (one year and two months after planting) are given below :—

<i>Treatments</i>		● <i>Mean diameter (in cm)</i>
2 applications per year		2·19
3	” ” ”	2·11
4	” ” ”	2·24
5	” ” ”	2·37
6	” ” ”	2·10
		L.S.D. 0·54

The treatments do not show any significant effect on diameter. However, no firm conclusion will be drawn from this experiment, since this is the first experiment of this nature that has been completed.

Field experiment No. 23—Frequency of fertilizer application (N. Yogaratnam & A. D. M. Karunaratne)

This experiment is similar to experiment No. 21. Here five frequencies of fertilizer applications viz. 2, 3, 4, 5 and 6, during the first year are being tested in a randomized block design replicated four times.

Field experiment No. 24—Manuring in relation to cover (N. Yogaratnam & A. D. M. Karunaratne)

This experiment is to study the effect of manuring of rubber in relation to cover.

Treatments

Main plots: (1) Legumes (L)
(2) Naturals (N)

Sub-plots: Nitrogen (1st year)

N₀ — 4 oz of sulphate of ammonia/tree

N₁ — 6 oz ” ” ” ” ”

N₂ — 8 oz ” ” ” ” ”

N₃ — 10 oz ” ” ” ” ”

Phosphorus

P₀ — Nil phosphorus

P_r — Phosphorus to tree (6 oz of rock phosphate/tree)

P_c — Phosphorus to cover (2½ cwt of rock phosphate/acre)

P_{rc} — Phosphorus to tree and cover (same as P_r and P_c)

All plots received a uniform basal application of muriate of potash (50%) and commercial epsom salt at the rate of 2 oz/tree.

Field experiment No. 25—Manuring in relation to cover (N. Yogaratnam & A. D. M. Karunaratne)

The treatments are the same as in experiment No. 24.

Field experiment No. 26—Manuring in relation to cover (N. Yogaratnam & M. A. Mendis)

Treatments

- Main plots: (1) Legumes (L)
(2) Grasses (G)
(3) Naturals (N)

Sub-plots: three levels of nitrogen (N_0 , N_1 and N_2)

Nursery fertilizer experiments—Nivitigalakele (N. Yogaratnam & A. D. M. Karunaratne)

Experiment No. N1: The purpose of this experiment is to study the effect of three levels of N, P, K and Mg on the growth of young seedlings in the field nursery. 3^4 factorial.

Experiment No. N2: The purpose of this experiment is to study the effect of five levels of phosphorus on the growth of young seedlings in the nursery. Randomized block replicated four times.

Experiment No. N3: Here again the purpose is to study the effect of five frequencies of application of fertilizer on the growth of young seedlings in the nursery. Randomized block, replicated four times.

Manuring was done according to treatments. Height and diameter measurements were recorded periodically. No firm conclusion could be made from the results obtained so far.

Experiment No. N4 (R. S. John & W. M. Abeysinghe): The aim of this experiment located at Nivitigalakele is to compare the effect of two sources of nitrogen (sulphate of ammonia and urea) and phosphorus (saphos phosphate and ordinary super phosphate) applied at three levels each, in factorial combination, on the growth of seedlings in the nursery. The experiment is based on a factorial design with four replicates.

Experiment No. N5 (R. S. John & J. Wijenayake): The purpose of this experiment located at Vogan Group is to study the effects of foliar fertilizers ("Folifertil"—Murphy Chemicals Ltd.) applied with and without the application of standard fertilizers on the growth of young seedlings in the nursery. The experiment is based on a randomized block design with four replicates.

Treatments:

1. Control
2. Fertilizer (standard)
3. Fertilizer (standard) + "Folifertil" 2 weekly spray
4. Fertilizer (standard) + "Folifertil" 4 weekly spray
5. "Folifertil" 2 weekly spray
6. "Folifertil" 4 weekly spray

Weed control experiments—Malaboda Estate, Matugama (N. Yogaratnam & A. D. M. Karunaratne)

1. Effect of MSMA and mixtures of MSMA, Amitrole, Dalapon and sodium chlorate on the control of *Paspalum conjugatum*,
2. Effect of mixtures of MSMA and Amitrole each at three levels on the control of *P. conjugatum*,

3. Effect of three levels of Amitrole and MSMA + Amitrole mixtures on *P. conjugatum*,
4. Effect of mixtures of MSMA and Amitrole or 2, 4-D each at two levels on the control of *P. conjugatum* and *Mikania scandens*,
5. Effect of mixtures of MSMA and 2, 4-D each at three levels on the control of *P. conjugatum* and *M. scandens*,
6. Effect of MSMA, 2, 4-D, Amitrole, Dalapon or sodium chlorate mixtures on the control of weeds,
7. Effect of MSMA, 2, 4-D and either sodium chlorate or Dalapon mixtures on the control of weeds.

The results of all these experiments were presented at the Ceylon Rubber Conference in a paper entitled "Weed control under *Hevea* in Ceylon with herbicide mixtures based on MSMA", which appears in the proceedings of the Ceylon Rubber Conference.

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| No. | 6 | DP experiment—Nakiadeniya Group—1956 clearing—Galle District—PB 86 |
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| 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 Growth response to three brands of complete concentrated fertilizers—1961 replanting—Gallewatta Estate
- No. 17 Time of fertilizer application experiment—clone PB 86—1951 clearing—Dewalakande Estate
- No. 18 Effect of eight levels of the standard fertilizer mixture R. 4 : 6 : 3 + Mg on four clones—1963 clearing—Kuruwita Sub-station
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- No. 21 Experiment on the frequency of fertilizer application—1969 clearing—Pembroke Estate
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- No. 24 Experiment to study the effect of manuring of rubber in relation to covers—1970 clearing—RRIM 623—Pussella Group
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- No. 26 Experiment to study the effect of manuring of rubber in relation to covers—1970 clearing—RRC 101—Hedigalla Sub-station

Nursery fertilizer experiments

- No. N1 To study the effect of three levels of N, P, K and Mg on the growth of young seedlings in the nursery—Nivitigalakele Sub-station
- No. N2 To study the effect of five levels of phosphorus on the growth of young seedlings in the nursery—Nivitigalakele Sub-station
- No. N3 To study the effect of five frequencies of application of fertilizer on the 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
- No. W1 The use of MSMA-based weedicide mixtures in the control of weeds in mature rubber areas—Malaboda Estate

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. A three-year programme for the establishment of five new process rubber factories based on fresh scrap rubber has been prepared. The total production of these five factories would be ten to fifteen thousand tons per annum. To find a solution to the social, economic and technical problems involved in purchasing latex from smallholders and converting it into new process rubber a project report has been prepared to set up a new process rubber factory at Mawanella.

A micronised form of graphite was successfully incorporated into rubber and would prove useful in applications such as solid tyres. Full scale field experiments on the use of bitumen/latex mixes for road surfacing are being carried out by the Department of Highways in collaboration with us. The best stabilizer for natural rubber (NR) field latex for use for addition to bitumen has been found to be 0.3% ammonia and 0.7% sodium hydroxide. Oil-extended, ammonia-preserved NR latex was found suitable for soil stabilization using compression and seepage tests.

The use of rubber seed oil to prepare dark factice has been investigated; the best method involves the use of sodium carbonate in addition to sulphur. Preserved NR field latex is being used by the Ceylon Leather Corporation in finishing leather and the use of methyl methacrylate-grafted NR latex in the surface finishing of leather shows promise.

Tocotrienols naturally present in latex have been shown to be important as antioxidants and the amounts present in various forms of NR have been investigated. Bacterial coagulation shows promise as a new method for coagulating latex in the field for new process rubber manufacture.

Since the method of preparation of pale crepe affects its technological properties, the grading of pale crepe on its method of preparation should be of value to consumers and is being studied. Carbon fibre could be obtained from cyclised rubber but it has the defect of being brittle. The adhesion and degradation of cyclised rubber during fabrication is undesirable for moulding purposes and work has to be carried out to remedy this problem.

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 was on a six-month training course at the NRPR, England, and at the University of Aston in Birmingham, U.K., from March to August. Mr. A. Coomaraswamy left in September for the U.K. on a Colombo Plan scholarship to do a post-graduate course leading up to the Ph.D.,

at the University of Aston in Birmingham. Mr. M. R. N. Fernando joined the staff as Assistant Rubber Chemist in October 1970 and Mr. G. Varathungarajan joined the staff in September 1970 as Assistant Rubber Chemist and is doing a course, on a Colombo Plan scholarship, in rubber technology and economics at the University of Aston, Birmingham, leading up to the Ph.D. Mr. D. S. Muthukuda, Assistant Development Officer, was on duty throughout the year. Mr. M. T. Veerabangsa Assistant Development Officer visited the RRIM for three weeks in May to further study new process rubber manufacture; he received his Processing Instructor's Diploma during this visit. Messrs. P. A. J. Yapa and R. Tharmalingam were in U.K. on Colombo Plan scholarships. Mr. E. G. Mendis who was appointed Senior Technical Assistant on 1st October 1969 was on duty throughout the year. Technical Assistants, Messrs. A. S. Dekumpitiya, W. D. Dharmasena, L. S. Goonewardena, S. Kasinathan, D. D. Medagama, H. Narangoda, K. A. Piyadasa and P. P. Jayasinghe were on duty throughout the year.

Publications

The following papers were presented at the Ceylon Rubber Conference held in September 1970.

- (1) Preparation of Heveacrumb from first fraction coagulum.
S. W. Karunaratne
- (2) Some investigations on the antioxidants of natural rubber.
M. Nadarajah, A. S. L. Tirimanne, A. Coomaraswamy and S. Kasinathan
- (3) Suggested improvements in the manufacture of Ceylon natural rubber.
M. T. Veerabangsa and M. Nadarajah
- (4) Possibilities of bacterial coagulation in raw rubber manufacture.
R. Satchuthananthavale, V. Satchuthananthavale, M. Nadarajah and I. Amarasinghe.

A project report for the establishment of a central laboratory for technical specification of natural rubber was prepared by Mr. M. T. Veerabangsa and sent to the Ceylon Government for approval.

The following papers were read at the annual sessions of the Ceylon Association for the Advancement of Science in December 1970.

