THE
RUBBER RESEARCH INSTITUTE OF CEYLON

ANNUAL REVIEW FOR 1969

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THE RUBBER RESEARCH INSTITUTE OF CEYLON

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(As at 31st December, 1969)

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Mr. L. C. de Mel (Co-opted)
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Dr. O. S. Peries

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Mr. H. G. R. de Mel
Senator S. D. S. Somaratne
Dr. O. S. Peries

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Dr. O. S. Peries
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Mr. K. M. U. Jayanetty, B.A. (Lond.)

Lawyers

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

Auditors

Cecil Arseculeratne & Co.,
Chartered Accountants,
Hemas 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, 1969)

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
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 Geneticist .. N. E. M. Jayasekera, B. Sc. Ag. (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, L.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)
Assistant Soils Chemists	..	*R. S. John, B.Sc. Ag. (Cey.)
		N. Yogaratnam, B.Sc. Ag. (Allhabad)
Senior Technical Assistant	..	T. Kanthasamy
Technical Assistants	..	G. N. de Silva
		M. U. J. de Silva
	..	P. P. Jayasinghe
		A. M. A. Perera
		H. A. Seemon
	..	F. P. W. Silva

Field Assistants	..	W. M. Abeysinghe A. D. M. Karunaratne M. A. Mendis J. T. K. V. Nageswaran

Rubber Chemistry

Head of Department	..	M. Nadarajah, B.Sc. (Cey.), M.Sc. (Birm.), A.R.I.C., A.I.R.I.
Rubber Chemist	..	S. W. Karunaratne, B.Sc. (Cey.), M.Sc. (Aston), A.R.I.C., A.N.C.R.T., A.I.R.I.
Polymer Chemist	..	Mrs. M. Rajasingham, B.Sc. (Madras), Ph.D. (Lond.)
Assistant Development Officers	..	A. Coomaraswamy, B.Sc. (Cey.) D. S. Muthukuda M. T. Veerabangsa
Assistant Rubber Chemists	..	*R. Tharmalingam, B.Sc. (Cey.) *P. A. J. Yapa, B.Sc. (Vidyodaya, Cey.)
Senior Technical Assistant	..	E. G. Mendis
Technical Assistants	..	A. S. Dekumpitiya W. D. Dharmasena L. S. Goonawardena S. Kasinathan D. D. Medagama H. Narangoda K. A. Piyadasa

Statistical Section

Assistant Statistician	..	G. A. J. P. R. Gunasekera, B.Sc. (Cey.), Dip. Stat. (Vidyodaya, Cey.)

EXTENSION SERVICES

Estates Advisory Department

Head of Department	..	A. B. Dissanayake, B.Sc. Ag. (Cey.), B.A. (Cey.)
Estates Advisory Officer	..	K. W. de Silva

Assistant Advisory Officers	..	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.)
Agricultural Economist	..	A. I. R. Gunawardena, Dip. Agri. Ing. (Leipzig)

Smallholdings Department

Chief Advisory Officer (Smallholdings)	..	H. H. Peiris
Deputy Chief Advisory Officer (Smallholdings)	..	Vacant
Divisional Advisory Officers (Smallholdings)	..	P. S. G. Cooray M. B. Dissanayake B. D. Pedrick D. R. Ranwala K. P. Siriwardena D. B. Weligodapola J. D. S. Wickremaratne L. A. Wijesinghe
Office Assistant	..	R. A. Somadasa
Chief Clerk	..	C. Jayasinghe
Accounts Clerk	..	K. J. L. Perera, F.S.A.A., A.C.B.I.
Clerk-Translators	..	W. A. A. Perera I. L. Sirisena
Artist Clerk	..	M. J. P. Lusena
Clerks	..	Miss K. S. N. de S. Abeysinghe M. Jayasuriya G. P. A. I. G. Pathirana R. E. Perera A. Wijesinghe
Rubber Instructors	..	W. D. Abeysena D. L. Abeysinghe M. D. Albert

Rubber Instructors (contd.)

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
K. Ekanayake
P. B. Fernando
P. I. N. Fernando
P. T. S. Fernando
R. Gunadasa
L. L. C. Gunasekera
W. W. Gunasekera
U. D. V. Gunasinghe
A. P. Gunatilake
R. K. Gunatilake
W. A. J. de S. Gunatileke
G. Gunawardena
B. A. Gurusinghe
G. P. G. S. Hapugoda
R. B. Heendeniya
T. B. Herath
D. Hettiarachchi
S. D. Hidellarachchi
T. W. Jayalath
A. K. Jayatissa
W. D. 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

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

ADMINISTRATION

Correspondence and Accounts Sections

Chief Administrative Officer and Secretary to the Board	..	K. M. U. Jayanetty, B. A. (Lond.)
Accountant	..	M. E. A. Peiris, I.C.W.A. (1-4) (Lond.), A.C.C.A. Int. (Lond.), Dep. Acc. (Cey.)
Assistant Administrative Officer	..	S. M. J. Neangoda, B.A. Econ. (Cey.)
Office Assistant	..	J. A. Attygalle
Accounting Assistant	..	E. P. D. Roberts, F.C.B.I. (Lond.)
Personal Assistant to the Director	..	P. Samarasinghe
Confidential Clerk	..	W. D. Jayawansa
Establishment Clerk	..	D. G. Udawatta
Translator cum Typist	..	J. A. A. R. I. St. R. Perera
Clerk/Typists	..	M. J. Abeyasinghe
		T. H. Wijesena

Junior Clerk/Typists	..	Miss D. T. Baranasuriya Miss M. M. B. R. J. Cooray H. B. de Silva J. D. Gunaratne Miss L. J. C. Ranasinghe Miss W. Sellamuttu Miss N. K. Seneviratne Miss R. S. Seneviratne
Accounts Clerks	..	A. K. D. Amaradasa L. W. S. C. de Silva N. de Silva K. G. A. K. Dharmawardena A. L. Gunawardena K. D. D. Navaratne J. H. C. S. Perera A. L. Ratnayake B. H. Withanachchi
Junior Accounts Clerk	..	R. C. Fernando
Store-keeper	..	D. P. W. Goonesekera
Stores Assistant	..	M. H. C. Ariyaratne
Cashier	..	D. C. A. D. B. de Silva
Clerk cum Steno/Typist (Board Office)	..	P. H. Seneviratne

Library

Librarian & Publications Officer	..	Miss S. M. Fernando, B.Sc. (Cey.)
Library Assistant	..	W. Ranasinghe
Library Clerk	..	D. C. Thambawita

Works Section

Works Engineer	..	P. C. J. F. Keerthisinghe
Electrical Foreman	..	K. C. L. Fernando
Mechanical Foreman	..	M. M. Anderson

Building Foreman	..	W. S. J. Benjamin
Transport/Stores Assistant	...	B. D. Ponnamperuma
Clerk/Typist	..	D. D. D. Adikaram
Junior Clerk/Typist	..	N. Jayasekera

ESTATES

Dartonfield Group

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

Kuruwita Sub-station

Visiting Superintendent	..	A. Q. Jinadasa
Senior Field Assistant	..	M. C. Perera

*on study leave overseas.

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

THE RUBBER RESEARCH INSTITUTE OF CEYLON

DIRECTOR'S REVIEW FOR 1969

BY

O. S. PERIES

General

The price of natural rubber (NR) rose to $ (U.S.) .32 cts per lb in August 1969 from $ (U.S.) .16.5 cts in February 1968. The consensus of opinion in NR circles is that a stable price of $ (U.S.) .22 cts to 23.5 cts (an equivalent Ceylon price of approximately Rs. -/90 cts to Rs. 1/- per lb) is a reasonable expectation, and that the natural product should be able to work at a favourable profit at these price levels. An abnormally high price for NR would in the long-term be detrimental to the industry. In this connection it is interesting to note that Mr. H. C. Bugbee, on the eve of his retirement as President of the Natural Rubber Bureau after 40 years of close association with the NR industry, has stated that he is fully confident of the future of NR and can foresee nothing which would inhibit the growth of the industry in the next ten years, except a possible temporary 'bull market' that would make NR too expensive and force the substitution of synthetic rubber (SR) in certain areas, despite possible losses in end-product performance standards.

The prosperity of the NR industry depends on continued acceptance of its product by users in other countries and this acceptance must now be dilligently pursued. The challenge from SRs must be assessed and countered at the vital points, mainly at the users' factories. In this context the essential role of research must be kept in mind. The SR industry spends a great deal of money on research, about 2.5% of its gross dollar turn-over annually. As compared to this, NR spends only 1% of its value, or less, on research. An increase in the industry's expenditure on research on NR is worthy of consideration at this stage.

Though neither NR nor SR could alone satisfy the total demand for elastomers the tendency is for SR to satisfy an increasing part of it in terms of both quality and quantity. It is likely in the near future that NR percentage of total rubber consumption would lie between 25% and 35%. Hence those concerned with the welfare of the NR industry should endeavour to slow down, if they cannot check, the pace of substitution. This could be done by: (*a*) reducing the cost of production of NR, (*b*) improving the competitive efficiency of NR by the production of technically specified rubbers presented in small, wrapped bales, (c) finding new uses for NR, specially in the rubber producing countries, (*d*) undertaking research in the

chemical modification of NR to enable it to be marketed as a speciality rubber, and (*e*) the manufacture of more rubber products for local consumption and for export by producing countries.

The NR industry in Ceylon may be called upon to face trying situations in the near future and in anticipation of this the Rubber Research Board has formed a Special Committee on rubber, to formulate long-term policies for the industry which would make its future economically sound. The line of research of treating NR as an agricultural commodity is being radically altered and the Institute's research programme is now geared to viewing it as an industrial raw product, which is its correct assessment.

It is vital for the NR industry to invest in research on finding new uses for its product. In the U.S.A. Styrene Butadiene Rubber (SBR) has enjoyed a 4.5% annual growth rate in spite of the development of other new forms of SR. If tests now being carried out prove that skid resistance can be improved by the use of more SBR in tyres and that the addition of SBR in some form to asphalt highways will decrease maintenance costs, extend highway life and result in safer roads, then an even greater growth rate for this product can be expected. Similarly the growth rate of NR can be increased by finding new uses for it.

Research

Botany : The increase in per acre yield of rubber, by the use of improved clones and various techniques such as correct methods of tapping and yield stimulants, is the most important area of research in the Botany Department. A problem that is closely related to the development of new high-yielding clones is the selection of a suitable stock plant, the root system of which would support the more vigorous new clones.

The commercial yields of clone RRIC 45 have continued to be promising and no serious outbreaks of diseases or wind damage have been recorded on this clone, which has surpassed most other clones in growth and establishment in the dry districts. Clone RRIC 36, which is very susceptible to Bark Rot, but has a very high yield potential is now recommended for planting in districts with an average rainfall of around 100 in. per year. The newer clones which have yielded better than PB 86 in large scale trials and at the same time have shown a fair degree of tolerance to diseases are AVROS 1734, WR 101, RRIC 13 and 55, PR 252, IRCI 2 and 9.

RRIC 100 and 101, two clones which have given high yields in preliminary small scale trials at the R.R.I.C. Sub-station at Kuruwita, have a very high yield potential, and are recommended for small scale planting in estates.

The S/2, d/2, 100% is still the most acceptable tapping system for most Ceylon clones. Until further experimental data are available it is recommended that, for

high-yielding clones, the double-four tapping system be introduced, if necessary, only after the tenth year of tapping.

The Institute has successfully formulated a yield stimulant mixture using locally available raw materials. The manufacturing rights for this mixture have been granted to a commercial firm in Colombo, and the product will be marketed shortly.

Experimental results indicate that as far as growth is concerned the seed of most recommended clones, except PB 86, will give comparable results to Tjir 1 as stock plants.

Genetics & Plant Breeding : The development of a clone that is high-yielding, disease-resistant and capable of growing under varied soil and climatic conditions is the goal of the Plant Breeder. It has been estimated that, with the available solar energy and photosynthetic tissue, the potential yield of the rubber tree should be about 6,000 lb per acre per annum. The results achieved in *Hevea* breeding up to date, with about a seven-fold increase in yield from the original 3—400 lb clonal seedlings, is quite impressive. The Institute is now studying various devices to induce mutations, so as to expedite the process of breeding high yielders.

Studies initiated on the use of chemical mutagens such as ethyl methyl sulphonate have been continued and the toxicity levels of the latter determined. Statistically based seedling variability trials for six parent clones have been planted both at Kuruwita and Nivitigalakele. The hand pollination programme, which was directed towards the increase of yield and vigour and a study of heterosis, has yielded 416 seedlings, which have been established in nurseries. The yields of RRIC 100 and 101 have indicated that these clones are suitable for tapping at 67% intensity during the first five years of tapping, when cuts are opened at $4\frac{1}{2}$ years. The *Oidium*-resistant clone 1103 produced satisfactory foliage when planted above 1,000 ft elevation; and gave very satisfactory yields at Kuruwita and Nivitigalakele. IAN 45—710, also an *Oidium*-resistant clone, has been found to be suitable for planting above 1,000 ft elevation, producing good foliage and above average yields.

Soils Chemistry : The increasing yields of the newer clones have made it necessary to assess their optimum nutritional requirements. Therefore, a soil and leaf nutrient survey is being organised for rubber growing areas, with a view to the lowering of the cost of production but maintaining the yields that are to be expected of the high-yielding clones. As an essential prerequisite to this programme the soil resources of the rubber growing areas and the leaf nutrient status of the experimental areas are being determined. The growth rate of the more vigorous clones like RRIC 7, 45 and 52 presently indicate that they do not require extra doses of manure for their better growth.

The optimum times and methods of fertilizer application and the most effective and cheap methods of controlling weeds are being studied. Herbicide mixtures based on MSMA appear to be effective in the control of the common weeds in

rubber plantations. The concentration of sodium arsenite and the total cost of control with this weedicide can be reduced, if control measures are adopted early.

The soil surveys have been continued, with more detailed studies in selected areas. Refinements of the Aluthgama 1 in. map have shown that there are other soil types, not already identified, in this area.

A study of wind damage in rubber has shown that while uprooting depends on the environment, trunk snap and branch breakage are clonal characteristics.

Plant Pathology : As the immediate pathological problems of *Hevea* have been satisfactorily resolved to a large extent, the Plant Pathology Department is carrying out certain fundamental studies on the physiology of disease resistance. The results of these studies will ultimately assist in the more economical control of the diseases of the rubber tree.

Preliminary investigations on the physiology of disease resistance have indicated that clones resistant to Bark Rot disease appear to possess certain 'factors' responsible for disease resistance. In resistant clones "phytoalexins" are produced in quantities toxic to zoospores of *Phytophthora* species. Work is being continued to isolate and identify these "phytoalexins". It has also been found that the cork layer of the bark of clone PB 86 is resistant to *Phytophthora* infection ; any injury to this layer would make all the underlying layers of bark susceptible to Bark Rot. The fungus sporulates well on rotted bark indicating that it may survive on the trunk for at least a limited period. The tapping cut has been found to be susceptible to infection up to about five days from the time the cut is opened.

Studies on survival of *Fomes lignosus* and decomposition of rubber wood have shown that there are a number of cellulose decomposing fungi, antagonistic to *Fomes*, which can grow on decomposing wood.

Field observations on *Xylaria* root disease have confirmed the relation of the food base to infection of *Hevea* roots by *Xylaria.*

Studies on mould species contaminating prepared rubber have shown that relative humidities above 95% and temperatures between 25° — 35°C are optimum for germination of spores and growth of mould. Observations made in rubber factories have established that contamination is high during rainy weather and practically nil during dry weather. Humid conditions prevailing during wet weather have been found to be ideal for growth of moulds.

Rubber Chemistry : The Rubber Research Board has accepted that the Institute should undertake research on all aspects of rubber production and usage. Therefore, the work of the Rubber Chemistry Department has expanded to a great extent during 1969, and a continuing programme of research has been formulated, with emphasis on the uses of natural rubber. A part of the required staff, to carry

out this expanded programme, has been recruited and is undergoing the necessary training both at the Institute and abroad.

Investigations on the production of viscosity stabilised rubber from lower grades have shown that storage hardening can be successfully inhibited by soaking cup lumps in an aqueous solution of hydroxylamine hydrochloride. Soaking in rubber serum from acid or assisted biological coagulation improved the PRI.

The wear properties of oil-extended natural rubber retreads have been found to be superior to those of non-oil-extended rubber, when due regard is paid to compounding. In the related field of the use of field latex in road surface dressings, the problem of the transport of latex to the site has been overcome by preparing rubber-bitumen masterbatches containing an optimum of 12.5 % rubber.

Vulcastab LW or mixtures of Vulcastab LW and potassium hydroxide or potassium sulphate or sodium carbonate were found to be suitable stabilizers for ammonia preserved field latex for mixing with cement. If the latex is pre-vulcanised, less stabilizer was necessary and if it is grafted with methyl methacrylate no stabilizer was necessary.

Investigations on the collection of rubber seed kernel have shown that estates can make a profit of about Rs. 150/- to Rs. 175/- per ton of kernel collected.

Work done in collaboration with the Ceylon Institute of Scientific and Industrial Research has shown that the tocotrienol contents of field latex exhibit a clonal variation and that these substances could be important antioxidants.

Field surveys and other preliminary investigations have been carried out by the Department for the erection of a central factory to process latex from smallholders and small estates into new forms of rubber.

Estates Advisory and Smallholdings : The extension services continued to give valuable advice to estate owners and smallholders, respectively. The Estates Advisory Department paid 342 routine visits to small and medium-sized estates during 1969. In such visits the advisory officers give a general report on all aspects of the industry, including planting, manufacture and factory operations. In addition this Department also visited 166 estates on request to advise on specific problems. All visits were followed by comprehensive reports to the owners of the estates. The Smallholdings Department continued to assist smallholders with lining for planting holes and soil conservation works, organisation of sulphur dusting groups, advice on the construction of approved type-plan smoke houses and the marking of trees for correct tapping.

Staff

The Institute had its full cadre of staff at the end of the year except for two appointments of Acting Heads of Departments.

Dr. O. S. Peries was confirmed as Director with effect from 1st January and was on duty throughout the year.

Messrs. L. B. Chandrasekera, Head of the Botany Department, D. M. Fernando, Head of the Genetics & Plant Breeding Department, A. B. Dissanayake, Head of the Estates Advisory Department, H. H. Peiris, Chief Advisory Officer Smallholdings Department, C. G. Silva, Acting Head of the Soils Chemistry Department, Dr. (Mrs.) V. Satchuthananthavale, Acting Head of the Plant Pathology Department, Dr. R. Satchuthananthavale, Botanist and Messrs. S. W. Karunaratne, Rubber Chemist and K. W. de Silva, Estates Advisory Officer, were on duty throughout the year.

The Intermediate Staff Officers, Messrs. A. Dahanayake, Assistant Advisory Officer, P. C. J. F. Keerthisinghe, Works Engineer, M. R. T. Mendis, Assistant Estate Superintendent, S. M. J. Neangoda, Assistant Administrative Officer, U. P. de S. Waidyanatha, Assistant Botanist, H. T. Wickremasekera, Assistant Advisory Officer, were also on duty throughout the year.

Mr. D. S. Muthukuda, Assistant Advisory Officer was transferred to the Rubber Chemistry Department as Assistant Development Officer.

Miss A. C. I. Yahampath, Assistant Botanist and Messrs. P. A. J. Yapa and R. Tharmalingam, Assistant Rubber Chemists, proceeded to the U.K. during the latter part of the year to do their post-graduate studies.

Mr. R. S. John, Assistant Soils Chemist continued his post-graduate studies at the University of Aberdeen.

Mr. A. Q. Jinadasa, Visiting Superintendent, continued to overlook the Kuruwita Sub-station, during the year.

Mr. M. T. Veerabangsa, Senior Technical Assistant in the Rubber Chemistry Department was promoted to the post of Assistant Development Officer with effect from 22nd February.

The following Senior and Intermediate Staff Officers joined the services of the Institute during the year :

Mr. K. M. U. Jayanetty as Chief Administrative Officer on 5th May,
Mr. M. Nadarajah as Head of the Rubber Chemistry Department on 1st July,
Mr. S. de S. Daluwatta as Estate Superintendent on 1st October,
Dr. (Mrs.) S. Rajasingham as Polymer Chemist on 17th November,
Mr. S. Hansen, Industrial Advisor—Rubber, was seconded for service at the Institute from 1st October.
Mr. A. de S. Liyanage as Assistant Plant Pathologist on 31st January,
Mr. M. E. A. Peiris as Accountant on 20th March,
Mr. N. Yogaratnam as Assistant Soils Chemist on 25th March,

Mr. N. E. M. Jayasekera as Assistant Geneticist & Plant Breeder on 1st June,
Mr. A. Coomaraswamy as Assistant Development Officer on 1st June,
Mr. R. A. Wijewansa as Assistant Advisory Officer on 1st October,
Mr. D. E. F. Suraweera as Assistant Advisory Officer on 1st October,
Mr. G. A. J. P. Gunasekera as Assistant Statistician on 1st October,
Miss S. M. Fernando as Librarian & Publications Officer on 1st October,
Mr. A. I. R. Gunawardena as Agricultural Economist on 11th October.

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

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

Senior Staff (Heads of Departments)	.. ..	8
Senior Staff (Non-Heads of Departments)	..	7
Intermediate Staff	.. ..	21
Assistant Staff	.. ..	184
Minor Staff	.. ..	90
		310

Visitors

Visitors to the Institute included :-

Messrs. P. A. Skovorodkin, U.K. Ebymymeko, I. K. Yovtustienko, F. A. Guzein-Zebe, Chesnokov Valdimir and Azizian Vazgen from U.S.S.R.
Messrs. S. Matsumotor and H. Tabei from Tropical Agriculture Research Project of Japan,
A Parliamentary Delegation from U.S.S.R.
Prof. R. A. Fox, Scottish Horticultural Research Institute, Dundee, U.K.
Miss P. Ady, St. Ann's College, Oxford and UNDP,
Mr. R. W. Bucen, Lincoln College, Oxford and UNDP,
Mr. L. H. Greenwood-Barton, Principal Scientific Officer, T. P. I., London,
Prof. N. V. Rotwell, Long Island University, Brooklyn, New York,
Mr. John Allen, London Director of the Dalkeith (Ceylon) Rubber Estates Ltd.,
Mr. Chalat Shripicharn, Shell Co. Ltd., Thailand,
Mr. Hunayien Khan Panni, High Commissioner of Pakistan in Ceylon,
Mr. L. Kassasian of the Weed Research Organization, Oxford,
Hon'ble Mr. M. D. Banda, Minister of Agriculture & Food,
A Ford Foundation Agricultural Research Review Team consisting of Drs. Nyle C. Brady (leader of the team), Sylvan H. Wittwer and Yoshiski Ishizuka,
Dr. Donald E. Hanz, Ohio State University, Columbia, Ohio, U.S.A.
Dr. L. Holm, University of Wisconsia, Madison, Wisconsia, U.S.A.,
Dr. O. G. Scoville, Dr. W. H. Edwards, L. B. Kristjanfon and Mr. K. N. Satyapal, a UNDP team,

Dr. J. S. Lowe, P.O. Box 714, Kuala Lumpur, Malaysia,
Mr. Victor M. Shorrocks, Borax Consolidated Ltd., London,
Dr. H. Semangan, Associate Professor, Gadjah Mada University, Jogjakarta, Indonesia,
Mr. James Ohagen and Mr. Owen Pryce of the I.B.R.D. Mission,
Mr. G. M. C. Higgins, N.R.P.R.A. Welwyn Garden City, England,
Mr. P. J. Grieve, Hoechst A. G., West Germany,
Prof. Gerald Scott, University of Aston, Birmingham,
Dr. and Mrs. Donald Sherman, American University of Beruit, Beruit, Lebnon.

Visits

Mr. D. B. Ellepola, Chairman, Rubber Research Board and Dr. O. S. Peries, Director, participated in the International Rubber Research & Development Board meetings held in London from 15th to 22nd July.

In addition, the Director and the research officers of the Institute attended the following meetings, conferences and seminars :-

The Malaysian Crop Diversification Conference, held in Kuala Lumpur,
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, continued to work full time in the Plant Pathology Department, under the supervision of Dr. O. S. Peries, Director, on the problem of the control of *Eupatorium odoratum* L, a noxius weed in the wet low country areas of Ceylon. He will be presenting his thesis for the M. Sc. degree shortly.

Mr. A. Thevarasa, the Cement Corporation scholar, and Mr. K. Varthunagarajan, the C.I.C. scholar to the University of Aston in Birmingham, worked for short periods in the Rubber Chemistry Department.

Miss L. Fernando, Vidyalankara University of Ceylon, continued to work on a research problem in soil microbiology in collaboration with the officers of the Plant Pathology 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 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, helping us organise a section on Polymer Science and Technology in that Department. Prof. Scott continues to be our consultant in this field.

Mr. Lakit Nualsri of the Rubber Development Project in Thailand, underwent a course of training for a period of three months, in the Soils Chemistry Department.

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.

Mr. C. G. Silva, Acting Head of the Soils Chemistry Department, delivered a lecture on Soil Science to the students at Vidyalankara University of Ceylon.

Lectures given by members of the staff and visiting scientists at the Botany Department auditorium were a regular feature at monthly intervals at the Institute. These lectures were greatly appreciated and enjoyed by the staff.

Exhibitions

The Institute took part in a number of Government sponsored industrial and trade exhibitions during the year, and also helped many schools with exhibits for their trade fairs.

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.

Publications

General

Annual Review for 1968
Annual Report of the Rubber Research Board for 1968 (trilingual)- Part 1 (in press)
Annual Report of the S.H. Department (Sinhala) for 1966
— do — 1967
— do — 1968
Quarterly Journal Vol. 45, Parts 1 - 2
— do — 3 - 4 (in press)
R.R.I.C. Bulletin (New Series) Vol. 4, Nos. 1 & 2,
— do — ,, 4, Nos. 3 & 4 (in press)
Advisory Circular No. 80 - A guide to the cost of replanting rubber (in press).

Roneoed Leaflets

1. *Oidium* Questionnaire 1969
2. *Phytophthora* Questionnaire 1969
3. Questionnaire re survey on economics of production of rubber 1968.
4. Circular letter to Agency Houses re. clonal susceptibility to Bark Rot and incidence of White Root disease in different districts.

Papers

ANON, A guide to the cost of replanting rubber. *R.R.I.C. Bull.* (New Series) **4,** 11- 15.

DISSANAYAKE, A. B. The development of the synthetic rubber industry. *R.R.I.C. Bull.* (New Series) **4,** 6 - 11.

DISSANAYAKE, A. B. A study of the future possibilities of the rubber industry. Part 1 - Supply prospects. *Rubb. Res. Inst. Ceylon Quart. J.* **45,** Parts 3 - 4 (in press).
Parts II - Demand prospects — do — — do —
Part III - Outlook — do — — do —

KARUNARATNE, S. W. AND M. W. THOMPSON. Experimental crumb rubber project at Peenkande. *R.R.I.C. Bull.* (New Series) **4,** 1 - 5.

KARUNARATNE, S. W. Use of oil-extended natural rubber in passenger car retreads in Ceylon—performance of retreads based on OENR and OENRM. *R.R.I.C. Bull.* (New Series) **4,** Nos. 3 & 4 (in press).

NADARAJAH, M. The use of oil-extended natural rubber (OENR) in passenger car retreads in Ceylon. *Rubb. Res. Inst. Ceylon Quart. J.* **45,** 1 - 13.

NADARAJAH, M. The collection and utilization of rubber seed in Ceylon. *R. R. I. C. Bull.* (New Series) **4,** Nos. 3 & 4 (in press).

SENANAYAKE, Y. D. A. The natural chlorophyll mutation frequency and the occurrence of yellows in nursery seedling populations of *Hevea brasiliensis* Muell. Arg. in Ceylon. *Rubb. Res. Inst. Ceylon Quart. J.* **45,** 14 - 21.

SENANAYAKE, Y. D. A. Species specific abaxial foliar characteristics of *Hevea benthamiana* Muell. Arg., *H. brasiliensis* Muell. Arg. and *H. spruceana* (*Benth.*) Muell. Arg. and their expression in interspecific hybrids. *Rubb. Res. Inst. Ceylon Quart. J.* **45,** 22 - 31.

YAHAMPATH (MISS) A. C. I. A comparison of nursery techniques. *Rubb. Res. Inst. Ceylon Quart. J.* **45,** Parts 3 - 4 (in press).

REVIEW OF THE BOTANY DEPARTMENT

By

L. B. Chandrasekera

Summary

The yield response to application of stimulants to virgin bark has continued to be poor.

During a six-year period, tapping without a "winter" rest has had no adverse effects on the rate of girthing of trees on clones Nab 15 and PB 86. The rate of girthing of clone RRIC 52 on full spiral fourth-daily and double-four tapping systems has remained uniform over a three-year period. There has, however, been a marked depression in growth rate for the two tapping systems as compared with the alternate-daily half spiral system.

On the basis of yields recorded up to the end of 1969 the following clones are likely to yield better than clone PB 86 :-

AVROS 1934, WR 101, RRIC 13 and 55, PR 252, IRCI 2 and 9.

Clone PB 28/59 has remained the best yielder in two large scale trials with clone RRIC 89 as the next best yielder in one trial. The incidence of Brown Bast in clone PB 28/59 however has been relatively high on the S/2, d/2, 100% tapping system.

Clone AVROS 427 though high-yielding has been a poor grower with a high degree of susceptibility to Bark Rot in the Kalutara District. Clone RRIC 94 in one large scale trial has yielded an average of 44.7 g dry rubber per tree per tapping in the first year as compared with 29.9 g for clone PB 86. The clone RRIM 623 though yielding well has been subject to wind damage.

Until further data are available, it is recommended that planting of the following clones in estates be discontinued :-

RRIC 52, 86, 90, 91, GT 1, TR 1406 and AVROS 427.

Staff

The following technical staff of the Botany Department were on duty throughout the year :-

Mr. L. B. Chandrasekera	Head of the Botany Department
Dr. R. Satchuthananthavale	Botanist
Mr. U. P. de S. Waidyanatha	Assistant Botanist

Miss A. C. I. Yahampath, Assistant Botanist, was on overseas study leave with effect from 15.10.1969.

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 Botany Department addressed the following Planters' Association meetings during the period under review :-

Kalutara	District Planters' Association			—	on 'Tapping'
Sabaragamuwa	,,	,,	,,	—	,, 'Tapping'
Kelani Valley	,,	,,	,,	—	,, 'Planting Material'

He also attended the Malaysian Crop Diversification Conference, which was held in Kuala Lumpur from 10-12 November 1969, and took this opportunity to visit the Rubber Research Institute of Malaya for discussions with the staff of the Botany Division of that Institute.

Publications

1. Annual Report of the Botany Department 1968
2. Annual Review of the Botany Department 1968
3. A comparison of nursery techniques. *Rubb. Res. Inst. Ceylon Quart. J.* 45.