- (1) Evaluation of locally available raw materials in the natural rubber industry.
S. W. Karunaratne, L. S. Goonewardena and D. D. Medagama
- (2) Use of natural rubber latex to stabilize soils.
S. W. Karunaratne, R. S. John and K. A. Piyadasa
- (3) Preliminary investigations into the preparation of carbon fibres from cyclised rubber and the use of cyclised rubber for injection moulding purposes.
M. Rajasingham
- (4) A study of the free amino acids in the latex of natural rubber.
S. Kasinathan, M. Nadarajah and A. S. L. Tirimanne.

Meetings, lectures etc.

A lecture on "Chromatographic methods used in the Rubber Research Institute of Ceylon in the study of natural rubber" was given by Mr. M. Nadarajah at the symposium on "Modern analytical methods in the study of local raw materials" held in November 1970.

Assistance was given by Mr. M. Nadarajah (40 lectures) to the Ceylon College of Technology, Katubedde, to conduct classes leading up to the L.I.R.I.

Rubber technology

Upgrading of low grades

Heat sensitivity of particulate raw rubber (S. W. Karunaratne & K. A. Piyadasa): A pilot crumb rubber dryer installed at Dartonfield by Messrs. Walker Sons & Co. Ltd., was used to study the heat sensitivity and the final colour improvement of different types of scrap material with and without chemical treatment. Particulate rubber based mainly on panel scraps will have deteriorated on completion of drying at temperatures of over 90°C. A hard rubber is obtained when the same rubber is dried at 80°C or below, but at 100°C excessive softening takes place.

A mixture of 0.3—0.4% oxalic acid and 0.1—0.2% sodium bisulphite gave the maximum improvement or colour over high temperature drying.

Upgrading of tree lace and shell scrap (M. Nadarajah & H. Narangoda): Tree lace of clone PB 86, shell scrap from clone PB 86 (varnished cups), cup lump from the factory and cup lumps from the Matugama rubber depot were soaked for 24 hours in water, in 1% oxalic acid solution, in 1% sodium bisulphite and oxalic acid solution and in 1% sodium bisulphite and formic acid solution and the PRI determined. The results obtained are given in Table 1. A mixture of oxalic acid and sodium bisulphite (1% solution) or a mixture of oxalic acid and sodium sulphite gave the best results.

TABLE I
Effect of soaking

Grade of rubber	Treatment	PRI
Tree lace from clone PB 86	Water	47
	Oxalic acid solution	58
	Sodium bisulphite and oxalic acid solution	73
Shell scrap from Dartonfield (varnished cups) from clone PB 86	Water	37
	Oxalic acid solution	55
	Sodium bisulphite and oxalic acid solution	66
Cup lump from Dartonfield factory	Water	65
	Sodium bisulphite and oxalic acid solution	74
Cup lump from Matugama rubber depot	Water	21
	Oxalic acid solution	27
	Sodium sulphite and oxalic acid solution	55

Fresh cup lump was collected from the Dartonfield factory, soaked overnight in various solutions (1% strength) and the PRI determined (Table 2). On the basis of these results soaking in an oxalic acid solution or in a mixture of oxalic acid and sodium sulphite or bisulphite gave the best results.

TABLE 2
Effect of soaking

Soaking treatment	PRI
Water	33
Sodium bisulphite solution	49
Oxalic acid solution	74
Oxalic acid and sodium sulphite solution	82
Oxalic acid and sodium bisulphite solution	87

Use of locally available graphite (S. W. Karunaratne, L. S. Goonawardena & D. D. Medagama): A micronised form of graphite of particle size less than 40μ was successfully incorporated into rubber both by the latex masterbatch method and the dry rubber method. Though not reinforcing to anywhere near the reinforcing carbon blacks, its high conductivity and lubricating effect and antifriction properties would prove useful in applications like solid tyres. This particular application does not demand high tensile properties, but it does demand high compression strength and graphite contributes to increasing the compression strength of reinforced rubber.

Levels of graphite ranging from 4% to 45%, based on dry rubber, have been used to replace HAF black in a typical tyre tread compound. There is a significant loss in modulus at 300% as the level of graphite is increased from 5% to 45%. The results indicate some reinforcement with graphite, but the overall tensile strength is reduced as the percentage of graphite is increased.

It was also observed that there was no reduction of tensile strength even when 12.5 parts of HAF black were replaced by an equivalent proportion of an oxidised form of graphite. The oxidised form of graphite was prepared from ordinary micronised graphite by digestion with strong oxidising agents.

In the incorporation of graphite into rubber by the masterbatching technique, the graphite slurry was dispersed using a sulphonate type of dispersing agent. It was preferable to incorporate oil into the masterbatch in order to overcome some of the problems in the subsequent dewatering and drying stages. A 50% oil emulsion based on Dutrex R was prepared using ammonium stearate as the emulsifying agent. A mixture of graphite slurry and oil emulsion in the appropriate quantities required for masterbatching were homogenised and mixed with field latex (DRC 33%) and coagulated with 2% formic acid. The coagulant was dewatered by compression between rollers and pressed into the form of a sheet and subsequently dried in an oven at 60 to 65°C and drying was completed in 10 to 12 hours.

Advisory service to producers

Routine advisory work

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

<i>Sheet manufacture</i>	<i>Crepe manufacture</i>	<i>Sole crepe manufacture</i>	<i>Latex weighing</i>	<i>Other visits</i>	<i>Total</i>
90	32	7	25	5	<u>159</u>

Some of the observations made during these visits are:—

(a) Dry coconut husks have been found to be suitable for use in smoking RSS on estates interplanted with coconut.

(b) Natural air-drying lofts of crepe producing estates can be converted to hot air-drying, using a burner and a heat exchanger. Millewa Estate, Padukka, has converted its natural air crepe drying loft to a hot air-drying loft using a Nu Way burner and a heat exchanger at a cost of Rs. 41,500/-. This unit can cope with a capacity of about 50,000 lb of rubber for blanket crepe manufacture and about 10,000 lb of rubber for sole crepe manufacture. The temperature is between 89 and 94°F and the drying time is about four days. A drying tower of smaller capacity which would have been necessary for the estate, if this modification was not effected, would have cost about Rs. 125,000/-.

(c) As milling facilities for scrap rubber are not usually available in sheet producing factories, tapping systems, which tend to give a high proportion of scrap may in certain areas be uneconomical.

Sheet manufacture

Assistance was given to the crash programme for improving the quality of smallholders' RSS. A smoke house with 1,500 lb capacity was commissioned for the Milleniya Group Processing Centre. 95% top grade sheet is now obtained in this centre. Plans for temporary smoke houses originally prepared in 1956 were reviewed for possible use in the crash programme.

Mr. M.T. Veerabangsa, Assistant Development Officer has prepared a plan for a 3,500 lb capacity ground floor type smoke house for use in group processing centres.

New process rubber manufacture (M. T. Veerabangsa)

While producers of high grade RSS and latex crepe should continue the production of these grades, scrap rubber can with advantage be processed into technically specified block rubber. A three-year programme for the establishment of five new process rubber factories based on fresh scrap rubber (field coagula) was prepared by Messrs. M. T. Veerabangsa and Svend Hansen and submitted to the Ceylon Government for consideration. The total production of these five factories would be 10,000 — 15,000 tons per annum.

On a long term basis, it is even more important that smallholders' latex (presently processed into RSS, mainly of low grades) is diverted to block rubber manufacture. A project report has been prepared by Mr. M. T. Veerabangsa in collaboration

with Mr. Svend Hansen, U.N. Industrial Adviser, for one factory to be set up at Mawanella. The report was submitted to the Ceylon Government for consideration and assistance from the United Nations has been requested.

The project is not designed on purely commercial lines. Its aim is to find a solution to a multitude of social, economic and technical problems involved in the purchasing and collection of latex, as well as in processing of the raw material into a uniform, high grade, technically specified block rubber and in marketing this product. If successful, this project should lead to the establishment of a network of factories for processing latex into block rubber.

Improvements to latex collecting cups (M. Nadarajah & E. G. Mendis)

The latex of clone LCB 1320 showed a marked tendency to precoat in coconut shell cups in spite of sodium sulphite being used as the anticoagulant at Mirishena Estate, Govinna. The use of coconut shells coated on the inside with a plastic paint helped in reducing this precoat. The cost of this treatment per shell was about 8 cents and the percentage of total scrap to latex rubber was 13.3% in the coated shells whilst it was 18.2%, 18.9% and 15.5% in the control plots.

Improvements to coagulating tanks (M. Nadarajah & D. S. Muthukuda)

Polypropylene sheet was used to line a cement coagulating tank at Udapolla Group, Polgahawela, by Browns Group Industries Ltd. The tank functioned satisfactorily and had a clean appearance. A disadvantage in the use of polypropylene for lining coagulating tanks is that the coagulum tends to stick to the lining, making the tanks more difficult to clean than if porcelain tiles were used to line the tanks. In removing the adhered rubber from the polypropylene lining, scrubbing has to be resorted to and this in course of time would aggravate the problem of adhesion. Hence polypropylene sheet is not suitable as a replacement for porcelain tiles for the lining of cement tanks. A cement coagulating tank at Nakiadeniya Group, Nakiadeniya, was lined with Epikote resin by Messrs. Lankem (Ceylon) Ltd. and the tank lining cost Rs. 5/04 per sq foot. The performance of the tank has been very satisfactory.

Biochemistry

Investigations into the non-rubber substances of Hevea latex

Tocotrienols in NR (M. Nadarajah, A. Coomaraswamy, S. Kasinathan & J. Kirubakaran): This work is being done in collaboration with Dr. A. S. L. Tirimanne of the CISIR. Thin-layer chromatography was used in the separation of the tocotrienols and the amounts present were estimated visually. The amount of tocotrienols in total solids and coagulated rubber from centrifuged, skim and field latex, from clone PB 86, by acetone extraction showed that skim latex contains more tocotrienols and centrifuged latex less tocotrienols than field latex.

Different coagulation conditions, *i.e.* controlled acid coagulation, bacterial coagulation, auto-coagulation and processes used in pale crepe manufacturing, such as fractionation into yellow and white fractions and the use of RPA No. 3 have no significant effect on the tocotrienol content of the rubber obtained and is the same as that present in latex total solids. Hence tocotrienols can be said to be rubber soluble antioxidants. However, the amount of ester present varies, being highest in auto-coagulation and lowest in the yellow fraction.