Yield Stimulation Experiments

The Field Experiment No. 2 was discontinued with effect from 1969 as the area was due for replanting.

Tapping Experiments

Field Experiment No. 4 — 1964 "*Winter*" *Tapping cum Yield Stimulation Trial*

In this trial the following treatments are applied to 20 trees of each of the clones Nab 12 and PB 86 and 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 girth and yield data for the first five years are presented in Table 1.

TABLE 1

WINTER TAPPING AND YIELD STIMULATION EXPERIMENT—DARTONFIELD

Yield in grammes dry rubber per tree per tapping
Test tapped from March 1964

(Nab 12)		A	B	C	D
Average girth in inches	(1964)	27.5	27.9	27.5	27.4
— do —	(1965)	28.7	29.2	28.6	28.3
	(1966)	29.0	29.9	28.8	28.9
	(1967)	30.0	30.9	29.8	30.0
	(1968)	30.8	31.7	30.5	30.7
	(1969)	31.1	32.0	31.4	31.2
Average yield before treatment		41.9	41.5	39.2	41.0
Average adjusted yield*	(1964)	58.0	55.2	56.4	50.2
— do —	(1965)	44.3	43.6	43.4	41.2
	(1966)	39.0	39.5	43.2	35.0
	(1967)	40.3	39.1	38.9	36.6
	(1968)	42.2	41.2	37.9	32.6
	(1969)	42.3	39.9	43.2	37.7
(PB 86)					
Average girth in inches	(1964)	27.0	27.1	27.0	27.9
— do —	(1965)	28.2	28.4	28.6	29.6
	(1966)	28.5	28.8	28.7	29.9
	(1967)	29.7	29.9	30.4	31.1
	(1968)	30.5	30.6	30.9	32.0
	(1969)	30.8	30.7	31.3	32.7
Average yield before treatment		31.7	35.0	32.8	39.1
Average adjusted yield*	(1964)	44.7	46.3	42.1	41.4
— do —	(1965)	41.9	39.7	40.1	36.7
	(1966)	37.4	36.2	37.5	37.7
	(1967)	38.4	40.2	37.8	38.5
	(1968)	36.7	34.2	30.6	42.8
	(1969)	35.2	28.6	44.6	36.4

* Yield results for five months

A — Yield stimulation of virgin bark tapping without winter rest
B — Yield stimulation of virgin bark tapping with winter rest
C — No stimulation and tapped without winter rest
D — No stimulation and tapped with winter rest

Field Experiment No. 50—Small Scale Tapping Experiment

This experiment is sited in a commercial estate in the Kalutara District. 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 during the first three years of this experiment are summarised in Table 2A.

TABLE 2A

SMALL SCALE TAPPING EXPERIMENT

Average yield of dry rubber in grms/tree/tapping

Block	Tapping system	1967	1968	1969	Mean
A	2S/2, d/4, 100%	49.5	43.8	54.2	49.2
	S/1, d/4, 100%	53.4	57.0	56.4	55.6
B	2S/2, d/4, 100%	52.4	44.9	46.8	48.0
	S/1, d/4, 100%	45.8	44.4	43.7	44.6

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

TABLE 2B

SMALL SCALE TAPPING EXPERIMENT

Rate of girthing of trees in inches

Block	Tapping system	1967 - 68	1968 - 69	Mean
A	2S/2, d/4, 100%	0.7	0.5	0.60
	S/1, d/4, 100%	1.0	0.5	0.75
B	2S/2, d/4, 100%	0.4	0.6	0.50
	S/1, d/4, 100%	0.5	0.5	0.50

The average rate of girthing of trees during the two years preceding the experiment when the trees were tapped on S/2, d/2, 100% system was 1.7 in. per year.

Tapping Experiment No. 52—Yatadola Estate

Based on the results of a preliminary study of the time taken by a tapper to perform various tapping operations, two large scale tapping experiments involving task sizes of 200 to 400 trees were set down in a commercial estate in the Kalutara District. The results to be evaluated in this trial are the influence of task size on yield and the optimum task size on the S/2, d/2, 100% tapping system.

Clone Evaluation Trials

Field Experiment No. 5—1946 *Replanted Area—Nivitigalakele*

The test tapping results of the original unreplicated 25-tree plots are presented in Table 3.

TABLE 3

LARGE SCALE CLONE TRIAL — 1946 REPLANTED AREA — NIVITIGALAKELE

Yield in lb dry rubber per tree per year

	RRIC 88	RRIC 89
No. of trees tapped in 1969	21—19	19—17
Yield — 1960	22.3	21.2
,, — 1961	25.2	21.7
,, — 1962	23.1	22.4
,, — 1963	20.3	20.0
,, — 1964	24.1	22.1
,, — 1965	24.6	26.0
,, — 1966	26.6	23.9
,, — 1967	31.1	25.4
,, — 1968	25.8	21.5
,, — 1969	18.5	23.3
Brown Bast cases 1969	1	—
Canker and Bark Rot cases 1969	—	—
Wind damage cases 1969	1	2
Girth in in. 1969	41.8	40.5

Of the two clones, RRIC 89 has given high average yields in one large scale trial planted in 1961. It has good secondary characters and shows a high degree of tolerance to diseases.

Field Experiment No. 6—1952 *Small Scale Clone Trial—Hedigalla*

Clones RRIC 90 and 91 represent the final selections from a large number of clones planted in this trial. Test tapping results of the unreplicated 5-tree plots are given in Table 4.

TABLE 4

SMALL SCALE CLONE TRIAL—1952 CLEARING—HEDIGALLA

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

Year of tapping	RRIC 90	RRIC 91
1961	22.9	20.5
1962	25.3	21.1
1963	22.3	26.0
1964	25.3	26.5
1965	24.6	26.4
1966	31.4	36.5
1967	25.6	30.3
1968	26.5	34.5
1969	24.6	29.2
Girth in in. 1969	35.6	39.1
No. of trees tapped in 1969	5	3
Wind damage cases in 1969	—	—

Two trees of RRIC 91 were blown down by wind in 1968. In subsequent large scale trials clone RRIC 90 has been a rather poor grower.

Field Experiment No. 7—1954 Clone Trial—Nivitigalakele

Clones in this trial are planted in 40-tree plots replicated five times. The yields of the best clones in this trial, clones IRCI 7 and PB 28/59, along with the control clone RRIM 501 are presented in Table 5.

TABLE 5

1954 CLONE TRIAL—NIVITIGALAKELE

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

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
No. of trees tapped in 1969	137—132	111—105	90—86
Canker and Bark Rot cases in 1969	—	—	—
Brown Bast cases, 1969	3	2	10
Wind damage cases, 1969	3	4	3
Total casualties, 1969	6	6	13
Mean girth in in. 1969	29.8	30.8	27.2
Bark thickness in mm			
Virgin bark	10.1	10.0	9.7
Renewed bark	7.3	6.5	6.5

The poorer yielders in this trial are the clones IRCI 10, PBT 207, PB 6/5, PB 24/3 and PB 24/51. In 1968 the incidence of Brown Bast in clones PB 28/59 and IRCI 7 had been around 20 %. Most of these trees have recovered after a rest period in 1969.

Field Experiment No. 11—1951 *Clone* Trial—*Hedigalla*

Clones in this trial are planted in 25-tree plots replicated three times. The test tapping results of the final selection clone RRIC 99 as compared with the control clone PB 86 are presented in Table 6.

TABLE 6

1951 SMALL SCALE CLONE TRIAL—HEDIGALLA

Tapped on S/2, d/3, 67% from 1958

Tapped on S/2, d/2, 100% from 1960

Yield in lb dry rubber per tree per year

Year of tapping	RRIC 99	PB 86
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
Girth in in. 1969	32.9	32.5
No. of trees tapped in 1969	51—42	54—51
Brown Bast cases, 1969	7	2
Wind damage cases, 1969	2	1

Field Experiment No. 12—1949 *Clone Trial—Hedigalla*

Each clone in this trial is planted in 25-tree plots replicated six times. The yields of the final selection clone RRIC 86 and the control clone PB 86 are presented in Table 7.

TABLE 7

1949 LARGE SCALE CLONE TRIAL—HEDIGALLA

Tapped on S/2, d/2, 100%

Yield in lb dry rubber per tree per year

Year of tapping	RRIC 86	PB 86
1962	21.0	15.6
1963	19.3	15.7
1964	20.9	18.1
1965	22.0	20.9
1966	19.8	16.9
1967	18.2	17.3
1968	15.8	15.2
1969	15.1	13.5
Girth in in. 1969	31.7	33.9
Trees tapped in 1969	58—59	92—91
Brown Bast cases, 1969	1	1
Wind damage cases, 1969	—	—

The reduction in the number of trees in tapping has been due to large scale wind damage that has occurred in one section of the trial area.

Field Experiment No. 13—1954 *Clone Trial—Hedigalla*

The clones were originally planted in unreplicated monoclonal blocks of 800 to 1,000 trees per clone. The test tapping yields of the two most promising clones compared with clone PB 86 are presented in Table 8.

TABLE 8

1954 LARGE SCALE CLONE TRIAL—HEDIGALLA

First tapped in July 1961 on S/2, d/2, 100%

Yield in grammes dry rubber per tree per tapping

Clone	No. of trees tapped in 1969	Girth in in. 1969	Yield							
			1962	1963	1964	1965	1966	1967	1968	1969
RRIC 36	368—406	30.8	33.0	44.1	41.8	37.9	41.8	52.9	44.8	45.2
RRIC 37	377—387	26.7	28.8	23.0	28.4	25.3	36.4	42.1	38.2	40.6
PB 86	520—537	28.2	—	32.9	31.0	28.0	37.2	43.6	39.8	37.7

Clones RRIC 36 and 37 are both highly susceptible to Bark Rot in the wet districts. Clone RRIC 37 in addition shows pronounced late drip. The relatively low average yields recorded for clone RRIC 37 in this trial could partly be attributed to extensive wounds resulting from Bark Rot. Clone PB 86 was first tapped in 1963.

Field Experiment No. 14—1955 *Clone Trial—Hedigalla*

Twelve RRIC clones were originally planted in the replicated monoclonal blocks of 750 trees per clone. The yield results of the best selections are summarised in Table 9.

TABLE 9

1955 LARGE SCALE CLONE TRIAL—HEDIGALLA

Yield in grammes dry rubber per tree per tapping

Year of tapping	RRIC 40	RRIC 50	RRIC 51	RRIC 13	RRIC 46
1962	28.5	17.7	30.3	30.3	31.1
1963	32.4	33.2	31.3	33.1	36.0
1964	42.0	38.4	35.0	34.8	36.2
1965	45.4	40.1	40.1	45.5	45.8
1966	46.2	59.5	46.2	48.3	55.9
1967	58.5	58.5	45.4	54.1	54.8
1968	44.7	49.9	47.6	59.1	45.6
1969	43.3	49.9	36.1	49.1	37.7
No. of trees tapped in 1969	397—327	449—428	495—493	534—531	156—144
Girth in in. 1969	30.1	28.0	27.1	27.3	26.0
Brown Bast cases, 1969	27	—	—	—	—
Wind damage cases, 1969	15	21	2	3	11
Other casualties, 1969					(*Fomes*) 1

Field Experiment No. 15—1953 *Clone Trial—Nivitigalakele*

In this trial clone RRIC 45 is planted as a monoclonal block in an extent of approximately five acres. The test tapping yields of this clone for the first eight years are presented in Table 10.

TABLE 10

1953 LARGE SCALE CLONE TRIAL—NIVITIGALAKELE

Tapped on S/2, d/2, 100%

Yield in lb dry rubber per tree per year

	RRIC 45
No. of trees tapped in 1969	556—538
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
Brown Bast cases in 1969	24
Bark Rot and canker cases 1969	—
Wind damage cases in 1969	3
Mean girth in in. 1969	27.4
Thickness of virgin bark in mm	8.9
Thickness of renewed bark in mm	6.3

Field Experiment No. 16—1956 *Clone Trial—Hedigalla*

All clones are planted in unreplicated blocks of 300 trees per clone. Tapping commenced as individual clones reached tappable girth as follows :-

First tapped in July	1963	—	RRIC 55, PB 86, IRCI 9, RRIM 605, 618, PR 252 and PR 257
,, ,, ,, March	1964	—	RRIC 39, 48, 54, 59, PR 253, AVROS 1447
,, ,, ,, ,,	1965	—	PR 247
,, ,, ,, ,,	1966	—	RRIC 42, AVROS 1851
,, ,, ,, September	1966	—	IRCI 1, 3, 6

The test tapping results are presented in Table 11.

TABLE 11

1956 LARGE SCALE CLONE TRIAL—HEDIGALLA

Yield in grammes dry rubber per tree per tapping

Clone	No. of trees tapped in 1969	Mean girth in inches	Yield					
			1964	1965	1966	1967	1968	1969
RRIC 55	191—182	25.1	22.2	29.7	35.1	43.7	37.6	39.6
AVROS 1447	179—162	25.8	17.3	22.8	35.2	35.3	31.9	38.9
RRIC 48	201	24.0	26.0	28.4	39.7	41.5	35.0	37.0
IRCI 6	143	22.8	—	—	16.5	19.3	25.2	33.7
PR 247	174—170	25.5	—	28.1	30.6	24.4	35.1	33.6
IRCI 9	190—189	27.8	23.7	31.7	38.8	36.5	38.9	33.6
RRIC 54	226—223	25.1	15.8	23.6	24.7	34.7	30.1	30.1
IRCI 1	179	22.8	—	—	22.9	24.2	25.0	30.1
RRIM 618	175—163	26.5	29.7	26.0	30.1	29.7	30.8	29.7
AVROS 1851	179	25.2	—	—	21.2	22.0	26.4	28.6
PR 257	196—194	24.4	29.5	29.4	29.2	28.4	28.5	28.1
RRIC 59	210—207	26.1	13.9	19.2	24.2	26.0	28.2	28.0
PR 252	224	25.6	24.5	35.3	33.0	34.5	32.3	27.7
RRIC 39	196	24.8	21.7	25.3	30.7	31.1	26.1	27.5
IRCI 3	204	21.0	—	—	21.8	22.0	23.4	27.3
RRIC 42	217	24.8	—	—	25.4	26.0	26.1	27.1
PB 86	232—229	28.9	20.6	23.1	28.1	29.5	25.8	26.8
RRIM 605	203—196	24.9	14.7	15.7	22.4	28.1	22.0	26.6

Field Experiment No. 17—1956 *Clone Trial—Dartonfield*

Clones GT 1, WR 101, AVROS 427 and 385 are planted in unreplicated 300-tree plots per clone, 48 points of clone RRIC 52 are planted along the boundaries. Clone RRIC 52 was first tapped in 1962. All other clones were first tapped in 1963.

Test tapping results are summarised in Table 12.

TABLE 12

1956 CLONE TRIAL—DARTONFIELD

Yield in grammes dry rubber per tree per tapping

	WR 101	GT 1	AVROS 385	AVROS 427	RRIC 52
No. of trees tapped in 1969	283	280	254	239	47—45
Yield in 1963	22.7	15.6	7.5	—	22.3
„ „ 1964	26.0	19.9	17.9	32.9	22.9
„ „ 1965	28.2	18.1	15.5	23.3	23.6
„ „ 1966	20.9	21.6	14.2	22.4	27.5
„ „ 1967	21.1	17.7	17.0	24.3	28.2
„ „ 1968	19.4	19.2	15.4	28.6	27.8
„ „ 1969	18.8	18.8	16.6	27.6	25.7

Field Experiment No. 18—1961 *Large Scale Clone Trial—Dartonfield*

All clones are planted in unreplicated monoclonal blocks of 500 to 600 trees per clone. Test tapping results for the first two years in tapping are presented in Table 13.

TABLE 13

1961 LARGE SCALE CLONE TRIAL—DARTONFIELD
Tapped on S/2, d/2, 100% from March 1968
Yield in grammes per tree per tapping

	RRIC 52	RRIC 7	RRIM 513	RRIC 45	PB 86	RRIC 88	PB 28/29	RRIC 89
Girth in inches								
1968	24.9	20.3	20.3	20.3	18.1	22.7	18.7	18.4
1969	27.4	22.0	21.7	21.7	20.9	25.1	20.6	20.2
Increase 1968/69	2.5	1.7	1.4	1.4	2.8	2.4	1.9	1.8
No. trees tapped in 1969	467	280	342	307—340	207—305	374—396	251	170
Yield in 1968	10.9	27.3	21.3	17.6	21.5	15.4	29.1	26.7
,, ,, 1969	14.4	25.8	23.5	18.7	25.9	16.9	47.9	34.9

Field Experiment No. 19—1962 *Large Scale Clone Trial—Nivitigalakele*

All clones are planted in unreplicated plots of 150 trees per clone. Yield results during the first year in tapping are summarised in Table 14.

TABLE 14

1962 LARGE SCALE CLONE TRIAL—NIVITIGALAKELE
Yield in grammes dry rubber per tree per tapping

Clone	No. of trees tapped in 1969	Average girth in inches			Yield 1969	Bark thickness in mm Virgin bark	Brown Bast cases	Bark Rot cases	Wind damage cases
		1967	1968	1969					
RRIM 628	72	16.0	18.9	19.3	51.8	6.2	—	—	—
RRIC 94	85—82	16.8	19.2	19.6	44.7	6.9	2	2	—
,, 92	79	16.3	19.1	19.6	34.6	5.7	—	3	—
,, 95	95	20.5	23.4	24.1	34.5	7.4	—	1	—
,, 93	80—67	16.6	19.7	19.7	33.7	7.4	2	1	1
RRIM 623	74—73	17.6	20.0	20.6	33.5	5.8	1	—	—
,, 701	100	17.9	20.2	20.6	31.0	7.4	—	2	—
PB 86	67	15.5	18.6	19.3	29.9	5.7	—	2	—
IAN 45—717	116	17.7	21.0	21.6	29.2	4.5	—	1	1
RRIC 39	109—108	18.7	22.1	22.5	28.1	5.4	1	1	—
,, 86	100	17.9	20.4	20.8	26.4	6.6	—	—	—
,, 5	109	18.9	22.0	22.4	25.3	7.5	—	1	—
,, 91	112	20.3	23.0	23.5	25.2	6.2	—	2	1
,, 96	86	17.4	20.0	20.4	22.8	6.4	—	—	—
,, 51	70	15.6	18.3	18.8	19.8	5.5	—	1	—
,, 90	—	14.1	16.9	17.5	not in tapping	—	—	—	—
,, 97	—	14.1	17.1	17.5	not in tapping	—	—	—	—

Field Experiment No. 25—1957 Clone Trial—Estate A—Kalutara District

All clones are planted in unreplicated plots of 300 trees per clone. Test tapping results are summarised in Table 15.

TABLE 15

SMALL SCALE CLONE TRIAL—ESTATE A— KALUTARA DISTRICT
Test tapped from March 1964
Yield in grammes dry rubber per tree per tapping

Clone	Girth in in.		No. of trees tapped in 1969	Yield					
	1968	1969		1964	1965	1966	1967	1968	1969
IRCI 2	25.3	26.2	250	21.0	27.1	26.8	40.2	40.8	47.8
IRCI 3	23.0	23.4	205—200	23.8	23.7	31.0	38.3	31.9	34.2
AVROS 529	24.6	25.6	290—285	16.7	19.0	20.4	23.7	27.3	31.3
TR 1406	26.9	27.6	265—250	26.5	28.2	28.7	38.5	33.3	30.0
RRIM 607	25.7	26.6	270—265	25.2	24.8	22.1	29.3	30.1	27.5
PB 86	23.9	25.0	260—255	17.5	17.3	16.4	23.1	25.8	27.3
Mean	24.9	25.7		21.8	23.4	24.2	32.1	31.5	33.0

Of the above clones IRCI 2 is recommended for small scale planting in estates.

Field Experiment No. 26—1957 Clone Trial—Estate B—Kalutara District

(a) 10 acres — six clones planted in monoclonal blocks of 300 trees per clone
(b) 20 acres — twelve clones planted in monoclonal blocks of 300 trees per clone

The yields of various clones compared with that of clone PB 86 are presented in Tables 16 and 17.

TABLE 16

1957 CLONE TRIAL—ESTATE B—KALUTARA DISTRICT (10 ACRES)
Tapped from April 1964
Yield in grammes dry rubber per tree per tapping

Clone	Girth in inches		No. of trees tapped in 1969	Yield					
	1968	1969		1964	1965	1966	1967	1968	1969
AVROS 1734	28.0	29.0	201—198	35.6	40.5	39.7	36.7	46.6	53.1
AVROS 2037	28.9	29.7	206—200	21.1	20.6	23.6	36.1	36.2	38.7
PR 254	25.9	27.1	259—250	19.0	19.6	28.4	33.5	31.0	37.0
TR 1548	29.1	30.2	200—195	22.0	23.9	24.1	23.2	27.0	28.5
PB 86	25.0	26.3	210—205	23.9	23.6	29.1	33.6	32.1	28.3
RRIM 612	30.6	31.8	226—218	19.8	24.8	28.2	28.6	26.0	21.0
Mean	27.9	29.0		23.6	25.5	28.8	32.0	33.2	34.4

TABLE 17

1957 CLONE TRIAL—ESTATE B — KALUTARA DISTRICT (20 ACRES)

Tapped on S/2, d/2, 100%
(First tapped in March 1964)

Yield in grammes dry rubber per tree per tapping

Clone	Girth in inches		No. of trees tapped in	Yield					
	1968	1969	1969	1964	1965	1966	1967	1968	1969
RRIM 623	27.4	28.2	250	29.8	33.3	39.3	32.1	38.9	38.7
RRIC 76	25.2	25.8	257—250	17.8	20.4	27.2	33.1	31.3	38.1
RRIC 61*	25.4	26.3	218	19.9	23.3	33.5	49.4	51.9	37.8
WR 101	26.3	27.3	212—195	22.0	19.1	28.2	37.0	32.4	33.0
RRIM 603	27.7	28.6	188—184	19.6	19.1	25.9	29.2	31.5	32.1
PR 248	26.8	27.6	234	17.2	18.0	20.1	21.5	26.9	28.7
RRIC 75	29.8	30.5	175—170	21.7	18.4	26.7	26.8	35.7	28.6
RRIM 622	25.3	26.3	192—191	21.3	19.1	19.6	26.1	30.2	23.6
TR 1542*	24.7	25.2	221	16.8	15.7	19.2	27.5	30.6	23.2
RRIM 602	26.3	26.9	266—260	15.4	14.4	21.2	19.9	24.9	20.0
RRIC 60	25.9	26.4	251—250	12.4	15.3	19.9	22.9	17.6	19.3
PB 86 (1) ,, ,, (2) ,, ,, (3)	24.9	25.9	267—260) 260—258) 233—228)	18.0	19.9	23.4	25.7	27.2	27.6
Mean	26.3	27.1		19.3	19.7	25.4	29.3	31.6	29.2

* Tapped on S/2, d/3, 67% from March 1967

The clone AVROS 1734 has good vegetative characters and a high degree of resistance to diseases in the wet districts. It is recommended for small scale planting in estates. Although clone RRIM 623 has been yielding well, there has been a high incidence of wind damage. The tapping intensity on clones RRIC 61 and TR 1542 has been reduced to 67 % owing to extensive damage to bark resulting from *Phytophthora* infections.

Field Experiment No. 27—1958 *Clone Trial—Estate B—Kalutara District*

All clones are planted in unreplicated plots of 300 trees per clone. The test tapping yields are summarised in Table 18.

TABLE 18

1958 CLONE TRIAL—ESTATE B—KALUTARA DISTRICT (30¼ ACRES)

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

Yield in grammes dry rubber per tree per tapping

Clone	Girth in in. 1968	1969	No. of trees tapped in 1969	Yield 1965	1966	1967	1968	1969
RRIC 36	26.5	27.6	205—198	24.1	27.9	27.6	29.4	30.6
,, 39	26.1	26.9	210—198	20.4	19.9	22.2	27.1	28.6
,, 41	25.5	26.4	252	18.2	19.5	22.1	23.3	27.2
,, 55	23.3	24.1	182	—	32.7	31.7	27.4	25.2
,, 37	23.1	23.7	230—224	16.3	20.2	19.4	18.8	25.0
,, 45	23.4	24.0	260	17.1	22.1	28.1	28.3	24.5
IRCI 6	26.3	27.8	203—202	16.2	19.2	24.5	29.1	24.1
,, 2	22.6	23.6	265—250	19.0	21.7	26.2	27.9	24.0
RRIM 605	23.0	23.8	270—240	21.7	22.5	27.9	23.9	24.0
AVROS 427	21.1	21.6	268—257	29.6	37.1	40.1	26.8	23.6
RRIC 22	25.5	26.4	255—254	17.4	19.7	20.7	22.2	23.3
,, 28	23.3	23.9	220—215	19.5	19.9	22.1	23.7	23.1
WJ 1	24.7	25.7	225	17.7	21.9	21.3	21.5	20.5
GT 1	24.0	24.8	295—290	13.3	16.6	21.0	19.6	19.6
RRIM 607	26.6	27.6	232	20.3	19.5	21.9	21.9	19.2
RRIC 52	28.4	29.5	257—249	13.8	15.0	15.1	16.0	18.6
,, 54	25.0	26.1	215—210	17.3	20.1	19.4	18.8	17.2
AVROS 385	26.9	28.1	272—254	11.1	11.6	13.4	13.6	14.7
PB 86 (1)	23.7	24.7	216—215	17.6	22.9	22.9	22.6	22.9
,, ,, (2)			245—240					
,, ,, (3)			235—232					
,, ,, (4)			240—236					
Mean	24.7	25.6		18.4	21.6	23.6	23.8	23.0

Clone AVROS 427 has been a good yielder, but a poor grower and is susceptible to *Phytophthora* leaf fall. The yields of GT 1 have been rather poor, while clone RRIC 52 has shown the expected annual yield increments with the girthing of trees.

Field Experiment No. 28—1957/58 *Clone Trial—Estate C—Kalutara District.*

The test tapping results of a selection of clones in a commercial plantation in the Kalutara District are presented in Table 19.

TABLE 19

CLONE TRIAL—COMMERCIAL ESTATES—KALUTARA DISTRICT
ESTATE C

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

Clone	No. of trees tapped in 1969	Yield						Girth in in. 1969	Remarks
		1964	1965	1966	1967	1968	1969		
RRIC 36	188—185	31.9	34.5	36.6	44.6	52.5	53.4	26.9	Tapped on S/2, d/3, 67%
RRIC 37	194—190	28.4	28.8	30.5	37.0	32.9	41.8	23.4	— do —
IRCI 7	210—205	28.1	33.8	35.7	40.9	38.3	38.2	27.6	
RRIC 41	240—234	28.6	24.2	29.5	34.0	29.7	35.3	25.6	
RRIC 5	210—200	22.8	26.1	28.7	40.8	27.9	32.2	25.9	
RRIC 45	260—250	23.6	24.5	29.5	34.0	31.8	28.7	23.9	
RRIC 7	175—173	29.7	27.1	38.4	39.4	33.5	26.1	25.4	

Clones RRIC 36 and 37 are being tapped on a reduced tapping intensity of 67 % owing to extensive bark damage resulting from *Phytophthora* infections.

Field Experiment No. 33—1962 *Clone Trial—Estate D—Kalutara District*

In this trial clones RRIC 7, 45, 52 and IRCI 7 were planted in monoclonal blocks of 1,800 trees per clone.

Clone RRIC 52 was first tapped in 1968. Owing to the relatively low yields of this clone in the early tapping years, it was tapped on the 2S/2, d/4, 100% system from 1968. In the second year of tapping in 1969 it has recorded an average yield of 28.7 g dry rubber per tree per tapping which would indicate an average theoretical yield of about 9 lb per tapper for a task of 150 trees in the double-four system.

Clone IRCI 7 was first tapped in 1969 on the S/2, d/2, 100% system. The average yield for the 10 acres in 1969 has been 28.9 g per tree per tapping which would indicate an average yield of about 15 lb per task per tapping on normal tapping days.

Immature Areas

Field Experiment No. 20—1963 *Clone Trial—Nivitigalakele*

The clones RRIC 59, 60, 64, 75 and PB 86 are planted at 300 trees per clone while clones RRIC 6, 39, 41 and 98 were planted at 150 trees per clone. The average girth of clones in the fourth, fifth and sixth years of growth are summarised in Table 20.

TABLE 20

1963 LARGE SCALE CLONE TRIAL—NIVITIGALAKELE

Average girth in inches

Clone	No. of trees	Average girth			Girth increase		
		1967	1968	1969	1966/67	1967/68	1968/69
RRIC 41	131	13.9	18.4	22.1	4.5	4.5	3.7
„ 60	286	10.9	14.7	18.3	3.7	3.8	3.6
„ 64	250	10.1	14.0	17.6	3.3	3.9	3.6
„ 39	130	10.9	14.2	17.5	3.6	3.3	3.3
„ 6	141	10.9	14.1	16.9	3.5	3.2	2.8
„ 75	253	10.3	12.1	15.5	3.6	1.8	3.4
PB 86	298	9.2	12.1	15.0	2.6	2.9	2.9
RRIC 98	130	8.5	11.2	14.2	2.8	2.7	3.0
„ 59	240	7.0	10.2	13.7	1.1	3.2	3.5

Field Experiment No. 21—1964 *Yield Trial—Nivitigalakele*

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 average rate of girthing of clones at the end of third, fourth and fifth years from planting are summarised in Table 21.

TABLE 21

1964 LARGE SCALE CLONE TRIAL—NIVITIGALAKELE

Average girth in inches

Clone	No. of trees	Average girth 1967	1968	1969	Girth increase 1967/68	1968/69
RRIC 52	269	10.3	15.6	20.4	5.3	4.8
,, 41	230	9.8	14.2	18.1	4.4	3.9
,, 86	233	9.3	13.7	17.4	4.4	3.7
,, 45	262	9.6	13.9	17.3	4.3	3.4

Field Experiment No. 22—1965 *Clearing—Nivitigalakele*

Ten acres of clone RRIC 45 were planted in 1965 to be used in tapping experiments. The trees have reached an average girth of 14.7 in. in 1969.

Field Experiment No. 23—1965 *Small Scale Clone Trial—Dartonfield*

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 the fourth year of growth are presented in Table 22.

TABLE 22

1965 REPLANTED AREA—DARTONFIELD

Average girth in inches

Clone	Girth 1969
RRIC 91	16.4
,, 45	15.7
,, 89	14.2
,, 88	16.6
RRIM 600	14.8
RRIC 90	12.6

The above results confirm the poor growth of clone RRIC 90 observed in other trials.

Field Experiment No. 24—*Spacing Trial—Kuruwita*

Each of the clones RRIC 41, 45 and 52 are planted in 150-tree plots at spacings of 8′x 30′ and 12′x 20′ and replicated three times. The average girth of trees in 1969 for the two spacings are presented in Table 23.