Alkali has an adverse effect on the tocotrienol content, especially on the rubber prepared from alkali-treated latex. It appears that the tocotrienols are converted to sodium or ammonium salts and are thus rendered water-soluble and leached out in the preparation of the rubber.

Amino acids in NR latex (M. Nadarajah & S. Kasingthan)

This work is being done in collaboration with Dr. A. S. L. Tirimanne of the CISIR. The free amino acids in natural rubber latex of clones RRIC 45, PB 86, RRIC 36, Wagga 6278, RRIC 100, RRIC 101, RRIC 7, RRIM 623 and Nab 15 were investigated by paper chromatography. The principal amino acids present were α -alanine and glutamic acid while phenylalanine, glycine and aspartic acid occurred in moderate concentrations. Addition of amino acids at 0.1% and at 0.2% to field latex and determining the PRI of the total solids showed that medium antioxidant activity was observed when α -alanine, valine, phenylalanine and tyrosine were added.

Bacterial coagulation in new process rubber manufacture (M. Nadarajah)

This work is being done in collaboration with Dr. R. Satchuthananthavale and Dr. (Mrs.) V. Satchuthananthavale.

The advent of new process rubbers has eliminated the need to bring rubber to the factory as liquid latex. Rubber collected in solid form can be made into new process rubbers conforming to high technical standards. Controlled coagulation of field latex could be effected by seeding field latex with suitable strains of bacteria. This may be called bacterial coagulation of latex. By this method coagulation of latex in the field in the tapping cup could be speeded up and collection of coagulum made possible on the day of tapping. Further, bacterially-coagulated rubber gives a better colour and less odour and has lower dirt content than that obtained by auto-coagulation. An important practical aspect is that the serum from bacterially-coagulated coagulum can be used as a satisfactory coagulant for four or five tappings, to give coagula with good physical characteristics. The serum from bacterially-coagulated coagulum can be squeezed into the cup at the time of collection.

Rubber chemistry

Properties of pale crepe (M. Nadarajah, M. Rajasingham, D. S. Muthukuda & P. P. Jayasinghe)

(a) *Gel content:* When RPA No. 3 is used for bleaching rubber the gel content is reduced considerably. Further fractionation concentrates the gel into the first fraction. Hence bleached, fractionated pale crepe has practically no gel in it, and consumers of pale crepe must be made aware of this fact.

(b) *Mill breakdown:* Remilled sole crepe was found to have a much greater rate of mill breakdown than unfractionated, yellow or white fraction crepe. This is because remilled sole crepe has undergone much more millings than pale crepe in its manufacture.

The rate of mill breakdown has also been found to be a clonal characteristic. The rate of mill breakdown of rubber from clone RRIC 36 and Wagga 6278 is slower than that of clone PB 86.

(c) *Whiteness of vulcanized product:* White fraction pale crepe gives a whiter vulcanized product than when no fractionation is done in the preparation of pale crepe. The yellow fraction on fractionation gives a vulcanized product of a greyish colour.

(d) *Grading of pale crepe*: Since the method of preparation of pale crepe affects its technological properties, it is recommended that the grading of pale crepe be dependent, in addition to the present visual system, on the method of preparation as well.

Polymer chemistry

Cyclised rubber

(a) *Carbon fibre from cyclised rubber (M. Rajasingham)*: Van Veersen's structure of cyclised rubber consists of a series of condensed polycyclohexyl groups. According to this structure carbonisation of cyclo-rubber should in principle give rise to a polyaromatic ladder which is even stronger and more stable than cyclised rubber.

Fully cyclised rubber is an amorphous powder with a softening point of 140°C. Above this temperature the polymer gradually degrades and a hard brown brittle solid product is formed on cooling. To produce fibres it has to be fabricated to improve its flow characteristics. The polymer has to be blended with a plasticizer and the plasticized polymer can then be melt fabricated at much lower temperatures. A high degree of oxidative stability is another requirement for fibre-forming polymers.

About 44 plasticizers were tested for compatibility with cyclised rubber. The following plasticizers showed compatibility with cyclised rubber.

1. Staybelite esters 3, 5 and 10.
2. Tritolylphosphate
3. Trixylylphosphate
4. Benzyl-n-butyrate
5. Triphenylphosphate
6. Benzyl benzoate
7. P-chloro metaxylene
8. Indene
9. Indane

Some progress has been made in fabricating the material to give long fibres. The brittle nature of the fibre could be due to the molecular alignment of cyclised rubber and the structure of cyclised rubber is such that a continuous linear fibre structure with good mechanical properties is difficult to obtain.

(b) *Cyclised rubber for injection mouldings (M. Rajasingham)*: Thermoplastics are imported into Ceylon for use in injection mouldings to make plastic products. The use of cyclised rubber for injection mouldings was investigated.

The problem of mill mastication of cyclised rubber is a complex one. Milling at high temperatures resulted in oxidative breakdown even in the presence of anti-oxidants. The cyclised rubber plasticizer tends to adhere on to the metal surface and does not seem to part readily from the metal surface and for moulding purposes adhesion is clearly undesirable. Internal mixing is found to be suitable to fabricate the blend. The problem of adhesion and degradation during fabrication of the sample has to be investigated in future work.

Modification of NR latex by non-radical mechanisms (M. Rajasingham): This work was done with Miss Subadra Karunanayake of the University of Ceylon, Peradeniya. Recent research has shown that in spite of the fact that many sulphides and derived compounds are antioxidants their antioxidant potential is not achieved quickly enough to be useful and that in fact the oxidation of sulphides by hydroperoxides leads to an accelerated breakdown of the rubber due to crosslink scission

and catalyst auto-oxidation. The sulphur compounds are eventually converted to antioxidants (SO₂ etc.) but in the meantime a good deal of accelerated degradation has occurred.

It seems desirable from the point of view of the stability alone to find an alternative to sulphur which will not be too expensive and will have at least some of the versatility of sulphur. It is also advantageous to use the same kind of reaction to introduce antioxidants and stabilizers to the rubber chains. Phenol formaldehyde resins are important non-sulphur crosslinking reagents. The cost of this type of process being high, it has not led to any application in the NR industry, but the position needs reviewing in the light of the decreasing cost of phenols. The application of this process to tied-in antioxidants is obvious. One of the likely antioxidants that can be used for this modification of natural rubber is 4-methyl-6-tertiary-butyl phenol.

Experiments carried out in the laboratory indicated that field latex cannot be used to crosslink with the quinone intermediate obtained from the methylol derivative of the phenol. The presence of water in the field latex reacted spontaneously with the quinone to give the original phenol.

Development work

Rubber in roads (M. Nadarajah, E. G. Mendis, K. P. N. de Silva & J. Kirubakaran): This work was done in collaboration with Mr. A. Weeraratne of the Department of Highways and full scale road experiments are being carried out by the Department of Highways under this programme. Test strips were laid down on the following roads to observe the effect of rubberised bitumen on:

- (1) asphalt penetration macadam
 - (a) Hotel road, Mount Lavinia—1 mile
 - (b) 12th mile Nagoda—Kalawellawa—Bellampitiya road— $\frac{1}{4}$ mile
- (2) seal coat surface treatment
(2nd mile Dehiwela—Maharagama road— $\frac{1}{2}$ mile)
- (3) subsequent coat bituminous treatment
(13th mile Panadura—Nambapana road— $\frac{3}{4}$ mile)
- (4) asphalt concrete
(60th mile Colombo—Galle—Hambantota—Wellawaya road— $\frac{1}{2}$ mile).

In the course of this work it was found that delays and difficulties usually associated with rubberised bitumen work could be mostly overcome by the introduction of a little kerosene oil into the bitumen (5%—10%). The kerosene oil not only facilitated the blending and spraying of the binder but also cut down on the idling time of labour and plant resulting from the delays caused in cleansing the plant. The use of masterbatches further speeded up the blending of rubber and made this work more congenial.

The laboratory investigations carried out indicated that the addition of rubber to bitumen improved its properties. The natural field latex was preserved with three stabilizers of which a mixture of 0.3% ammonia and 0.7% sodium hydroxide were found to be the best followed by 0.7% sodium hydroxide and 1.06% ammonia respectively.

The experimental stretches of road so far laid down indicate that better bonding properties had been imparted to the aggregates coated with rubberised bitumen

and also that this reduced the tendency to bleed. The cost was seen to increase by about 10% for labour intensive work such as seal coat surfacing and to a lesser extent for asphalt concrete paving. However, the initial cost of a road should not be taken as the criterion as the maintenance during its life time too has to be considered, so that if better durability is obtained this will more than off-set the initial cost.

Use of NR latex to reduce seepage losses in soil (S. W. Karunaratne & K. A. Piya-dasa): A pilot experimental study on the use of NR latex as a binder for soil to improve seepage resistance was undertaken. The selection was based on its suitability for *in situ* soil stabilization. This was evaluated using compression and seepage tests. It was observed that the treated soils out-performed their unmodified counterparts. Oil extension of rubber in the latex stage helps to improve the binding effect of soil particles. The binding and sealing effect is improved with increasing oil content up to a maximum of about 50 parts of oil per 100 parts of dry rubber. Defoaming agents were used to reduce the tendency to foam when latex is mixed with soil. A study of compression strength increased sharply when the level of binder in terms of dry weight in soil is increased from 1% to 3%. Compression strength is only marginally increased above 3%. The results also indicate that ammonia-stabilized field latex contributes to a higher compression strength in soil than sodium hydroxide-stabilized field latex at equivalent levels of stabilization.

Manufacture of dark factice from rubber seed oil (M. R. N. Fernando): The best method for preparation of dark factice from rubber seed oil was found to be as follows: air is blown through the oil for 15 min, while it is at 140°C. Sulphur at 25% and sodium carbonate at 10% by weight of the rubber seed oil are added and heating continued till the gel point is reached (about $\frac{1}{2}$ hr). Heating is then stopped and the product allowed to cool to room temperature. The product was found to be of good quality.

Use of NR latex in the surface finishing of leather (M. Nadarajah): Low ammonia and high ammonia field latex was supplied to the Ceylon Leather Corporation for use in the finishing of their leather. The use of methyl methacrylate-grafted NR latex has been recommended for use as part substitution of imported acrylic latices at present used by them. The preliminary experiments carried out by them have given promising results.

Analysis

Specification testing

A project report for the establishment of a central laboratory for technical specification of NR was prepared by Mr. M. T. Veerabangsa and sent to the Ceylon Government for approval. This laboratory will not only ensure that all of Ceylon's new process rubber manufacture conforms to the technical specifications but is also of consistently uniform quality.

Dry rubber and latex testing (S. W. Karunaratne & A. S. Dekumpitiya): The demand for routine analysis continued throughout the year. The bulk of the analyses was on dry rubber. Over 900 samples from commercial estates were analysed for dirt, volatile matter, nitrogen, ash, copper, manganese and PRI. Increased production of Heveacrumb from first fraction coagulum, at the Institute's pilot plant at Peenkande, meant an increase in the SCR testing by more than 25% over the previous year. Test certificates were issued to market eight five-ton lots of Heveacrumb from first fraction coagulum. Test data on five-ton consignment lots of Heveacrumb from first fraction coagulum are given in Table 3. These include crumb rubber production figures from the date of commissioning of the pilot plant up to the end of December, 1970.

TABLE 3

Test data on five-ton consignment lots of
Heveacrumb from first fraction coagulum

Lot No.	No. of samples tested	SCR tests (mean values)						Mn (ppm)
		Dirt % wt.	V.M. % wt.	PRI	N ₂ ● % wt.	Ash % wt.	Cu (ppm)	
2	143	0.019	0.5018	81.8	0.43	0.21	<8	<10
3	111	0.022	0.4747	84.6	0.48	0.29	<8	<10
4	107	0.020	0.4706	84.2	0.60	0.50	<8	<10
5	108	0.020	0.4205	82.8	0.60	0.50	<8	<10
6	81	0.018	0.4388	83.9	0.60	0.50	<8	<10
8	21	0.018	0.4352	85.3	0.60	0.50	<8	<10
9	16	0.016	0.4280	88.2	0.47	0.23	1.7	1.0
10	15	0.019	0.4485	87.4	0.60	0.50	<8	<10
11	18	0.022	0.4200	80.9	0.45	0.21	0.13	0.96
12	18	0.021	0.4000	83.5	0.43	0.15	<2.0	< 2.0
13	20	0.028	0.2900	83.4	0.47	0.23	<2.0	< 2.0
14	18	0.022	0.2800	73.1	0.47	0.23	<2.0	< 2.0
15	127	0.027	0.3736	81.8	0.40	0.23	1.67	2.21
16	71	0.028	0.3815	80.3	0.38	0.22	<2.0	< 2.0
17	68	0.027	0.3835	81.9	0.39	0.23	<2.0	< 2.0
18	72	0.028	0.3741	83.4	0.39	0.23	<2.0	< 2.0
19	72	0.025	0.3482	84.6	0.37	0.23	<2.0	< 2.0
20	72	0.024	0.3454	82.2	0.39	0.22	<2.0	< 2.0
21	72	0.024	0.3370	82.7	0.36	0.25	<2.0	< 2.0
22	72	0.025	0.3518	81.1	0.39	0.22	<2.0	< 2.0

Analytical methods (S. W. Karunaratne & K. A. Piyadasa): A modification of the B.S. method for the determination of ammonia content in NR latex is suggested. The main feature of the modification is the replacement of the normal indicator, *i.e.* bromothymol blue solution by filter paper treated with bromothymol blue solution and used externally. The advantage is that the modified method affords a means of obtaining a sharp end point. The use of bromothymol blue solution as an internal indicator as suggested in the B.S. method is inherent with practical difficulties in determining the end point which is masked by the milky white appearance of latex.

REVIEW OF THE STATISTICS SECTION

• BY

G. A. J. P. R. GUNASEKERA

Introduction

The year under review was a busy one for the Statistics Section due to the work with regard to the papers prepared by the research departments and the Estates Advisory Department for the Ceylon Rubber Conference. Routine analysis of experimental results for the research departments was also carried out. Assistance was rendered to the Botany, Rubber Chemistry, Soils, Genetics & Plant Breeding and Plant Pathology Departments and the Agricultural Economics Unit, in the design of experiments, surveys and the solution of certain economic problems.

Staff

The valuable assistance of the Consulting Biometrician, Mr. V. Abeywardena was available to the Section. The Assistant in Statistics continued to be on duty. Mr. L. T. Peiris was recruited as Technical Assistant with effect from the 2nd of December.

Meteorology

A start was made in the course of the year to copy down past records of meteorological data for the rubber growing areas, available at the Department of Meteorology. Casual employees were engaged for the purpose. This was in response to a suggestion made by the Assistant Plant Pathologist to find probabilities of occurrence of weather conditions conducive to diseases in *Hevea*. The work still continues. The co-operation given by the Director of Meteorology and his staff is gratefully acknowledged.

Visits

The distribution of a total of 47 visits is as follows :—

Field investigations	7
<i>Oidium</i> survey	7
Education (C.A.A.S., Ceylon Rubber Conference, lectures, library reference and consultations)	7
Estates Advisory Department	11
Meteorology Department	8
Others	7
	<hr/>
	47
	<hr/>

REVIEW OF THE ESTATES ADVISORY DEPARTMENT

BY

A. B. DISSANAYAKE

General

The Estates Advisory Department gives advice to all small estates of 25 acres and over and all medium estates of 100—500 acres. According to available statistics this Department caters for about 35.3% of the island's acreage under rubber.

The Estates Advisory Department was shifted from Dartonfield, Agalawatta, to Colombo to the premises occupied by the Smallholdings Department as close co-operation between the two departments were considered necessary.

Staff

The Head of the Estates Advisory Department and the four Assistant Estates Advisory Officers were on duty throughout the year.

The Estates Advisory Officer, Mr. K. Wilson de Silva retired at the beginning of the year after twenty two years of service in the advisory departments of the Institute. We wish him a happy retired life.

The Assistant Agricultural Economist recruited in 1969 resigned at the end of March 1970. Another Assistant Agricultural Economist was recruited in August and is being trained at Dartonfield on the agricultural aspects of the rubber industry. In December a Technical Assistant was recruited to assist the Assistant Agricultural Economist.

Assistant Estates Advisory Officers were stationed at Galle and Ratnapura. Another officer will be stationed in the field in January 1971.

Correspondence

A great deal of correspondence was attended to by this Department in the form of advisory reports on visits to estates, advisory letters on simple problems referred to us and other reports on specific problems, surveys etc.

Visits

Routine visits

A total of 548 visits were made by officers of this Department. A break-up of the visits made to the different categories of estates is given in Table 1.

TABLE 1

Routine visits to estates

<i>Category of estate</i>	<i>No. of visits</i>
Small estates	415
Medium estates	133
Total	548

In routine visits 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 they will have the advice given, for easy reference as and when they require. Wherever necessary, advisory circulars are also sent for their information. The reports are sent in Sinhala where necessary.

Visits on request

A total of 65 visits were made by the officers of this Department on request. A break-up of such visits is given in Table 2.

TABLE 2

Visits to estates on request

<i>Category of estate</i>	<i>No. of visits</i>
Small estates	26
Medium estates	24
Large estates	15
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 small and medium estates, other aspects of the plantation were also looked into and recommendations to improve the general working of the estate were discussed.

Other visits

In addition a total of 84 visits were made by the officers of this Department for annual verification of stores, discussions with institutions and other officers, committee meetings, attending lectures and seminars etc. A break-up of such visits would be as follows :—

TABLE 3
Other visits

<i>Purpose of visit</i>	<i>No. of visits</i>
Seminars	07
Lectures, discussions etc.	18
Committee meetings	12
Smallholdings Department, university, and other departments	16
Provident Fund and staff meetings	11
Visits with visitors	08
Annual verification of stores	17
Total	89

It can therefore be seen that a total of 702 visits have been made by the officers of this Department for the year 1970. These are in addition to discussions with superintendents, owners of estates, visiting the Department and other discussions with scientific staff on specific problems. In addition, all officers attended the Ceylon Rubber Conference held in September 1970 and helped to make it a success. The officers of this Department participated in a "replanting survey" of estates in Colombo District and a "crumb rubber project survey" in Agalawatta area.

Economic research

The cost data received from estates are being grouped and studied. The study was interrupted by the resignation of the Assistant Agricultural Economist in March. It is now being started again after the training of the new officer. A Technical Assistant to help this officer has been appointed. It is also hoped to recruit another Assistant Agricultural Economist this year.

The paper entitled "An analysis of the economic prospects of the rubber industry" was read by the Head of the Department at the well attended Ceylon Rubber Conference in September 1970.

Publications

For the benefit of smallholders and small estate owners who are not fluent in the English Language, a Sinhala publication named "Rubber News" (රබර් පුවත්) was organised. Articles of general interest and which would help to educate the smallholder and small estate owner are being published. One of the articles on replanting was prepared by the author to be printed as an advisory leaflet. This will be published in the English and Sinhala bulletins and reprints obtained for circulation. The two half yearly issues of the "Rubber News" for 1970 are being printed as one issue. This is now in print and will be out very soon.

Other work

The Head of the Department helped in the preparation of the new "crash programme" for smallholdings with emphasis on group schemes rather than on aid to individual smallholders as had been the practice in the past.

Radio broadcast

Radio broadcasts for the benefit of smallholders are being arranged. Initial discussions have been held and finalised.

Conferences for smallholders •

Details of a conference for smallholders have been worked out and are included in the " crash programme " for smallholdings which it is hoped will be in operation in 1971.

Lastly the author wishes to thank 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

A good portion of officers' time was devoted to improve the smallholders' sheet to Grade 1 RSS. A great deal of attention too was directed on the formation of co-operative rubber production and sales societies. Detailed data were collected for the Rubber Chemistry Department to study the feasibility of organising central rubber factories. An all-island smoked rubber sheet competition was held in Colombo. All assistance was given to the Plant Pathology and the Soils Chemistry Departments for their surveys.

Due consideration was given to smallholders in new planting work and all lands were visited and the owners advised in planting their lands according to rubber control regulations. All new rubber planting applications received by the Rubber Controller and referred to this Department for preliminary reports were attended to.