TABLE 23

1965 SPACING TRIAL—KURUWITA

Average girth in inches in 1969

Clone	Spacing	
	8′ x 30′	12′ x 20′
RRIC 41	14.6	14.8
RRIC 45	14.0	14.1
RRIC 52	14.0	14.7
Total	42.6	43.6
Mean	14.2	14.5

Field Experiment No. 29—1964 *Yield Trial—Salawa Estate*

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 summarised in Table 24.

TABLE 24

1964 YIELD TRIAL—SALAWA ESTATE

Average girth in inches

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

The average girth measurements for 1969 of clones planted in various yield trials in 1966 are given below :—

Field Experiment No. 36—1966 *Yield Trial*—10 *acres—Malaboda Estate, Matugama*

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

Average girth :- RRIC 45 — 8.9" RRIC 86 — 9.1"
RRIC 88 — 8.8" RRIM 701 — 9.7"

Field Experiment No. 37—1966 *Yield Trial*—10 *acres—Udapolla Group, Deraniyagala*

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

Average girth :- RRIC 5 — 8.9" RRIC 45 — 7.5"
RRIM 701 — 7.2" Nab 15 — 7.4"

Field Experiment No. 38—1966 *Yield Trial—10 acres—Kiribatgalla Group, Nivitigala*

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

Average girth :- RRIC 45 — 10.9" RRIC 88 — 9.7"
RRIC 91 — 10.4" AVROS 427 — 8.5"

Field Experiment No. 39—1966 *Yield Trial—15 acres—Halgolla Group, Yatiyantota*

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

Average girth :- RRIC 45 — 10.1" RRIM 605 — 10.2"
RRIM 701 — 8.4"

Field Experiment No. 40—1966 *Yield Trial—10 acres—Biddescar Group, Kegalle*

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

Average girth :- RRIC 36 — 10.6" RRIC 41 — 8.8"
RRIC 45 — 8.4" RRIM 605 — 9.3"

Field Experiment No. 41—1966 *Yield Trial—20 acres—Yatawatta Estate, Matale*

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

Average girth :- RRIC 36 — 7.5" RRIC 41 — 9.7"
RRIC 86 — 8.4" PB 86 — 9.2"

Field Experiment No. 44—1967 *Yield Trial—10 acres—Udapolla Group, Polgahawela*

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

Field Experiment No. 45—1967 *Yield Trial—10 acres—Zion Estate, Rattota*

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

Field Experiment No. 46—1967 *Polyclone Trial—2½ acres—Hedigalla*

Clones RRIC 41, 45, 86, 88 and 89 are planted at random in order to study the effects of clonal competition as well as the yields from such mixed plantings.

Field Experiment No. 48—1969 *Yield Trial*—10 *acres—Salawa Estate, Hanwella*

Clones RRIC 45, 100, 101 and AVROS 1734 are planted at 135 trees per plot replicated three times.

Field Experiment No. 49—1969 *Yield Trial*—27 *acres—Vogan Group, Matugama*

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. 51—1966 *Yield Trial*—10 *acres—Dalkeith Group, Latpandura*

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

Average girth :- RRIC 45 — 7.8" RRIC 88 — 7.0"
RRIC 89 — 6.6" RRIC 75 — 7.0"

Intercropping Trials

Two trials were planted in 1964 and 1965 in the relatively dry districts where the climatic conditions are not very favourable for rubber but where cacao could be successfully grown. These trials were to be interplanted with cacao at a later stage.

Field Experiment No. 3—1964 *Trial*—15 *acres—Rosebury Estate, Koslanda*

Clones RRIC 45, 52 and PR 107 were planted in plots of 300 trees per clone replicated three times. The rubber is planted on contour rows at spacings of 8′ x 30′. Half of each plot was interplanted with cacao in 1967. The cacao seedlings raised in polythene bags were planted centrally between the rubber rows at a spacing of 12 ft. within the row. In 1969 approximately 50 % of the cacao seedlings had to be re-supplied due to the very dry weather conditions prevailing in this district in 1968.

The average girth measurements of clones at the end of the fourth and fifth years of planting are summarised in Table 25.

TABLE 25

1964 INTERCROPPING TRIAL—ROSEBURY ESTATE

Average girth in inches

Clone	No. of trees	Average girth 1968	Average girth 1969	Girth increase 1968/69
RRIC 52	825	7.3	10.5	3.2
,, 45	795	6.0	9.3	3.3
PR 107	808	6.0	9.0	3.0

It is apparent that the growth rate of all clones had been rather poor, mainly due to the inadequate distribution of rainfall in this district.

Field Experiment No. 31—1965 *Trial—15 acres—Redegama Estate, Rambodagalla*

Clones RRIC 36, 45 and PB 86 are planted at 300 trees per plot replicated three times. The rubber is planted on the contour at spacings of 8′ x 30′. Owing to very dry weather conditions in the district the growth of rubber had been very poor. Interplanting of cacao had therefore to be postponed to a later stage.

Stock Experiments

Field Experiment No. 34—*Small Scale Stock Experiment—Nivitigalakele*

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*. The seeds were collected from monoclonal blocks of each clone. The average girth of these buddings at the end of 42 months from planting are summarised in Table 26.

TABLE 26

SMALL SCALE STOCK EXPERIMENT—NIVITIGALAKELE

Type of stock	Average girth (in.)
Tjir 1	14.0
RRIC 7	15.3
,, 41	14.5
,, 52	14.2
,, 86	14.5
,, 88	14.5
,, 89	13.3
H. spruceana	13.3

Field Experiment No. 47—*Small Scale Stock Experiment—Nivitigalakele*

In this trial seedling stocks of RRIC 7, 41, 52, 86, Gl 1, Wagga 6278 and Tjir 1 were budgrafted with clone RRIC 45. Growth was measured during the first year in terms of the height of scions above the graft union. The results are summarised in Table 27.

TABLE 27

SMALL SCALE STOCK EXPERIMENT—NIVITIGALAKELE

Type of stock	Average height of scion (ft)
RRIC 7	13.2
,, 41	12.8
,, 52	11.5
,, 86	12.9
Gl 1	13.0
Wagga 6278	11.4
Tjir 1	11.4

Other Investigations

Embryo Culture

Attempts were made to grow *Hevea* embryos in sterile culture. Embryos at the "torpedo" stage of development (varying from 1.0 to 2.0 mm in size) were especially dissected from immature *Hevea* fruits and cultured in sterile agar media, containing inorganic and organic supplements and growth substances. The embryos showed initial growth, and attained nearly a ten-fold increase in size with well developed cotyledons. However, they failed to develop any further. This work will be continued during the next year.

Latex Coagulation

Preliminary investigations indicate that latex obtained in a sterile condition from trees is stable and could be kept for more than 15 days at an ambient temperature 28° $\pm$ 2°C without coagulating. When sterile bark extracts in distilled water are added to sterile latex, coagulation takes place within a period of 24 hours. It is likely that certain substance/s present in the bark play an important role in the plugging of latex vessels and coagulation of latex on the tapping cut. These 'substances' may be even more important as those released by possible damage to lutoid particles, resulting pressure release accompanying the opening of latex vessels. These studies are being continued with a view to elucidating these problems.

(*a*) *Latex Flow*

Preliminary investigations on the latex flow studies along the vertical height of the trunk of budded trees indicate that the latex yield decreases with increase in the distance between the root stock and the point of extraction of latex.

(*b*) *Diurnal Variation in Latex Flow*

The relationship between latex flow and time of day is being investigated in small scale tapping experiments.

(*c*) *Studies on Tapping*

Observations were carried out on the normal method of tapping including :—

(i) depth of tapping
(ii) thickness of shaving
(iii) time taken for tapping, collection etc.

The above observations will be continued in the coming year as well.

Flow Pattern and Plugging Indices of Clones

The latex flow pattern and the plugging indices of a number of clones were investigated. On the basis of results obtained hitherto, provisional plugging indices

of some clones planted in Ceylon have been worked out and they have been categorised as follows :-

Provisional grouping of clones based on plugging index

Group I — Plugging Index O — 2

RRIC 100
RRIM 701
RRIC 37
RRIC 101

Group II — Plugging Index 2 — 3

RRIC 41
RRIC 36
RRIM 623
RRIC 45
RRIM 707

Group III — Plugging Index 3 — 4

RRIC 52

Group IV — Plugging Index > 4

RRIC 88

Within each group, the clones are arranged in ascending order of plugging index. Those clones with a low plugging index continue to flow for longer periods and are generally high yielders.

Studies are also being undertaken on any possible variation in plugging index according to age of clones, tapping systems and climatic conditions.

Antitranspirants and Stomatal Regulation

These investigations are being made in relation to the establishment of *Hevea* in the dry districts of Ceylon. Attempts are being made to reduce deaths of newly planted material in dry weather with the use of antitranspirants.

Experiments to determine non-phytotoxic optimal dosages of chemicals and their degree of effectiveness are being evaluated. The antitranspirants under test are : phenylmercuric acetate, naphthaleneacetic acid, naphthoxyacetic acid, 8 — hydroxyquinoline, di-butyl oxalate, and atrazine.

Each substance was tested at three concentrations of 20, 80 and 320 p.p.m. They were sprayed on both surfaces of leaves of three months old Tjir 1 seedlings grown in polythene bags. The extent of stomatal closure was estimated using an infiltration technique involving crystal violet in absolute ethanol.

Out of a range of chemical substances that were tested so far, phenyl mercuric acetate and 8-hydroxyquinoline appear to be the most effective in reducing the rate of transpiration in young *Hevea* seedlings.

Anatomical Studies

Waxoline red was found to give excellent results when used as a stain for rubber in latex vessels. Sections of fresh or fixed bark of thickness 30-40 μ were dehydrated in a graded series of alcohol and stained in a concentrated solution of waxoline red in absolute ethanol for 15 to 30 minutes. Excess stain was removed with either absolute ethyl alcohol or alcohol containing a trace of hydrochloric acid. The sections were mounted in glycerine or glycerine jelly.

Index to Field Experiments

Field Experiment No.

4 Winter Tapping cum Yield Stimulation Trial—Dartonfield
5 1946 Clone Trial—Nivitigalakele
6 1952 Small Scale Clone Trial—Hedigalla
7 1954 Clone Trial—Nivitigalakele
11 1951 Small Scale Clone Trial—Hedigalla
12 1949 Large Scale Clone Trial—Hedigalla
13 1954 Large Scale Clone Trial—Hedigalla
14 1955 Large Scale Clone Trial—Hedigalla
15 1953 Large Scale Clone Trial—Nivitigalakele
16 1956 Large Scale Clone Trial—Hedigalla
17 1956 Clone Trial—Dartonfield
18 1961 Large Scale Clone Trial—Dartonfield
19 1962 Large Scale Clone Trial—Nivitigalakele
20 1963 Large Scale Clone Trial—Nivitigalakele
21 1964 Yield Trial—Nivitigalakele
22 1965 Ten-Acre Monoclonal Block of RRIC 45—Nivitigalakele
23 1965 Small Scale Clone Trial—Dartonfield
24 1965 Spacing Trial—Kuruwita Sub-station
25 1957 Clone Trial—Estate A—Kalutara District
26 1957 Clone Trial—Estate B—Kalutara District
27 1958 Clone Trial—Estate B—Kalutara District
28 1957/58 Clone Trial—Estate C—Kalutara District
29 1964 Yield Trial—Salawa Estate
30 1964 Yield/Intercropping Trial—Rosebury Estate, Koslanda

31 1965 Yield/Intercropping Trial—Redegama Estate, Rambodagalla
33 1962 Large Scale Clone Trial—Estate D—Kalutara District
34 1966 Small Scale Stock Experiment—Nivitigalakele
36 1966 Yield Trial—10 Acres—Malaboda Estate, Matugama
37 1966 Yield Trial—10 Acres—Udapolla Group, Deraniyagala
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39 1966 Yield Trial—15 Acres—Halgolle Group, Yatiyantota
40 1966 Yield Trial—10 Acres—Biddescar Group, Kegalle
41 1966 Yield Trial—20 Acres—Yatawatte Estate, Matale
44 1967 Yield Trial—10 Acres—Udapolla Group, Polgahawela
45 1967 Yield Trial—10 Acres—Zion Estate, Rattota
46 1967 Polyclone Trial—$2\frac{1}{2}$ Acres—Hedigalla
47 1968 Small Scale Stock Experiment—Nivitigalakele
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50 1967 Small Scale Tapping Experiment—Dalkeith Group, Latpandura
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52 1969 Tapping Experiment—Yatadola Estate, Matugama

REVIEW OF THE GENETICS & PLANT BREEDING DEPARTMENT

By

D. M. Fernando

Summary

Studies were initiated on the use of chemical mutagens such as ethyl methyl sulphonate and toxicity levels were determined. Statistically-based seedling variability trials for six parent clones were established both at Kuruwita and Nivitigalakele. The hand pollination programme, which was directed towards increase of yield, vigour, and a study of heterosis, yielded 416 seedlings. Assistance was given to the Estate Department in order to expedite the release of RRIC 100 and 101 budwood to estates. The yields of clones RRIC 100 and 101 showed that they were suitable for 67% intensity tapping during the first five years, when opened at $4\frac{1}{2}$ years of age. Clones 1103 and IAN 45-710 showed satisfactory foliage when planted above 100 ft elevation and the former gave very satisfactory yields at Kuruwita and Nivitigalakele.

Detailed Review

Staff

The Head of the Department, Mr. D. M. Fernando, was on duty throughout the year. The Geneticist, Dr. Y. D. A. Senanayake, left the services of the Institute in July to take up an appointment in the Faculty of Agriculture, University of Ceylon, Peradeniya; but liason continued to be maintained with him on studies nearing completion. Mr. N. E. M. Jayasekera was appointed Assistant Geneticist & Plant Breeder from 1st June and worked at Dartonfield under the guidance of the Geneticist for some time.

The Senior Field Assistant, Mr. H. B. H. de Silva; Technical Assistant, Mr. P. Samaranayake; Field Assistants, Messrs. D. S. Gamage, W. A. C. Wijesinghe and A. K. M. S. Senaratne were on duty throughout the year.

Messrs. M. S. C. de Silva and B. M. S. G. Peiris were appointed to this Department in 1969 as Technical Assistant and Field Assistant, respectively.

Visits

The Head of the Department made 60 visits and the rest of the staff made 246 visits in connection with experimental work.

Meetings

The writer attended one Kalutara District Planters' Association meeting and two Sabaragamuwa District Planters' Association meetings. He also helped to conduct a refresher course given to the officers of the Smallholdings Advisory Service, and addressed the Estates Staffs' Union (General Meeting) on yield improvement.

Publications

The following publications were prepared in 1969. The collaboration and assistance of Prof. M. S. Tambiah, Dean of the Faculty of Natural Sciences, University of Ceylon, Colombo, and Dr. Y. D. A. Senanayake, Senior Lecturer in Agriculture, University of Ceylon, Peradeniya, in the preparation of papers is gratefully acknowledged.

(i) Annual Review of the Department for 1968

(ii) Fernando, D. M. and Tambiah, M. S. (1969). A study of the significance of latex in *Hevea* spp.
(Read at the 25th Sessions of the C.A.A.S.—December 1969)

(iii) Fernando, D. M. and Tambiah, M. S. (1969). Sieve tube diameters and yields in *Hevea* spp.
(Read at the 25th Sessions of the C.A.A.S.—December 1969)

(iv) Fernando, D. M. and Wijesinghe, W. A. C. (1969). The growth and yields of RRIC 100.
(Paper read at the 25th Sessions of the C.A.A.S.—December 1969)

(v) Fernando, D. M. (1969). Breeding for multiple characters of economic importance in *Hevea*—Preliminary assessment of recent selections.
J. Rubb. Res. Inst. Malaya **21** (1), 27-37.