The two publicity units of the Department did useful propaganda in the field, directing smallholders to follow the recommendations of the Institute on all matters connected with rubber.

The state-aided sulphur dusting scheme was successfully carried out during the year under review. Field staff gave necessary technical advice and supervised dusting throughout the dusting operations. The survey carried out by the Plant Pathology Department with the assistance of this Department was concluded in April.

Much propaganda was given in the field by both field staff and the two publicity units in connection with sheet improvement. The all-island sheet rubber competition of 1969 and the mass meeting was held in Colombo culminating range and divisional competitions, held in all rubber growing areas.

DETAILED REVIEW

General

The officers of this Department devoted a good portion of their time in the improvement of smallholders' sheet to Grade 1 RSS to attain high standards in sheet production. The field staff carried out a number of demonstrations in sheet-making in the demonstration smoke houses and ordinary smoke houses in their respective ranges. During the period under review a great deal of attention was focussed on the formation of co-operative rubber production and sales societies. The field officers also collected detailed data to study the feasibility of organising central rubber factories for the production of new forms of rubber.

The all-island smoked rubber sheet competition for the improvement of sheet rubber was concluded at the Red Cross Society Hall, Colombo 7, on 14.5.70.

The weather conditions experienced in most rubber growing areas were of an insular nature with conventional rain during usually dry months. It is felt that these conditions were more suitable for planting rubber.

The price of sheet rubber remained between -/80 to -/90 cents per lb of RSS 1 and as a result profits of the smallholder were reduced.

The field staff rendered all assistance to the Plant Pathology Department and the Soils Chemistry Department for *Oidium* and soil surveys.

Staff

The Chief Advisory Officer, Mr. H. H. Peiris was on duty throughout the year. Mr. A. L. Gunawardena, Accounts Clerk and Miss N. K. Seneviratne, Junior Clerk were transferred to this Department from Head Office on 2nd January, as Cashier cum Stores Clerk and Typist Clerk, respectively. Mr. G. P. A. I. G. Pathirana, Clerk was transferred to Head Office on 2nd January, Miss M. A. P. P. Seneviratne, reported for duty as Junior Typist Clerk on 1st February. Messrs. D. D. Premaratne and M. W. Gunadasa were appointed Messenger/Labourer and Labourer Publicity Unit respectively on 1st November. Mr. R. P. M. de Zoysa assumed duties as Deputy Chief Advisory Officer on 7th April, 1970.

Mr. A. P. Gunatillake, Rubber Instructor, retired on 8th October after serving for 22 years. Messrs. G. Weeratunga and L. L. C. Gunasekera, Rubber Instructors of Kesbewa and Kiriella, resigned from service on 1.2.70 and 13.9.70 having served the Department for 16 and 17 years respectively. Miss K. S. N. de S. Abeyasinghe, Clerk Typist resigned on 15.10.70 after 11 months service in the Department. Messrs. G. P. G. S. Hapugoda, K. Ekanayake and R. K. Gunatillake, Rubber Instructors, were transferred to the Rubber Processing Unit with effect from 2.12.70. Mr. M. B. Dissanayake is supervising the field work of this unit in addition to his duties as Divisional Advisory Officer, Kegalla.

Loans: A sum of Rs. 51,705 was given to ten officers of this Department for the purchase of motor vehicles.

Correspondence

General:

Inward	—	7,101
Outward	—	7,619

With Rubber Controller:

Inward	—	1,744	(applications for new planting, unregistered rubber lands and new planting permits)
Outward	—	3,589	(preliminary reports, final inspection reports and special reports etc.)

From Rubber Instructors to permit holders—2,614 letters.

Visits

New planting: In spite of the important work undertaken by the Department, due consideration was given to new planting work done by smallholders. Rubber Instructors also visited new planting lands and advised smallholders in planting their holdings in keeping with the rubber control regulations.

All new rubber planting applications received by the Rubber Controller were referred to this Department for reports as to the suitability of such lands for new planting, before permits were issued by him. These applications were in turn referred to the respective Rubber Instructors for preliminary reports, after visits to such lands, and 781 preliminary reports have been submitted to the Rubber Controller during the period. Further, 279 final inspection reports and 2,529 special reports on new rubber planted lands too have been furnished to the Rubber Controller at his request. A total of 537 new planting permits covering an extent of 790 acres have been issued by the Rubber Controller during the year to new planting smallholders.

Rubber Instructors lined new planting and replanting smallholdings for soil conservation works and planting points at the request of the owners. Accordingly they have lined a total of 77 new planting permit areas for 1970, covering an extent of 111 acres for soil conservation works and 79 permit areas covering an extent of 58 acres for planting points. They have also lined a further total of 28 permit areas of the previous year covering an extent of 40 acres for soil conservation works and 27 permit areas covering an extent of 35 acres for planting points.

First visits (138) and subsequent visits (713) were made by Rubber Instructors to new planting and new planted permit areas of this year as well as of the previous year. Further, a total of 4,025 subsequent visits too were made by them to permit areas for which permits have been issued prior to 1969.

Rubber Instructors have marked a total of 1,057 tappable trees in 20 new rubber planted smallholdings as demonstrations and marking for tapping.

Soil conservation: A sum of Rs. 1,957/13 has been paid to 68 peasant class permit-holders for conserving soil in their lands.

A total of 37 peasant class permit areas covering an extent of 50 acres have been measured and four of these permit areas covering an extent of three acres have been checked in the field by Divisional Advisory Officers, during the period, for payment.

Replanting: In all 3,563 Rubber Replanting Subsidy Scheme permits covering an extent of 4,668 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. A total of 6,814 visits to subsidy replanting permit areas of this year and 26,836 visits to subsidy replanted permit areas of the previous years have been made by Rubber Instructors during the year. Rubber Instructors have lined a total of 1,195 subsidy replanting permit areas of this year covering an extent of 1,568 acres for soil conservation works and 1,488 subsidy replanting permit areas covering an extent of 2,020 acres for planting holes. Further, 263 subsidy permit areas covering an extent of 430 acres and 311 subsidy permit areas covering an extent of 507 acres of the previous year were lined by Rubber Instructors for soil conservation works and planting holes respectively.

A total of 8,583 tappable trees in 176 subsidy replanted holdings have been marked by Rubber Instructors as demonstrations.

Random checks on planting material issued to subsidy replanting smallholders by the Rubber Controller at various Commodity Purchase Depots were carried out

by the Rubber Instructors. A total of 11,330 plants were checked at 123 random inspections by Instructors during the two planting seasons May/June and October/November this year.

Mature holdings: Visits to mature holdings are being now done only on requests from owners or for special reasons such as sulphur dusting work etc.

Special inspections for Rubber Control Department:

Visits for preliminary reports	—	781
Visits for final inspection reports	—	279
Visits for special reports (new planting)	—	2,529
Visits for special reports (replanting)	—	62
Visits for random inspection reports	—	185

Meetings and conferences

Village propaganda: The two publicity units of the Department operated in the field successfully during the year. They do useful propaganda work in the field in guiding the smallholders in planting, maintaining and tapping their lands in keeping with the recommendations of the Institute. Film shows are held in the ranges according to a programme set out by this Department and Rubber Instructors select the venues in their ranges. A public meeting presided over by the local Rubber Instructor is followed by a film show. The Rubber Instructor of the Publicity Unit and the local Rubber Instructor address the audience on important subjects of the rubber industry especially on improvement of smallholders' sheet rubber to Grade 1 RSS. The two films of the Department "This is rubber" and "Naturally it's rubber" were screened at these shows along with other films of agricultural interest borrowed from various foreign embassies. Publicity meetings cum film shows totalling 208 were held by the two publicity units of the Department during the year.

The two publicity units were also sent to Badulla and Ratnapura National Exhibitions from 18th to 21st February and from 27th February to 2nd March 1970. A few film shows were also held at points where Instructors had their tapping training classes and at functions where certificates were awarded to successful tapping trainees.

The 16 mm documentary colour film produced for the use of the Smallholdings Department was screened before the members of the Rubber Research Board and was approved by them. The producer, Mr. Lester James Peries has been requested to complete the film very early.

The writer and some of the field staff attended the following meetings:—

A conference of all Divisional Advisory Officers was held at the Smallholdings Headquarters on 16th January, 1970.

- Heads of Departments Conferences (2)
- Action Committee (5)
- Advisory Services Committee (1)
- Ceylon Rubber Conference held on 19—20 September

Publications: Arrangements are being made to reprint all leaflets with amendments.

Sulphur dusting

The state-aided co-operative sulphur dusting scheme, which is organised for the purpose of controlling *Oidium* leaf disease on smallholdings, was successfully carried out in 1970. The Smallholdings Department provides a sulphur dusting machine free of charge to each of the accepted co-operative sulphur dusting groups to dust the smallholdings in that group. Necessary technical advice is given to smallholders by the field staff and they guide the smallholders in organising sulphur dusting groups and in carrying out dusting while sulphur dust of approved quality is supplied at a subsidised rate, to smallholders owning under ten acres. The Rubber Instructors and the supervisory staff supervise dusting throughout the dusting operations. Necessary instructions regarding correct procedure of dusting and other requisite instructions in connection with this scheme were given to all field staff prior to commencement of dusting.

As a result of publicity given to this scheme by means of leaflets publicity meetings, press notifications and the efforts of the Rubber Instructors it was possible to form 73 sulphur dusting groups for the 1970 dusting season, covering an extent of 7,813 acres. Out of the 73 dusting groups organised 20 groups had to be dropped as some of the members did not pay for their sulphur dust owing to the favourable weather conditions that prevailed in these areas. The 53 groups that were dusted totalled 5,295½ acres. The smallest holding to be dusted was ½ acre while the largest holding dusted was 31 acres. Of the total acreage 4,032¾ acres (76%) were provided with subsidised sulphur while 1,262½ acres were supplied with sulphur dust at the non-subsidised rate.

This year the dusted and undusted holdings which wintered early generally showed no signs of infection by *Oidium* due to the dry climatic conditions prevailing during refoiliation.

Although it was proposed to form at least 45 groups covering an acreage of about 4,500 in the forthcoming 1971 dusting season, only 21 groups comprising of 1,951¼ acres have been formed. Twenty four proposed dusting groups were abandoned in accordance with the research findings and recommendations that sulphur dusting should mostly be carried out at an elevation of above 300 ft from sea level. Therefore dusting groups were formed only in Kegalla and Ratnapura Districts (in Kegalla, Pasyala, Avissawella and Ratnapura Divisions). As the recommendation was primarily in the case of PB 86 budded rubber, exceptions were made to dust Tjir 1 clonal seedling groups if a sufficiently large acreage was available in any part of the island irrespective of the elevation.

Trial dusting groups to ascertain efficiency of control of Oidium infection by leaf counts: The survey carried out by the Plant Pathology Department with the assistance of our field staff, to ascertain the incidence of *Oidium* leaf disease on clone PB 86 and Tjir 1 clonal seedlings was concluded in April. The field staff submitted their reports, schedules and charts direct to the Assistant Plant Pathologist.

Sheet manufacture

Improvement of smallholders' sheet. All possible advice and assistance was given by the field staff to improve their sheets to RSS Grade 1. Much propaganda was given to this scheme in the field by the two Publicity Units of the Department and the field staff. The all-island sheet rubber competition 1969 was concluded at the Red Cross Society Hall, Colombo 7, on 14.5.70. This competition and the mass meeting was the culmination of the range and divisional competitions held in all rubber growing areas. Several distinguished personalities were present. The mass meeting was presided over by Dr. O. S. Peries, Director.

The judges at this final competition were :—

1. Mr. A. B. Dissanayake, Head, Estate Advisory Department.
2. Mr. M. Nadarajah, Head, Rubber Chemistry Department.
3. Mr. K. V. D. Perera, Senior Rubber Surveyor, Commodity Purchase Department.

The Chief Advisory Officer Smallholdings in his speech dealt in detail with the progress made by the Department regarding improving the quality of smallholders' sheet and assistance rendered by the Department. Mr. O. de Alwis, Factory Assistant, who was the guest speaker delivered an interesting talk on the production of sheet rubber of Grade 1 quality. Mr. D. W. Premachandra of Kosgama and Mr. K. D. D. Kumarasiri of Matugama represented small estate owners and smallholders respectively and made interesting speeches.

Renewed efforts were made by the field staff to organise rubber co-operative production and sales societies. Yatalamatta, Nugadanda-Ihalagama and Dangampola co-operative societies were registered this year and are now ready to commence building of smoke houses and curing sheds with assistance from the Institute. The society at Milleniya went into production in April and is now producing up to 95% Grade 1 RSS. Societies in Kandana, Opalla, Govinna, Lunugama and Palugama are awaiting registration.

Societies are also being formed at Mitirigala, Pallabedda, Poratota, Hathella, Uragaha, Udukawa, Kehelpannala, Aludeniya and Gantuna.

At the Horawala Multi-purpose Co-operative Society in the Matugama range a cheap wattle and daub 1,500 lb capacity smoke house and curing shed was built with a simple external furnace incorporated. A close observation on its progress is being made to obtain first hand information as to whether this type of cheap smoke house would be suitable to some of the societies where financial difficulties exist.

Visits to rubber co-operative societies totalled 745 and 502 visits to Commodity Purchase Depots too were made by the field staff to advise smallholders against defects in sheet. A total of 1,449 sheet-making demonstrations were given by the Rubber Instructors to smallholders in order to induce them to produce better quality sheets.

Draft proposals for the implementation of the 1971 "crash programme" have been submitted for approval. Construction of demonstration smoke houses were stopped as from 15th August.

Instructions were given to the officers to prepare detailed lists showing the names of owners, extents, clones, yields etc., in smallholdings and estates around Dehiowita and Eheliyagoda ranges with a view to setting up a new process rubber factory at Clunes Estate, Dehiowita. Similar data are being collected around Peenkande Group in order to increase the output of new process rubber at this factory.

Tapping training classes. The scheme of training smallholders in rubber tapping, manufacture and other allied subjects was organised during this year as well. Nine training classes in nine ranges were organised.

Exhibitions: This Department participated in the following exhibitions during the year:—

1. National Exhibition (4th to 7th January) at Kurunegala. (The Divisional Advisory Officer, Kegalla and Rubber Instructors of Polgahawela, Hettimulla, Aranayake, Rambukkana took part).
2. National Exhibition (18th to 21st February at Badulla. (The Divisional Advisory Officer, Ratnapura and Rubber Instructors of the publicity units took part).
3. National Exhibition (27th February to 2nd March) at Ratnapura. (The Divisional Advisory Officer, Ratnapura and Rubber Instructors of the publicity units took part).

Demonstrations: The following demonstrations were given by the field staff during the year:—

Sheet-making	..	1,449
Tapping	..	583
Disease control	..	586
Miscellaneous	..	1,039

General assistance: General advice and assistance were given by the field staff to smallholders in planting and maintaining their lands according to the rubber control regulations. $1\frac{1}{2}$ tons of R 4 : 6 : 5 + Mg and 4 tons of R 4 : 5 : 6 rubber manure mixtures were purchased by smallholders through this Department at a discount.

Visitors: Mr. Haj Mohamed Yusof Bin Mohamed, M.P., Chairman, Smallholdings Association, Malasiya, visited smallholdings in Pasyala, Kegalla and Matugama Divisions.

REVIEW OF THE ESTATE DEPARTMENT

● BY

S. DE S. DALUWATTA

SUMMARY

The Institute's group of estates, known as Dartonfield Group, comprises Dartonfield Division at Agalawatta, Nivitigalakele Division at Matugama and Hedigalla Division at Lathpandura. Including the jungle area of 377 acres 3 roods and 38 perches, the total extent of the Group stood at 1,548 acres 0 roods and 30 perches. The planted acreage was 990 $\frac{3}{4}$ acres, out of which 803 $\frac{3}{4}$ acres were tapped during the year. The immature acreage and nurseries stood at 154 $\frac{1}{4}$ acres and 32 $\frac{3}{4}$ acres, respectively.

The weather conditions were not conducive for the harvesting of crop. Heavy rainfalls in April, May, June, July, September, October and November hampered tapping and collection of crop. The crop harvested was 559,905 lb representing an average yield of 696.6 lb per acre, and fell short of the estimate by 10.42%.

The incidence of *Oidium heveae* during refoliation of early winterers was very light, but late winterers, especially at Nivitigalakele and Hedigalla Divisions were adversely affected, resulting in a mild attack. Sulphur dusting operations were confined to "spot" dusting to achieve a satisfactory control.

Phytophthora leaf fall in mature areas and the incidence of *Gloeosporium* in young clearings were negligible this year. The occurrence of Bark Rot was considerably reduced, although a few scattered cases were treated at Hedigalla Division.

Budwood of RRIC clones has continued to be much in demand. 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 1971, in connection with the working of the Group, were prepared and submitted to the Rubber Research Board, for approval.

DETAILED REVIEW

Staff

The Superintendent, Mr. S. de S. Daluwatta, and the Assistant Superintendent, Mr. M. R. T. Mendis were on duty throughout the year. The Superintendent, who was temporarily stationed at Hedigalla Division, came into residence at Dartonfield on 1st April and the Assistant Superintendent was transferred back to Hedigalla with effect from that date.

The Chief Field Assistant, Mr. H. M. Bultjens and the Senior Field Assistant at Hedigalla Division, Mr. D. C. Kannangara, retired on 13/2/70 and 24/1/70, respectively, after long periods of service in the Institute. The post of Chief Field Assistant was suppressed by the Rubber Research Board and hence no new appointment was made on this cadre. Mr. C. Jeyaraj, Accounts Clerk, resigned on 18/2/70 to take up an appointment at the Tea Research Institute of Ceylon.

The following new appointments were made during the year:—

Mr. S. Abeywarda, K.P. at Hedigalla, on 16/1/70 in place of Mr. D. D. H. de Alwis, who resigned in 1969.

Mr. A. Jayasena, Field Officer, on 15/2/70 in place of Mr. D. C. Kannangara.

Mr. S. K. S. de Silva, K.P. at Dartonfield, on 15/2/70 in place of Mr. H. M. Buultjens.

Mr. D. A. Rajapaksa, Clerk Grade II, on 16/5/70 in place of Mr. C. Jeyaraj.

The salary scales attached to the Field Officer and K.P.P. are based on the collective agreement between C.E.E.F and C.E.S.U.

Messrs G. A. Kannangara and G. S. Doolwela, who were appointed as clerks in November 1969, on the salary scales under C.E.E.F./C.E.S.U. collective agreement, were placed on Institute's Assistant Staff Grade III salary scales, with effect from 1st January 1970.

There was some labour unrest at Hedigalla Division on 31.5.70 as a result of rivalry between the supporters of two political parties.

The Estate Department cadre stood at 28 at the close of the year, made up as follows:—

Senior Staff	..	1
Intermediate Staff	..	1
Assistant Staff	..	17
Minor Staff	..	9
Total	..	28

Members of the clerical staff, except one, participated in the sympathy strike from 1st February sponsored by the Ceylon Mercantile Union on behalf of harbour workers. The strike was called off on the 11th February.

Correspondence

Inward	..	674
Outward	..	1,197

Acreage summary

	Dartonfield			Nivitigalakelle			Hedigalla			Total		
	A.	R.	P.	A.	R.	P.	A.	R.	P.	A.	R.	P.
Mature	103	1	07	74	1	23	626	0	13	803	3	03
Immature	11	2	12	61	2	00	81	1	04	154	1	16
Nurseries	3	2	00	9	1	07	20	0	00	32	3	07
Total	118	1	19	145	0	30	727	1	17	990	3	26
Abandoned	12	2	00	10	0	36	59	2	30	82	1	26
Building sites, etc.	40	2	36	15	1	33	8	1	18	64	2	07
Pinewood plantation	—	—	—	—	—	—	1	0	34	1	0	34
Roads	6	2	22	0	3	27	9	0	04	16	2	13
Swamp areas	—	—	—	0	2	08	0	2	20	1	0	28
Streams and reservations	0	0	29	—	—	—	13	0	29	13	1	18
Jungle, etc.	—	—	—	1	3	38	376	0	00	377	3	38
Total	178	1	26	174	1	12	1,195	1	32	1,548	0	30

Visiting Agent

The Visiting Agent, Mr. M. W. Thompson, paid two visits to Dartonfield Group on 25th March and 6th December 1970, respectively.