(vi) Senanayake, Y. D. A. (1969). The natural chlorophyll mutation frequency and the occurrence of yellows in nursery seedling populations of *Hevea brasiliensis* (Muell. Arg.) in Ceylon.
Rubb. Res. Inst. Ceylon Quart. J. **45**, 15-21.

(vii) Senanayake, Y. D. A. (1969). Species specific abaxial foliar characteristics of *Hevea benthamiana* (Muell. Arg.) and *H. spruceana* (*Benth.*) (Muell. Arg.) and their expression in interspecific hybrids.
Rubb. Res. Inst. Ceylon Quart. J. **45**, 22-31.

Buildings and Facilities

A five-roomed building was completed and handed over to the Department towards the end of the year. Mains current from the Department of Government Electrical Undertakings was also made available from September and greatly facilitated the work of the Department.

Clone Evaluation

RRIC 100 and 101 showed yields indicative of suitability for profitable tapping at S/2, d/3, 67% intensity for the first five years when opened at 4 ½ years of age. Clone 1290 (RRIC 52 x PB 86) showed remarkable stability and uniformity under conditions of early opening but the latex is highly coloured. Clone 1103 showed sustained high yields, when planted at high elevations.

Over 80 acres of new clone trials and observation plots were established during the year. Budwood of selected clones was released for an additional 20 acres of planting above 1000 ft elevation.

Individual identification was maintained on over 1,500 (small ten trees and below) experimental plots.

Laboratory Investigations

Cytology

Cytological studies of interspecific hybrids of *Hevea*, initiated by the Geneticist, were continued by the Assistant Geneticist.

Mutagenic Treatment

Germinating seeds of RRIC 52 were treated at 0.1%, 0.5% and 1% levels of ethyl methyl sulphonate and methyl ethyl sulphonate. All seedlings at the 1% level of treatment died but indications of mutagenesis were evident and it is proposed to repeat these studies in 1970.

Seedling Variability Trials

Tjir 1 Seedlings

A study of 2,000 Tjir 1 seedlings was initiated by the Assistant Geneticist and measurements from random sampling are being recorded for later analysis.

Clonal Seedlings

Two experiments on Latin Squares designs were laid down at Nivitigalakele and Kuruwita for a study of variability of clonal seedlings from RRIC 52, RRIC 36, Tjir 1, RRIC 37 and Ch 26.

Artificial Pollination Programmes

A total of 12,243 pollinations were completed during the year on trees sited at Kuruwita, Hedigalla and Peenkande Group. Clones of RRIC 52 and LCB 1320 selfed origin were used as parents in some of the combinations and an appreciable number of seedlings was established. The details of the programme are outlined in Table 1.

TABLE I

ARTIFICIAL POLLINATION PROGRAMME FOR 1969

Site	Cross made	Parentage/origin		No. of pollinations	No. of seedlings
Hedigalla	Ch 26 x IAN 45-873	(Br 2 x Br 2)	x (PB 86 x FA 1717)	2801	122
	,, x RRIC 100	,,	x (RRIC 52 x PB 86)	658	26
	,, x 1103	,,	x (RRIC 52 x RRIC 7)	1173	25
	,, x 1458	,,	x (LCB 1320 x RRIC 7)	148	4
	,, x 4008	,,	x (RRIC 52 x RRIC 52)	10	2
Kuruwita	RRIC 100 x 1458	(RRIC 52 x PB 86)	x (LCB 1320 x RRIC 7)	1454	55
	,, x 3148	,,	x (LCB 1320 x LCB 1320)	1399	75
	1103 x Ch 26	(RRIC 52 x RRIC 7)	x (Br 2 x Br 2)	502	2
	,, x RRIC 100	,,	x (RRIC 52 x PB 86)	329	9
	,, x 3148	,,	x (LCB 1320 x LCB 1320)	360	6
	,, x 4008	,,	x (RRIC 52 x RRIC 52)	454	5
	1458 x RRIC 100	(LCB 1320 x RRIC 7)	x (RRIC 52 x PB 86)	270	12
	,, x 4008	,,	x (RRIC 52 x RRIC 52)	224	3
	4008 x 1458	(RRIC 52 x RRIC 52)	x (LCB 1320 x RRIC 7)	318	24
Peenkande	IAN 45-873 x Ch 26	(PB 86 x FA 1717)	x (Br 2 x Br 2)	1015	19
		Unsuccessful crosses		1128	
			Total	12,243	416

Releases to Estates

Assistance was given to the Estate Department in expediting the release of nucleus budwood of RRIC 100 and RRIC 101 to a large number of estates. Arrangements were made to release 25 to 100 yards of budwood of these clones to a few more selected estates for the planting of observation plots of these two clones.

The exceptional vigour of these clones, apparent even in the first year of growth, is expected to generate appreciably increased enthusiasm for replanting.

Disease Resistance

Oidium

The foliage of test clones at Matale and Gampola was satisfactory. The 1963 trial at Matale was re-identified during the year. The yield of the *Oidium*-tolerant clone 1103 at Kuruwita and Nivitigalakele, as shown in Tables 5 and 7, were very satisfactory. Two hundred plants of this clone were released to estates at Kepitigalla and Kurunegala for multiplication purposes.

Budded stumps of IAN 45-710 and 1103 were supplied for a ten-acre replanting in the Kurunegala District.

Gloeosporium

All the test clones planted in 1969 in Nakiadeniya Group showed vigour and freedom from *Gloeosporium* leaf disease in contrast to the control clone PB 86 which showed some set back.

Phytophthora

It was observed that the selfed clone 4008 (RRIC 52 x RRIC 52) did not set fruit except when artificially pollinated. The early yields of this clone are average but it appears to show promise of later high yields.

Dothidella

Fourteen selections evolved in Ceylon were despatched to Trinidad for evaluation of possible disease resistance. Testing facilities were kindly made available by the Rubber Research Institute of Malaya at their Unit at Trinidad.

IAN 45-873 showed promise of high yields in the wet zone as shown in Table 2. IRCI 7 continued to be the highest yielding clone in this trial. FX 3810 showed the least wintering of leaves.

TABLE 2

1960 CLONE TRIAL AT MAHAVALE DIVISION OF PEENKANDE GROUP

Tapped 2S/2, d/4, 100% intensity

Clone	Trees tapped	Girth at 150 cm 1968 cm	Girth at 150 cm 1968 in	Yield in g/tree/tapping (Average of two cuts) 1967	1968	1969
IAN 45—710	37	65.2	25.7	23.4	25.9	32.1
IAN 45—717	36	65.0	25.6	23.6	30.2	33.0
IAN 45—873	33	72.6	28.6	33.2	38.5	38.5
FX 2261	34	63.5	25.0	22.4	36.3	37.2
FX 3810	38	70.3	27.7	19.1	22.2	25.4
AVROS 427	24	55.8	22.0	47.3	34.6	28.3
AVROS 385	24	68.3	26.9	19.2	24.0	27.6
TR 1548	32	65.2	25.7	21.3	22.9	24.4
ST 71	32	59.4	23.4	21.6	23.2	19.8
IRCI 7	36	67.5	26.6	32.1	46.4	48.6
OY 1	26	55.6	21.9	8.7	12.0	12.0
IRCI 10	27	56.8	22.4	15.5	21.9	26.6
Harbel 1	26	57.9	22.8	24.2	15.3	21.3
RRIC 86	16	60.9	24.0	16.2	22.7	25.4
C 695	31	60.9	24.0	27.2	29.9	38.5
PR 228	32	62.9	24.8	35.5	33.7	36.3
PB 86	38	63.2	24.9	26.1	28.3	26.4

Clone Trials

1961 *Small Scale Clone Trial—Kuruwita*

The yields of RRIC 100 as shown in Table 3 are still substantial. In view of these yields it is felt that the trees in test tapping could revert to third-daily, half-spiral, 67% intensity in 1970, as such a tapping intensity would give adequate yields without unduly taxing the trees.

TABLE 3

1961 SMALL SCALE CLONE TRIAL AT KURUWITA

Tapped S/2, d/3, 67% in 1966 and 1967, S/2, d/2, 100% in 1968 and 1969

Clone		Plot size	Trees tapped	Girth in cm at 150 cm height		Yields in g/tree/tapping			
				1968	1969	1966	1967	1968	1969
RRIC	100	10	10	59.0	61.8	34.0	66.5	91.2	63.7
RRIC	100	5	4	58.5	61.5	39.5	75.5	87.3	67.3
	266	10	8	66.0	70.6	30.3	55.3	63.7	53.7
	266	5	4	61.1	68.0	47.7	60.8	81.8	69.8
	1152	10	7	60.8	65.7	35.8	61.9	67.4	49.6
	1152	5	5	59.1	64.4	33.3	61.8	47.8	48.7
	1305	10	6	67.4	73.1	44.2	48.6	64.7	73.8
	1305	5	3	75.4	80.1	57.5	70.9	62.6	66.1
	734	10	9	69.0	74.8	28.8	42.9	58.7	52.6
	1290	10	4	73.0	81.4	28.9	38.4	53.8	62.2
	1290	5	4	73.0	79.2	33.6	54.7	53.8	58.1
	1222	5	4	62.5	66.3	41.4	47.1	56.0	53.4
	1173	10	10	65.2	66.7	47.1	51.8	50.1	45.8
RRIC	101	10	7	61.6	64.1	64.4	76.3	47.9	56.5
	82	10	8	64.8	71.8	27.5	45.9	46.3	40.6
	1157	5	3	63.7	68.0	38.8	78.1	76.2	63.3
	1167	10	6	54.4	56.5	—	52.4	58.2	33.0
	1167	5	3	67.1	71.9	62.0	66.5	45.8	58.2
	708	5	4	61.3	63.7	43.8	57.9	68.1	64.6
	1177	10	5	64.4	67.0	35.3	45.7	68.9	54.0
	1177	5	4	59.5	64.4	—	52.9	52.5	45.3
	724	10	10	57.2	58.4	32.4	37.8	50.3	46.2
	724	5	3	54.6	58.0	29.6	44.2	50.5	49.1
	254	10	7	69.8	76.3	33.0	43.1	45.4	41.3
	254	5	3	72.8	79.2	46.4	31.7	58.1	61.0
	407	10	7	51.3	52.7	36.0	53.6	43.6	39.1
	359	10	6	64.4	69.9	30.6	42.5	88.8	79.0
	359	5	3	68.8	75.4	—	—	67.0	76.0
PB	86	10 x 50	61	60.0	66.0	26.0	30.1	35.0	37.8

1962 *Clone Trial—Kuruwita*

This clearing was opened on S/2, d/2, 100% intensity in 1969 and the yields are shown in Table 4. RRIM 623 showed the most satisfactory combination of yield and number of trees opened. RRIC 52 was as expected very low-yielding in its first year of tapping. A more satisfactory indication of the performance of the local and foreign clones in this trial could be expected after a few more years of tapping.

TABLE 4

1962 CLONE TRIAL—KURUWITA

Clone	Trees plot size	Trees tapped	Girth in cm at 90 cm height 1968	Girth in cm at 150 cm (all trees) 1969	Yield g/tree/tapping 1969
AVROS 529	150	103	54.4	57.0	35.2
AVROS 2037	300	211	53.4	56.8	24.1
Harbel 1	300	122	43.1	49.4	30.8
IAN 45—717	300	175	50.9	53.0	21.0
IAN 6497	150	78	43.8	48.6	21.4
IRCI 7	150	101	51.4	53.4	39.5
IRCI 9	150	74	47.2	50.6	35.8
PB 86	300	149	47.1	50.9	30.0
PR 228	150	104	50.3	53.4	37.8
PR 251	150	101	49.6	52.2	39.3
PR 259	150	64	44.9	47.7	35.0
RRIC 7	150	91	47.7	50.9	43.7
RRIC 14	300	202	57.9	61.5	31.4
RRIC 36	300	181	48.8	52.8	35.3
RRIC 37	150	100	52.2	55.9	27.5
RRIC 41	150	115	57.7	60.0	34.1
RRIC 45	300	196	51.4	54.0	36.9
RRIC 51	300	187	49.4	53.7	17.3
RRIC 52	300	256	47.4	57.4	10.2
RRIM 607	300	178	49.2	52.7	24.9
RRIM 623	300	232	58.8	58.0	46.5
RRIM 628	150	73	39.5	45.2	52.2
RRIM 701	300	239	57.2	60.5	32.1
RRIM 707	300	202	52.2	56.7	26.1
WR 101	150	98	55.8	58.1	40.9
TR 3702	300	186	50.7	54.3	38.0
TR 1548	300	209	50.8	54.3	25.0

1962 *Small Scale Clone Trials at Kuruwita and Nivitigalakele*

This trial was tapped on S/2, d/2, 100% intensity in 1969. The yields of the *Oidium*-tolerant selection 1103 continued to be very satisfactory at both Nivitigalakele and Kuruwita as shown in Table 5. The yields for 1969 were on the whole lower than 1968, possibly due to weather conditions.

TABLE 5

1962 S.W. SMALL SCALE TRIAL—KURUWITA AND NIVITIGALAKELE

Tapped S/2, d/3, 67% in 1967 and 1968, and S/2, d/2, 100% in 1969

Clone	Parentage	Plot size	Trees tapped N	Trees tapped K	Girth (cm) N	Girth (cm) K	Yield in g/tree/tapping 1968 N	Yield in g/tree/tapping 1968 K	Yield in g/tree/tapping 1969 N	Yield in g/tree/tapping 1969 K
1103	RRIC 52 x RRIC 7	10	10	6	54.6	57.6	40.1	58.3	41.4	48.5
1018	T 170 x RRIC 52	10	—	10	—	60.5	—	34.3	—	23.1
1009	T 170 x RRIC 52	10	10	8	58.0	57.6	28.5	22.1	24.3	21.1
1317	RRIC 45 x LCB 1320	10	10	8	60.6	59.3	31.2	30.4	28.8	29.7
1458	LCB 1320 x RRIC 7	10	7	10	54.9	58.1	38.6	48.6	39.3	38.9
2005	PR 107 x LCB 1320	10	—	8	—	55.6	—	51.7	—	39.5
2028	RRIC 52 x RRIC 7	10	—	8	—	59.3	—	37.1	—	25.4
2031	RRIC 52 x RRIC 7	10	—	10	—	62.5	—	36.5	—	31.3
2002	LCB 1320 x GPM 1	10	—	9	—	64.7	—	34.0	—	33.9
2124	RRIC 52 x Wagga 6278	10	—	10	—	62.8	—	22.6	—	24.1
RRIC 91	PB 86 x RRIC 5	10	—	8	—	61.7	—	29.6	—	31.6
RRIC 92	PB 5/139 x RRIM 520	10	—	6	—	58.2	—	35.4	—	40.6
815	PB 5/139 x RRIC 52	10	2	10	57.2	62.3	—	28.0	37.2	27.9
784	PB 5/139 x RRIC 52	10	—	9	—	57.4	—	20.7	—	21.1
1108	RRIC 52 x RRIC 7	10	—	9	—	58.9	—	22.6	—	23.3
RRIC 52	—	10	7	—	61.8	—	20.5	—	24.1	—
82	RRIC 41 x RRIC 10	10	6	—	66.0	—	45.4	—	42.2	—
RRIC 45	RRIC 8 x Tjir 1	10	5	—	54.6	—	36.3	—	32.5	—

N = Nivitigalakele K = Kuruwita

1963 *Small Scale Clone Trial—Kuruwita*

Though opened at five years, a girth of over 20 in. (50.8 cm) was shown by many clones. Yields of over 30 g were also obtained, as shown in Table 6 from many plots and the best clones were multiplied in the course of the year for further large scale trial. The best trees of the control clone PB 86 of which a ten-tree plot was planted for every 10 clones, were taken into tapping at the same time as the experimental plots.

TABLE 6

1963 SMALL SCALE CLONE TRIAL—KURUWITA

Tapped S/2, d/3, 67% in 1968 and 1969

Clone	Parentage	Trees tapped	Girth in cm		Yield in g/tree/tapping	
			1968	1969	1968	1969
3333	Ch 26 x RRIC 36	6	—	58.9	—	45.8
2228	RRIM 513 x LCB 1320	10	59.1	60.3	20.8	45.2
739	RRIC 52 x Tjir 1	5	58.4	62.6	21.0	44.3
GT 711	—	8	50.04	53.6	28.5	43.4
2992	RRIC 36 x Ch 26	7	52.8	54.2	32.4	42.7
2231	RRIM 513 x LCB 1320	10	52.8	55.0	25.2	42.1
3606	RRIC 45 x LCB 1320	2	—	65.3	—	39.2
3060	Ch 26 x Wagga 6278	7	55.6	60.0	33.1	38.3
1620	Tjir 1 x LCB 1320	4	54.8	60.2	29.9	38.1
T 132	RRIC 37 x Wagga 6278	7	52.3	54.4	31.7	37.8
2284	RRIM 513 x RRIC 36	8	53.0	56.2	28.2	37.7
3279	Tjir 1 x LCB 1320	6	—	56.9	—	37.0
1501	RRIC 45 x GPM 1	9	49.2	50.7	19.4	36.6
3076	RRIC 45 x Wagga 6278	6	—	52.2	—	36.2
1729	RRIC 51 x PR 107	5	—	51.4	—	36.0
2994	RRIC 36 x Ch 26	8	54.6	57.6	32.7	35.6
3278	Tjir 1 x LCB 1320	6	—	65.5	—	35.7
2053	RRIC 52 x RRIC 7	9	53.0	54.9	33.5	35.0
T 57	PR 107 x LCB 1320	9	—	48.4	—	34.5
2164	RRIC 45 x RRIC 36	7	54.6	52.4	24.8	33.9
3787	RRIC 88 x RRIC 36	6	—	49.8	—	33.1
2044	RRIC 52 x RRIC 7	9	51.5	56.2	21.4	33.1
2276	RRIM 513 x RRIC 36	9	49.7	50.2	27.5	30.6
4008	RRIC 52 x RRIC 52	10	56.0	59.7	20.8	24.3
PB 86	—	45	51.0	52.1	24.2	26.2

1964 *Clone Trial at Kuruwita*

Fifteen-tree plots and replicated 30-tree plots of high-yielding clones from the 1961 and 1962 clearings, selected on growth and early yield indices, were opened in 1969 and provided a much needed correlation between primary selections and subsequent plantings. Clone 1103 showed appreciable yields. Other selections from the 1961 clearing such as 266, 359, 1290 and 1152 showed lower yields but appreciable girths. The yields of the better clones are given in Table 7.

TABLE 7

1964 N. E. CLEARING—KURUWITA

Tapped S/2, d/3, 67% in 1969

Clone	Parentage	Trees tapped	Girth in cm at 150 cm height	Yield in g/tree/ tapping
6333	LCB 1320 x RRIC 7	8	57.2	27.3
1103	RRIC 52 x RRIC 7	41	55.87	26.8
6323	LCB 1320 x RRIC 7	14	51.6	25.4
6328	LCB 1320 x RRIC 7	26	50.7	23.8
6326	LCB 1320 x RRIC 7	13	52.3	23.5
316	Tjir 1 x RRIC 50	4	54.1	22.4
1152	RRIC 45 x RRIC 13	11	55.3	21.6
1361	RRIC 45 x RRIC 51	4	50.4	20.9
266	Mil 3/2 x Tjir 1	17	54.0	20.3
6310	LCB 1320 x RRIC 7	23	50.6	20.0

1965 *Clone Trial—Dartonfield*

The girth measurements of the three 5-tree replicates of each clone are given in Table 8.

Some of the selections earlier found tolerant to *Oidium* such as 6788 and 1103 show very satisfactory growth. The depression in growth encountered in successive generations of breeding for *Dothidella* resistance is found to have been successfully countered in most of the selections established in this trial as seen in clones with FX and IAN parentage.

TABLE 8

1965 SMALL SCALE CLONE TRIAL—DARTONFIELD

Girths of Selections

Clone	Parentage	Girth in cm at 150 cm height Repl. 1	Repl. 2	Repl. 3	Repl. 4
IAN 45—710	PB 86 x F 409	33.8	33.0	38.0	—
566	RRIC 52 x PB 86	36.6	47.0	—	—
828	PB 5/139 x RRIC 52	38.0	44.6	36.7	—
864	PB 5/139 x RRIC 52	41.7	38.4	37.4	—
1010	T 170 x RRIC 52	43.3	40.5	40.4	—
1103	RRIC 52 x RRIC 7	39.9	35.1	38.5	—
1108	RRIC 52 x RRIC 7	34.5	33.8	35.8	—
690	PB 86 x RRIC 52	36.9	42.4	46.0	—
661	PB 86 x RRIC 52	39.6	37.9	27.1	—
788	PB 5/139 x RRIC 52	59.3	48.7	46.0	—
1067	T 792 x RRIC 52	42.8	42.7	39.6	—
1142	LCB 1320 x RRIC 45	46.0	44.3	35.7	—
1289	RRIC 52 x RRIC 86	39.0	50.0	43.2	—
1330	RRIC 52 x PB 86	49.0	43.8	52.0	—
1460	RRIC 52 x T 792	55.2	49.2	49.4	—
1461	RRIC 52 x T 792	50.5	50.2	39.2	—
2412	RRIC 45 x FX 4098	31.5	36.8	37.9	—
2416	RRIC 45 x FX 4098	50.7	49.1	46.0	—
2417	RRIC 45 x FX 4098	38.6	41.4	38.1	—
2419	RRIC 45 x FX 4098	36.8	39.1	35.7	—
2473	RRIC 45 x IAN 45—873	44.9	41.0	37.7	—
2479	RRIC 45 x IAN 45—873	36.4	39.1	40.1	—
2885	Ch 26 x RRIC 52	48.5	50.0	44.6	—
3101	RRIC 45 x Wagga 6278	39.1	41.8	36.8	—
3131	LCB 1320 x Wagga 6278	43.4	33.6	29.7	—
3134	LCB 1320 x Wagga 6278	52.3	49.0	41.9	—
3151	LCB 1320 x LCB 1320	30.4	43.0	44.3	—
3164	LCB 1320 x RRIC 51	33.6	44.5	43.4	—
3185	Wagga 6278 x LCB 1320	39.6	44.6	46.7	—
3463	RRIC 52 x Wagga 6278	42.2	46.0	46.0	—
3585	RRIC 52 x LCB 1320	39.0	37.8	—	—
3895	Wagga 6278 x RRIC 52	39.8	40.7	31.1	—
3900	Wagga 6278 x RRIC 52	35.6	34.0	36.9	—
5323	PB 28/59 x FX 516	43.6	43.9	37.6	—
5326	RRIC 51 x F 4542	43.1	41.6	42.5	—
5350	RRIC 52 x IAN 45—710	40.4	37.1	39.9	—
5352	RRIC 52 x Wagga 6278	41.8	53.5	44.8	—
6182	PB 28/59 x IAN 45—873	46.1	43.7	44.5	—
6306	RRIC 36 x FX 516	43.4	34.0	40.7	—
8440	RRIC 52 x IAN 45—710	42.2	38.8	29.2	—
8595	RRIC 36 x RRIC 52	49.8	44.7	41.1	—
8768	*H. spruceana* x RRIC 51	39.4	28.6	26.6	—
RRIM 623	PB 49 x Pil B 84	45.6	44.1	40.9	—
RRIC 45	RRIC 8 x Tjir 1	25.5	34.3	40.8	45.4
,,	,,	44.3	44.0	44.7	38.2
,,	,,	40.6	42.6	46.1	41.8
,,	,,	40.9	39.9	35.8	43.5
,,	,,	42.2	38.5	40.4	35.3
,,	,,	38.7	42.4	32.6	41.0
,,	,,	39.4	44.1	42.8	17.1
,,	,,	39.0	24.2	—	—

1965 *Small Scale Clone Trial—Moneragala*

A number of clones are planted in this trial as replicated ten-tree and 30-tree plots. Clones 451, 1103, 1305 and 734 and RRIC 101 show suitability for this

area as evidenced in this trial (Table 9). The supply plants in each plot were not measured.

TABLE 9

1965 SMALL SCALE TRIAL—MONERAGALA

Clone	Trees measured	Mean girth in cm
451	20	25.6
1305	23	24.0
266	35	23.0
RRIM 623	46	22.0
1487	18	21.8
734	21	21.3
1068	25	21.8
RRIC 45	53	20.9
1307	22	20.8
444	15	20.8
1103	28	20.3
RRIC 101	27	20.3

1966 *Clone Trial—Kuruwita*

RRIC 101 showed the best growth in this trial as shown in Table 10. A Morris-Mann test tapping carried out in this area revealed clone 451 to have an equivalent yield potential to RRIC 101.

TABLE 10

1966 CLONE TRIAL—KURUWITA

Girths in cm at 90 cm height

Clone	Parentage	Replications	Total trees	Average girth
828	PB 5/139 x RRIC 52	3	249	31.7
451	RRIC 52 x PB 86	3	216	31.3
1004	T 170 x RRIC 52	4	220	28.8
RRIC 101	Ch 26 x RRIC 7	3	206	33.9
RRIC 45	RRIC 8 x Tjir 1	4	300	29.8
	Means for clearing	—	1191	31.0 cm (12.2 in.)

Recent Small Scale Clone Trials

The details of plantings of recently synthesized material are as follows :-

1967 *Small Scale Clone Trial—Kuruwita*

Three replicates of ten trees each of the following clones were planted during the South West monsoon with RRIM 623 as the control clone (Table 11).

TABLE 11

1967 SMALL SCALE CLONE TRIAL—KURUWITA

Parentage		Clone
FX 360	x RRIC 52	4737
FX 25	x Ch 26	5641, 5682
PB 28/59	x IAN 45—873	6182
LCB 1320	x RRIC 7	6337
RRIC 52	x FX 516	6408
RRIC 52	x FX 2784	6902, 6907, 7117
IAN 2668	x RRIC 51	8000
IAN 45—873	x RRIC 52	7281
IAN 2668	x RRIC 52	8005
RRIC 36	x RRIC 52	8384
RRIC 52	x FX 360	8455, 8501
RRIC 52	x PB 86	8711, 8576, 10624, 10625, 10720, 10727
H. spruceana	x RRIC 36	8776, 8778
RRIC 52	x IAN 6167	8794
LCB 1320	x *H. spruceana*	8798
LCB 1320	x RRIC 52	8811
RRIC 45	x IAN 6167	8926
IAN 6497	x RRIC 52	9359
IAN 6584	x *H. spruceana*	9144
PB 86	x RRIC 52	9741
IAN 6584	x RRIC 52	9948, 9969, 9962
IAN 6587	x RRIC 52	9983, 10007, 10041, 10042, 10051, 10259, 10278, 10347, 10361, 10380, 10479, 10489
H. spruceana	x IAN 6584	10511
H. spruceana	x RRIC 52	10522
RRIC 45	x PB 28/59	10570
IAN 6500	x RRIC 52	10747, 10748, 10798, 10836

1968 *Small Scale Clone Trial—Kuruwita*

Three replicates of ten trees each of the following selections, with RRIM 62 as the control, were planted during the South West monsoon (Table 12).

TABLE 12

1968 SMALL SCALE CLONE TRIAL–KURUWITA

Parentage	Clone
RRIC 52 x PB 86	692
RRIC 52 x Tjir 1	734
RRIC 52 x RRIC 7	1103
RRIC 41 x Ch 26	1305
RRIC 52 x RRIC 36	3221
FX 360 x RRIC 52	4905
PB 86 x RRIC 52	5213
PB 28/59 x IAN 45—873	6182
RRIC 36 x FX 516	6306
LCB 1320 x RRIC 7	6333
PB 86 x F 1633	6433
PB 86 x IAN 2750	6435
FX 25 x PB 86	6843
FX 3482 x RRIC 52	7263
IAN 45—873 x RRIC 52	7283
RRIC 36 x RRIC 52	8319, 8394
IAN 6587 x RRIC 52	10194, 10365
IAN 45—873 x RRIC 36	5—37
RRIC 45 x IAN 45—873	5—54
RRIC 36 x IAN 45—717	5—71
RRIC 52 x RRIC 45	5—80
IAN 45—710 x RRIC 45	5—90, 5—102
IAN 45—710 x RRIC 52	5—180, 5—270, 5—228
IAN 45—710 x IAN 45—710	6—99
IAN 45—710 x 451	6—285
IAN 45—873 x Ch 26	6—317
451 x 451	6—492
451 x Ch 26	6—511
451 x AVROS 157	6—522
RRIC 36 x RRIC 36	6—541
IAN 45—710 x Ch 26	6—704
RRIC 7 x RRIC 7	6—782, 6—802
IAN 45—873 x RRIC 36	6—831

1969 *Small Scale Clone Trial—Kuruwita*

Three replications of ten trees each of the following clones, with RRIC 45 as the control clone, were planted during the South West monsoon (Table 13).

TABLE 13

1969 SMALL SCALE CLONE TRIAL—KURUWITA

Parentage	Clone
IAN 45—873 x RRIC 45	5—30
RRIC 36 x IAN 45—717	5—70
RRIC 52 x IAN 45—717	5—72
IAN 45—710 x RRIC 45	5—274, 5—267
IAN 45—710 x IAN 45—710	6—29
IAN 45—710 x RRIC 52	6—381, 6—410, 6—418, 6—419
451 x Ch 26	6—507
451 x AVROS 157	6—524
IAN 45—873 x RRIC 45	6—545
IAN 45—710 x Ch 26	6—746
RRIC 7 x RRIC 7	6—798
IAN 45—873 x Ch 26	7—1016
IAN 45—873 x 815	7—1023, 7—1026
Ch 26 x 1458	7—1029, 7—1034
H 440 x H 440	7—1035
Ch 26 x 815	7—1077, 7—1078, 7—1131, 7—1113, 7—1154, 7—1161, 7—1165, 7—1175, 7—1176
1103 x RRIC 89	7—1184, 7—1185
1103 x Ch 26	7—1201, 7—1206, 7—1218
Ch 26 x RRIC 100	7—1238, 7—1262
Ch 26 x 266	7—1298
RRIC 89 x Ch 26	7—1412, 7—1413, 7—1415,
RRIC 89 x 1103	7—1443, 7—1453, 7—1456
815 x Ch 26	7—1474, 7—1484

Other New Plantings

1969 *Small Scale Clone Trial—Hedigalla*

A small scale clone trial of over 30 replicated two-tree plots of each of the clones 1103, 451, 1458, 1173, RRIC 100 and RRIC 101 was planted in Hedigalla during the North East monsoon, with RRIC 45 as the control clone. At the same time observation plots of each of these clones were planted around the experimental area.

1969 *Small Scale Clone Trial—Eladuwa*

A small scale clone trial of over 30 replicated two-tree plots with an adjacent observation plot of each clone was planted during the North East monsoon in Eladuwa Estate. RRIC 45 was used as the control clone and the clones on test were 451, 1458, 82, 1305, RRIC 100 and RRIC 101.