Weather (estate gauge)

Comparative rainfall figures (in inches) for 1970 and 1969 are given below:—

Month	Dartonfield		Nivitigalakele		Hedigalla	
	1970	1969	1970	1969	1970	1969
January	8.70	6.39	8.97	5.25	14.33	5.65
February	8.52	5.77	7.74	1.93	7.82	4.68
March	11.99	7.16	8.92	11.19	8.56	6.11
April	15.67	7.37	15.10	14.13	20.95	9.31
May	22.64	47.36	25.16	40.40	11.49	32.05
June	13.48	13.00	11.84	10.94	20.58	11.89
July	16.23	2.83	16.24	2.42	19.17	2.94
August	7.69	12.86	6.84	9.50	11.96	9.60
September	10.36	9.79	8.36	8.98	14.51	8.26
October	19.52	22.85	18.49	24.06	25.15	20.27
November	18.88	18.46	25.85	13.48	19.19	25.77
December	6.50	23.42	4.60	20.51	13.99	27.23
	<u>160.18</u>	<u>177.26</u>	<u>158.11</u>	<u>162.79</u>	<u>187.70</u>	<u>163.76</u>
Average (five-year period)	172.37"		157.97"		165.73"	
Total No. of wet days	227	219	225	213	255	234

The rainfall for the year at Dartonfield, Nivitigalakele and Hedigalla Divisions amounted to 160.18 in., 158.11 in. and 187.70 in. on 227, 225 and 255 days, respectively. The second and fourth quarters of the year received heavier rainfalls. The wettest months were May, November and October at Dartonfield, Nivitigalakele and Hedigalla, respectively. The highest rainfall was recorded in November at Nivitigalakele and was 25.85 in.

Crop

The weather conditions were not favourable for tapping and harvesting of crop. The major factors contributing to the deficit in crop this season are:

- heavy and uneven distribution of rainfall, specially during the cropping months of May/June and October/November,
- labour unrest at Hedigalla Division due to union activities,
- poor out-turn of village tappers at Hedigalla on late tapping days, owing to wet and humid weather conditions that prevailed.

	1970	1969
Estimated ..	625,000 lb	625,000 lb
Harvested ..	559,905 ..	526,098 ..
Deficit ..	<u>65,095 ..</u>	<u>98,902 ..</u>

The crop harvested for the year 1970 = 89.58% of the season's estimate.

Comparative yield records of individual fields

<u>Dartonfield</u>		Acreage in tapping	Total yield in lb		Yield in lb per acre	
			1970	1969	1970	1969
1950/51 replanted area	..	24 $\frac{3}{4}$	10,649	11,836	430.3	459.7
1952	" "	27	17,683	19,489	654.9	721.8
1953	" "	8	4,996	5,078	624.5	634.8
1954	" "	2 $\frac{1}{2}$	2,149	2,348	859.6	939.2
1955	" "	5	3,606	3,544	721.2	708.8
1955/56	" "	4 $\frac{3}{4}$	2,625	2,935	552.7	617.9
1960/61	" "	31 $\frac{1}{2}$	20,075	16,045	637.3	509.4
		<u>103$\frac{1}{4}$</u>	<u>61,783</u>	<u>61,275</u>	<u>596.9</u>	<u>586.4</u>
<u>Nivitigalakele</u>						
1941 and 1943 clearings		—	—	5,940	—	—
1944 clearing	..	4 $\frac{1}{2}$	1,587	2,749	352.7	610.9
1946	" "	21	20,151	21,987	959.6	1,047.0
1953	" "	10	8,472	10,270	847.2	1,027.0
1954	" "	10	7,992	9,100	799.2	910.0
1962 replanted area	..	16 $\frac{3}{4}$	13,006	7,819	776.5	466.8
1963	" "	4	2,438	—	609.5	—
1964	" "	8	3,382	—	422.8	—
		<u>74$\frac{1}{4}$</u>	<u>57,028</u>	<u>57,865</u>	<u>768.1</u>	<u>929.6</u>
<u>Hedigalla</u>						
1946 clearing	..	—	—	4,218	—	330.9
1947	" "	35	13,076	16,614	373.6	369.2
1949	" "	34 $\frac{3}{4}$	22,268	24,792	640.8	713.4
1950/51	" "	18	9,395	12,814	521.9	711.9
1952	" "	79 $\frac{1}{2}$	65,331	54,381	821.8	684.0
1953	" "	132 $\frac{1}{2}$	90,455	90,616	682.7	683.9
1954	" "	171	119,535	99,266	699.0	580.5
1955	" "	78	66,128	55,469	847.8	711.1
1956	" "	60	44,362	41,011	739.4	683.5
1957	" "	17 $\frac{1}{2}$	10,544	7,777	611.3	450.9
		<u>626</u>	<u>441,094</u>	<u>406,958</u>	<u>704.6</u>	<u>639.9</u>
Total for the Group	..	<u>803$\frac{1}{4}$</u>	<u>559,905</u>	<u>526,098</u>	<u>696.6</u>	<u>655.4</u>
Other sources	..	..	652	2,892		
Total	..	..	<u>560,557</u>	<u>528,990</u>		

Tapping

Dartonfield and Nivitigalakele: Tapping was stopped for winter rest in all areas at Dartonfield and Nivitigalakele on 20/2/70 and 24/2/70, respectively, and resumed on 1/3/70.

Hedigalla: Tapping was stopped at Hedigalla for wintering on 21/2/70 in experimental areas and on 23/2/70 in commercial areas, and resumed on 1/3/70.

Tapping panels were marked with appropriate guide lines for bark consumption.

Analysis of tapping rounds on Dartonfield Group for 1970 (1969 figures in brackets)

Dartonfield	Early tapping	Late tapping	Winter rest	No tapping	
				Rain	Holidays
1st quarter	54 (76)	22 (11)	8 (—)	5 (2)	1 (1)
2nd „	41 (35)	16 (15)	— (—)	27 (36)	7 (5)
3rd „	52 (57)	11 (17)	— (—)	28 (18)	1 (—)
4th „	56 (45)	16 (26)	— (—)	19 (21)	1 (—)
	203 (213)	65 (69)	8 (—)	79 (77)	10 (6)

Nivitigalakele

1st quarter	59 (66)	16 (11)	8 (12)	6 (1)	1 (—)
2nd „	41 (35)	16 (18)	— (—)	27 (32)	7 (6)
3rd „	45 (61)	19 (14)	— (—)	27 (17)	1 (—)
4th „	53 (45)	15 (26)	— (—)	24 (21)	— (—)
	198 (207)	66 (69)	8 (12)	84 (71)	9 (6)

Hedigalla

1st quarter	64 (63)	14 (9)	6 (14)	6 (1)	— (3)
2nd „	40 (37)	9 (11)	— (—)	35 (41)	7 (2)
3rd „	43 (69)	17 (12)	— (—)	30 (11)	2 (—)
4th „	57 (45)	17 (22)	— (—)	18 (25)	— (—)
	204 (214)	57 (54)	6 (14)	89 (78)	9 (5)

Manufacture

A summary of the various forms of manufacture during the year is given below:—

	<u>Latex grades</u>	<u>Total lb</u>	<u>Percentage</u>
Pale crepe No. 1 ..		389,555	69.58
Pale crepe No. 2 ..		10,528	1.88
Pale crepe No. 3 ..		76,281	13.62
Latex for experiments ..		4,961	0.89
		481,325	85.97

	<u>Scrap grades</u>	<u>Total lb</u>	<u>Percentage</u>
Scrap crepe No. 1 ..		29,568	5.28
Scrap crepe No. 2 ..		25,019	4.47
Scrap crepe No. 3 ..		23,968	4.28
Scrap for experiments ..		25	—
		78,580	14.03
Total ..		559,905	100.00
From outside sources ..		652	

560,557

Increasing difficulties were encountered in the manufacture of No. 1 crepe. This is mainly attributed to the multiplicity of clones under test, planted in close proximity to one another, with different types of latices in production.

Factory machinery

Mill No. 5 — 26" × 14" (C.C.C. axially and spirally grooved mill): This mill was repaired during the year. Rolls were regrooved and bearings were rebushed.

Mill No. 6 — 26" × 14" (Brown's smooth mill): The motor attached to this mill was pronounced irreparable; hence a new 20 H.P. A.C. motor was fitted in its place.

Mill No. 9 — 26" × 14" (Brown's grooved mill): A 30 H.P. motor was installed for A.C. conversion.

Field and technological experiments

The Rubber Chemistry, Botany, Genetics & Plant Breeding, Plant Pathology and Soils Chemistry Departments were given necessary assistance in carrying out their field and technological experiments.

Estimates

Estimates for 1971, both capital and revenue, were prepared in respect of Dartonfield Group and submitted to the Rubber Research Board for approval.

Roads

All roads within the estate including main approach roads to outlying divisions were maintained in good condition effecting surface repairs where necessary.

Pests and diseases

Oidium heveae: The incidence of *O. heveae* was very mild on fields that wintered early but in the case of late winterers a fairly heavy attack was recorded. Uneven wintering was noticed throughout the Group. At Hedigalla wintering was very late and confined to scattered plots. Misty mornings and evening showers prevailed during the first two weeks in February at Dartonfield and Nivitigalakele Divisions. Sulphur dusting operations were carried out at weekly intervals in experimental areas and dusting in commercial areas was confined only to "spot" dusting in isolated plots. "Spot" dusting was continued at Hedigalla even up to the first week in April.

Gloeosporium alborubrum: The incidence of *Gloeosporium* was negligible.

Phytophthora spp.: No noticeable attack was experienced.

Bark Rot: Except for a few scattered cases at Hedigalla Division, the incidence of Bark Rot was greatly reduced, in spite of the heavy rains experienced.

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 lost due to wind damage at Dartonfield, Nivitigalakele and Hedigalla totalled 40, 63 and 511 trees, respectively.

Capital account — agricultural development

Dartonfield Division — immature areas

1965 replanted area .. $11\frac{1}{2}$.. $11\frac{1}{2}$ acres

Nivitigalakele Division — immature areas

1963	replanted area	..	14		
1965	" "	..	10		
1966	" "	..	$5\frac{3}{4}$		
1967	" "	..	$8\frac{3}{4}$		
1969	" "	..	$4\frac{1}{2}$		
1970	" "	..	$22\frac{1}{2}$	..	$65\frac{1}{2}$ acres

Hedigalla Division — immature areas

1965	replanted area	..	$11\frac{1}{2}$		
1967	" "	..	10		
1968	" "	..	$11\frac{1}{4}$		
1969	" "	..	$22\frac{1}{4}$		
1970	" "	..	$26\frac{1}{4}$	..	$81\frac{1}{4}$ acres

1963 replanted area (14 acres) at Nivitigalakele: This area consists of plants of clones RRIC 6, 39, 41, 59, 60, 64, 75, 98 and PB 86. Approximately four acres (589 trees) were brought into tapping in early April. The growth in the balance ten-acre area, though uneven, is improving gradually.

1965 replanted areas

(a) *11½ acres at Dartonfield:* This is planted with clones of RRIC 45, 88, 89, 90, 91, RRIM 600 and five-point buddings of H.P. seedlings. Plants are coming up well.

(b) *10 acres at Nivitigalakele:* This area consists of a monoclonal block of RRIC 45. Growth is satisfactory, but uneven. It is expected that at least 75% of trees would reach the required girth for tapping in 1971.

(c) *11½ acres at Hedigalla:* This area carries plants of clone RRIC 52. Plants are showing a vigorous growth.

1966 replanted area (5¾ acres) at Nivitigalakele: Clones of RRIC 5, 7, 41, 45, 52, 58, 59, 86, J 1, *Hevea spruceana*, Nos. 451, 1000 and 1004 are planted in this area. Growth is vigorous. Routine agricultural operations were carried out.

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:* This area was planted by the Botany and Genetics & Plant Breeding Departments with clones of RRIC 41, 45, 86, 88, 89, 101, Nos. 451, 1004, 1010, 1108 and 1174. Plants are coming up well.

1968 replanted area ($11\frac{1}{2}$ acres) at Hedigalla: Clones of RRIC 45, 101, Nos. 135, 451, 1004, 1152, 1174 and 1305 are planted in this area. This also includes two acres planted with stumped buddings of clone RRIC 45 during the South-West (June) planting period in 1970. Growth is fairly satisfactory.

1969 replanted areas

(a) $4\frac{1}{2}$ acres at Nivitigalakele: This area includes the two acres planted during (June) South-West planting period in 1970 with stumped buddings of clone RRIC 45. The other clones planted are RRIC 5, 41, 52, 89, RRIM 623 and Tjir 1. Routine agricultural operations were carried out and the plants are coming up well.

(b) $22\frac{1}{4}$ acres at Hedigalla: This area was planted during the North-East planting period with a total of 3665 budded stumps of clones RRIC 45, 100, 101, Nos. 451, 1103, 1173 and 1458, by the Genetics & Plant Breeding Department. Growth is satisfactory.

1970 replanted areas

(a) $22\frac{1}{2}$ acres at Nivitigalakele: Approximately $15\frac{1}{2}$ acres were planted during (June/July) South-West planting period with budded stumps of clones RRIC 13, 45, 100, 101, PR 252, IRCI 2, WR 101 and AVROS 1734. Close attention was paid to weeding, manuring and disease control work. Plants are coming up well. Planting of the balance seven acres was postponed for 1971.

(b) $26\frac{1}{4}$ acres at Hedigalla: Budded stumps of clones RRIC 45, 100 and 101 were planted in this area excepting in the $6\frac{1}{2}$ -acre block. Stumped buddings of clone RRIC 45 were established in the $6\frac{1}{2}$ -acre block. Plants are growing well. Attention was paid to routine agricultural operations.

Nurseries

Budwood multiplication nurseries — $3\frac{1}{2}$ acres at Dartonfield, $7\frac{1}{4}$ 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, as the number of *Fomes*-affected cases at Nivitigalakele was high. A total of 238 budwood points were uprooted during the year due to *Fomes*.

Seedling stock nurseries—2 acres at Nivitigalakele and 6 acres at Hedigalla

(a) The seedling stock nurseries were satisfactorily maintained throughout the year. Routine weeding, manuring and attention to paths and drains were carried out.

(b) Vigorous growing stocks in these nurseries were budded to meet both experimental and commercial requirements.

(c) Two new nurseries were established at Nivitigalakele and Hedigalla Divisions extending to 1 acre and $1\frac{1}{2}$ acres respectively.

Budwood issues

(a) To outside estates	..	3,023 yards
(b) For Nivitigalakele budgraftings	..	122 „
(c) For Botany Department experiments	..	237 „
		<hr/>
		3,382
		<hr/>

Budded stumps issues

(a) For Botany Department experimental plantings	976 budded stumps
(b) For Estate Department replantings	.. 1,415 „ „
	<hr/>
	2,391 „ „
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Labour and health

Labour force: The permanent labour force was generally adequate, but temporary/casual workers had to be employed, especially during paddy cultivation periods, when village labour was not regularly available.

As a sequel to union activities within the estate and the unfortunate incident which took place at Hedigalla on 31/5/70, there was a tendency for labour unrest. A day's strike was reported at Hedigalla on 1.6.1970.

Line rooms: Line room accommodation was satisfactory. Repairs to lines and labour cottages were carried out where necessary. When counting on per room basis, the number of occupants per room, was slightly above the normal average.

Wages: Wages were paid during the year in accordance with the Wages Board's Ordinances in force. Price/wage supplement to workers in the rubber growing and manufacturing trade too, was paid, with effect from March. This was made payable under the collective agreement between the C.E.E.F. and the C.W.C., but was discontinued in December, since the estate membership was withdrawn from the Ceylon Estates Employers' Federation. The Labour Officer, Matugama, had advised me that this was only an agreement and still not being gazetted.

Dartonfield Group

<u>Working Ceylonese</u>	<u>Resident</u>	<u>Non-resident</u>	<u>Total</u>
Men	.. 131	145	276
Women	.. 127	124	251
Children	.. —	—	—
 <u>Working immigrants</u>			
Men	.. 27	—	27
Women	.. 15	—	15
Children	.. —	—	—
	<hr/>	<hr/>	<hr/>
	300	269	569
	<hr/>	<hr/>	<hr/>

Annual holidays: Annual holidays with pay were given to all labourers who were entitled to these in accordance with the labour ordinance.

Maternity benefits: In all twenty one full and seven alternative maternity benefit payments were made.

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.

Anti-mosquito measures: DDT spraying was carried out at regular intervals in and around bungalows and lines during the first quarter of the year. This was suspended due to difficulties confronted, in purchasing DDT powder. In the meantime, the Director of Anti-Malaria Campaign had issued a directive categorising Kalutara District a non-malaria zone.

Births: Eleven infants were born during the year on the Group.

Deaths: There were two deaths on the Group this year.

A list of diseases treated by the Institute's Apothecary is given below :—

Influenza	..	1,335
Ulcers	..	787
Roundworm	..	708
Diarrhoea and enteritis	..	450
Eye and ear diseases	..	430
Other diseases	..	5,565
		<hr/>
Total	..	9,275
		<hr/>

REVIEW OF THE KURUWITA SUB-STATION

BY

E. F. JINADASA

Acreage statement

Mature rubber	A.	R.	P.
1961 replanting	84	0	00
1962 " " " "	38	3	00
1963 " " " "	22	2	00
1964 " " " "	9	0	00
 Total mature acreage	 <u>154</u>	 <u>1</u>	 <u>00</u>
 Immature rubber			
1964 replanting	9	2	00
1965 " " " "	19	2	00
1966 " " " "	10	0	00
1967 " " " "	10	0	00
1968 " " " "	10	0	00
1969 " " " "	10	0	00
 Total immature acreage	 <u>69</u>	 <u>0</u>	 <u>00</u>
 Total rubber	 <u>223</u>	 <u>1</u>	 <u>00</u>
 Nurseries	 2	 0	 20
Paddy fields	5	2	00
Roads, deniya and buildings	17	1	10
 Grand total	 <u>248</u>	 <u>0</u>	 <u>30</u>

The balance 15 acres of the 1963 replanting and a further three acres of the 1964 replanting were brought into tapping in April.

Weather

	<i>Rainfall</i>	<i>Wet days</i>
1969	160.01 in.	55
1970	160.43 "	59
 Increase	 <u>.42 "</u>	 <u>4</u>

Wet conditions were experienced from March to November with heavy rainfalls in June, July and October. December was comparatively very dry.

Crop

		1969	1970
Estimate	..	70,000 lb	106,000 lb
Secured	..	71,516 ,,	91,700 ,,
		●	—
Increase	..	1,516 ,,	—
Decrease	..	—	14,325 ,,

The harvest for the year fell short of the estimate by 14,325 lb due to adverse weather, resulting in more partial tappings and the complete loss of 125 tapping days as against 118 in 1969.

All fields recorded increases in yield as compared with the last year, with the exception of 64 acres of the 1961 replanting where the system of tapping was changed from S/2, d/2, 100% to 2S/2, d/3, 133% on trees 27 in. and over in girth and S/2, d/3, 67% on the rest of the trees in tapping. Only about 15% of the trees fall into the former category.

Manufacture

The self-feeding device on the Guthrie Cadet mill transferred from Dartonfield in 1969 was not working smoothly due to worn runners. Consequently, more labour than normally necessary had to be employed.

One D.C.L. tank was transferred from Dartonfield.

Buildings

Routine repairs, whitewashing and the tarring of roofs were done to the six twin cottages.

The proposed renovations to the manure and sulphur stores were deferred.

General

Mr. A. Q. Jinadasa relinquished his services as Visiting Superintendent at the end of September 1970 and Mr. M. C. Perera, Senior Field Assistant, managed the sub-station under the supervision of Mr. S. de S. Daluwatta, Superintendent, Dartonfield Group till the end of the year.

Thanks are due to Mr. M. W. Thompson for his advice as Visiting Agent, Mr. A. Q. Jinadasa for his services during his tenure as Visiting Superintendent and the staff on the sub-station for their co-operation and good work.