1969 *Clone Trial—Pantiya*

Four replications of 100 trees each were planted at Pantiya Estate. The clones used were 815, 451, and RRIM 600 (control).

1969 *Clone Trial—Sirikandura*

Four replications of 50 plants each, with an additional observation plot, were planted at Sirikandura Estate. The clones used were 1103, 1152, 1004, RRIC 101, 451, with RRIC 45 as the control clone.

Index to Field Experiments

Field Experiment No.	*Trial*	*Site*
1	1961 Small Scale Clone Trial	Kuruwita
2	1961 Medium and Small Scale Clone Trial	,,
3	1962 Large Scale Clone Trial	,,
4	1962 Small Scale Clone Trial	,,
5	1962 Small Scale Clone Trial	Nivitigalakele
6	1963 Small Scale Clone Trial	Kuruwita
7	1964 Clone Trial (S.W. & N.E.)	,,
8	1965 Small Scale Clone Trial	Dartonfield
9	1965 ,, ,, ,, ,,	Moneragala
10	1965 Medium ,, ,,	Matale
11	1966 Clone Trial	Kuruwita
12	1966 ,, ,,	Nivitigalakele
13	1966 ,, ,,	Moneragala
14	1967 ,, ,,	Nivitigalakele
15	1967 Small Scale Clone Trial	Kuruwita
16	1967 Clone Trial	Gikiyanakande
17	1967 ,, ,,	Peenkande
18	1967 ,, ,,	Gampola
19	1967 ,, ,,	Hedigalla
20	1967 ,, ,,	Bibile
21	1968 Small Scale Clone Trial	Kuruwita
22	1968 Clone Trial	Pannagula
23	1968 ,, ,,	Hedigalla
24	1968 ,, ,,	Bibile
25	1968 ,, ,,	Matale
26	1969 ,, ,,	Sirikandura
27	1969 ,, ,,	Pantiya
28	1969 Small Scale Clone Trial	Kuruwita
29	1969 Clone Trial	Eladuwa
30	1969 ,, ,,	Hedigalla

REVIEW OF THE PLANT PATHOLOGY DEPARTMENT

BY

(MRS.) V. SATCHUTHANANTHAVALE

SUMMARY

Studies on the physiology of disease resistance have shown a distinct difference in the phenolic constituents of resistant and susceptible clones. 'Phytoalexins' formed due to host/fungal interaction in resistant clones were toxic to zoospores of *Phytophthora.*

Studies on Bark Rot disease on clone PB 86 have shown that (i) any injury to the corky layer of the bark will enable all the underlying tissues to be infected by Bark Rot, (ii) *Phytophthora* is capable of survival on bark debris and in soil at least for a limited period, and (iii) a tapping cut could remain vulnerable to infection for about five days from the time the cut is opened.

During the refoliation season maximum concentration of conidia of *Oidium heveae* present in the atmosphere was found to be in the afternoon for any day and the number was governed by the weather conditions prevailing for that day.

Studies on *F. lignosus* have shown that a number of cellulose decomposing fungi are antagonistic to *F. lignosus.*

Three field experiments in the control of *Oidium* leaf disease have shown that 10 lb sulphur per acre reduce leaf fall significantly on clone PB 86 but not on Tjir 1.

A census was taken of the incidence of White Root disease in the two experimental areas.

Field observations on *Xylaria* root disease have confirmed the importance of a food base for root infection in *Hevea.* An experiment has been laid out to test the various methods for control of this root disease.

Relative humidity above 95% and temperatures between 25—35°C constitute the optimum laboratory conditions for germination and growth of moulds found on prepared rubber. Observations on mould growth on crepe, in factories, have shown that high humidity was responsible for mould contamination.

DETAILED REVIEW

Staff

The Acting Head of the Plant Pathology Department, Dr. (Mrs.) V. Satchuthananthavale was on duty throughout the year.

The Senior Technical Assistant, Mr. H. L. Munasinghe, Technical Assistants, Messrs. T. M. Fernando, S. K. Samaraweera, W. C. Dayaratne and Z. E. Irugalbandara were on duty throughout the year. Mr. E. G. Mendis, Technical Assistant, was transferred to the Rubber Chemistry Department with effect from 1st February 1969.

The posts of Assistant Plant Pathologist and four Technical Assistants were filled. The Assistant Plant Pathologist, Mr. A. de S. Liyanage assumed duties on 31st January 1969. The Technical Assistants, Messrs. L. Halangoda and R. D. Sebastian assumed duties on 5th March 1969 and Messrs. H. Narangoda and S. Kasinathan on 15th March 1969.

Messrs. S. Kasinathan and H. Narangoda were transferred to the Rubber Chemistry Department with effect from 1st September 1969 and 23rd September 1969, respectively. These posts were filled with the appointment of Messrs. S. S. Jayasooriya and D. M. Dantanarayana with effect from 14th and 15th December 1969, respectively.

All the newly appointed officers were on duty from the dates of their appointment to the end of the year.

Dr. (Mrs.) Satchuthanathavale was chosen by the editors of the Journal, Mycopathologia et Mycologia Applicata as a noted living Mycologist and at the request of the Editor-in-chief, Prof. T. Benedek, a portrait was sent for publication in the section "Gallery of contemporary noted Mycologists" of that Journal.

The Senior Technical Assistant, Mr. H. L. Munasinghe, was successful in Part I of the examination for M. I. Biology.

Visits

Advisory	33
Experimental work	245
Others	27

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

Routine Laboratory Work

Diseased Specimens : The following diseases and pests were identified on the plant parts of *Hevea* and oil palm received in this Department in connection with advisory work during the period under review :—

A. *On* Hevea

(a) *Fungi*	*No. of cases*
Oidium heveae	1

(b) *Pests*

Mites	1
Slugs	1
Bats	1

(c) *Other causes*

Death of budded stumps due to damage of tap root and laterals at the time of planting	1

B. *On Oil Palm*

Beetles	2
Root rot of unknown etiology of palms in the nursery.	1

Culture Collection (S.K. Samaraweera) : Routine attention was given to the culture collection maintained in the Department.

Rhizobia *Cultures (H. L. Munasinghe) : Rhizobia* cultures were maintained in the Department and were sent on request to estates.

Testing of Fungicides for Bark Rot Control : Results of the tests with Tiezene for fungitoxicity to *Phytophthora* spp. were inconsistent. It is considered to be unsuitable for application in the field, for the control of Bark Rot.

Laboratory Investigations

Physiology of Disease Resistance (R. Satchuthananthavale and V. Satchuthananthavale): These studies were carried out in collaboration with the Botany Department.

(1) *Resistant Factors :* Tissue samples collected from *Hevea* clones, reported to be resistant to *Phytophthora* diseases, were examined for resistant factors and compared with those of susceptible clones. Preliminary paper chromatographic studies indicate a distinct difference in phenolic constituents of resistant and susceptible clones.

(2) *Host/Fungal Interaction :* The study of Bark Rot and its control in the field would be greatly facilitated by an understanding of the host/parasite interaction and relationships. Studies of such a nature have to be first carried out in the laboratory, for which sterile bark samples of *Hevea* clones have to be obtained. A method has been devised to obtain sterile bark plugs from clones of *Hevea* growing in the field.

(3) *Investigations on Phytoalexins :* The production of phytoalexins was studied in *Hevea* clones resistant and susceptible to *Phytophthora* diseases. Diffusates from artificially inoculated pods of susceptible and resistant clones were tested for germination of zoospores. Zoospores 'disintegrated' rapidly in diffusates obtained from pods of resistant clones, while they remained encysted in diffusates from susceptible clones, but germination was not observed during the first 24 hours.

In control diffusates—that is the diffusates from uninoculated pods—of both resistant and susceptible clones, 85—90% of the zoospores germinated during the first 24 hours, but the growth of the germ tubes was retarded in the control diffusates from resistant clones when compared with those from susceptible clones.

These results indicate that, during infection of resistant clones by *Phytophthora* spp., certain substances toxic to zoospores are formed, due to host/fungal interaction. It is possible that these substances are akin to phytoalexins. Work on these lines is being continued with a view to isolating and identifying these substances.

The retarded germ tube growth in uninoculated diffusates of resistant clones, suggests that the 'factor' from which these substances are formed during host/fungal interaction is present in resistant clones in a concentration to affect the growth of the fungus.

As pods are available only for a limited period of the year semi-mature leaflets were tested and found suitable for such studies. Inoculation trials were carried on semi-mature leaflets to select virulent and avirulent isolates of *Phytophthora* spp. When classed on colour of lesion and lesion development, two isolates appeared to be more virulent than the others tested. Further tests will be carried out to confirm this and to select a few avirulent isolates.

Studies on Bark Rot Disease (V. Satchuthananthavale and T. M. Fernando)

(1) *Bark Injury and Incidence of Bark Rot :* When the surface of uninjured bark was inoculated with a heavy zoospore suspension of *Phytophthora* spp. symptoms of Bark Rot did not set in. Any injury to the outer corky layer resulted in infection, indicating that all the underlying tissues except this layer were susceptible to infection by *Phytophthora* spp.

At the end of seven weeks, sporangia were found on the bark, rotted as the result of infection, indicating that the fungus is capable of sporulation and survival on bark debris, at least for a limited period.

Typical black streaks seen on the wood when examined microscopically revealed the presence of fungal hyphae.

(2) *Effect of Bark Renewal on Infection :* The results of this experiment have shown that the exposed tissues of a tapping cut are susceptible to infection by

Phytophthora spp. from the time a cut is opened to about five days, 0—48 hours being the most critical period. The presence of scrap on the cut did not protect it from infection.

(3) *Anatomy of Bark in Relation to Infection* (*V. Satchuthananthavale and Z. E. Irugalbandara*): Sections were made of the various layers of healthy bark of clone PB 86 from cork to cambium. Parenchymatous tissues in all the underlying layers of cork appeared to be easily penetrated by the fungus.

The anatomy of bark of clones resistant to *Phytophthora* will be examined for anatomical characters contributing to resistance in those clones.

Studies on Phytophthora *Occurring on* Hevea (*V. Satchuthananthavale*) : Over two hundred isolates of Group I and 60 isolates of Group II collected from various plant parts of *Hevea*, from different estates were screened, on cultural characteristics, at constant temperature. Some of the isolates of Group I did not conform to the characteristics of type isolate 60. A number of isolates of Group II produced oospores in abundance by the fifth day at 25—30°C. These oospores were smaller when compared with those of type isolate 62.

On the basis of production of oospores and sporangia, eight isolates were selected for detailed studies.

Physiology of Phytophthora *Species*

(a) *Growth* (*V. Satchuthananthavale and S. Kasinathan*) : The selected isolates were grown on a chemically defined medium. Distinct differences in the rate of growth of the two groups were noted.

(b) *Sporulation* (*V. Satchuthananthavale and H. Narangoda*) : A number of methods were tried to induce sporulation of the eight isolates at the same time. Two of them failed to produce sporangia in any of the media or methods tested.

(c) *Bacteria Inducing Sporulation* (*V. Satchuthananthavale*) : Cultures which produced sporangia sparingly and late on Lima Bean Agar were found to sporulate early and in abundance in the presence of a bacterial contaminant in the same medium. This bacterium has been isolated with a view to testing it for sporangial production of the late sporulating isolates of *Phytophthora* spp.

Survival of Phytophthora *in Soil* (*A.de S.Liyanage and R.D.Sebastian*): Four methods were tested for the isolation of *Phytophthora* spp., causing panel and leaf diseases of *Hevea*, from the soil collected from three locations in Dartonfield. Of these, use of cacao pods as bait material to trap the fungus gave the best results.

Monthly samples were collected, at three different depths, from the three locations and by baiting with cacao pods,three isolates of *Phytophthora* were obtained in August

and September but none in November or December. An antibiotic incorporated medium is to be tried for isolation of the fungus from those soil samples which have not yielded the fungus by the bait method.

Nutritional Studies on Gloeosporium (*A. de S. Liyanage and R. D. Sebastian*): A number of media were tested for growth and sporulation of *G. alborubrum*. A Glucose-asparagine medium was found to be the best. On this medium the fungus attained maximum growth with complete utilisation of sugar on the fourth day. The optimum pH range for growth and sporulation was between pH 5 and 6 with maximum growth at pH 6 on the fourth day.

Incidence of Oidium *Spores* (*T. M. Fernando*): The occurrence of conidia of *Oidium heveae* at Dartonfield was studied, using a Burkyard recording volumetric spore trap, for a period of two months commencing from the end of January 1969. Meteorological data too were collected for the period.

Spore concentration in the air was at its maximum in the afternoon, between 12 noon and 4 p.m., with two peaks, one at 12 noon and another at 3 p.m. for each day. The weather conditions prevailing for any particular day governed the number of conidia present in the atmosphere for that day. Higher numbers were recorded on bright sunny days.

Studies on Fomes lignosus (*V. Satchuthananthavale and L. Halangoda*)

(1) *Soil Conditions and Survival of* Fomes lignosus : Soil moisture at three levels is being tested for survival of *F. lignosus* using artificially inoculated wood pieces. Observations are being made at frequent intervals and at the end of the incubation period viability of the fungus in the wood pieces will be tested.

(2) *Fungi Antagonistic to* Fomes lignosus : A number of fungi were isolated from infected roots of *Hevea* and tested for antagonism against *F. lignosus*. Cellulolytic and non-cellulolytic fungi inhibited growth of *Fomes* on culture media and on sterile wood pieces. Some fungi were strongly antagonistic, inhibiting growth at a distance, indicating production of substances toxic to *Fomes*, which was unable to overcome such inhibition even with the passage of time.

Some fungi and *Fomes* were mutually antagonistic to each other; of these some overgrew *Fomes* with the passage of time and in the case of others *Fomes* was able to overcome the inhibition. The ability of *Fomes* to overcome inhibition depended on its initial establishment on the substrate.

Fast growing species and heavily sporing species were at an advantage in occupying the surface of the substrate. *Fomes* failed to establish itself on such substrates.

(3) *Effect of Sulphur on* Fomes lignosus

(a) The growth of *Fomes lignosus* was studied on culture media and on sterile soil. In culture the fungus failed to grow on the surface of agar dusted with sulphur

but grew submerged within the agar medium. In sulphur-treated sterile soil, growth was poor and restricted; the wood pieces used as the base for inoculum were not permeated by the fungus. Growth was good in the untreated soil and the fungus grew out luxuriantly from the wood pieces.

(b) Naturally infected wood pieces were buried in sulphur-amended unsterile soil contained in pots. Untreated soil served as controls. At the end of one month, the fungus failed to grow out of the pieces buried in sulphur-amended soil. The fungus grew out from wood pieces buried in untreated soil.

(c) Naturally infected roots were buried in pots containing untreated soil and soil in which sulphur was forked at the surface, as in the field. The fungus grew from roots from both treatments, but with a difference. *Fomes* grew from the rhizomorphs on roots, taken from untreated soil, while growth on the roots from the treated soil was from pin points inside the bark and not from rhizomorphs.

These observations indicate that sulphur does restrict the growth of the fungus. Studies are being carried out to confirm this.

Studies on Other Fungi

Xylaria *Root Disease* (*H. L. Munasinghe*) : *Xylaria* isolated from fructifications from the field when cultured on sterile plant material in the laboratory produced typical fructifications.

Mould Growth on Rubber (*W. C. Dayaratne*) : Conditions suitable for germination and growth of *Aspergillus niger*, *A. ochraeus* and *Penicillium citrinum* were studied. Results have shown that free water is detrimental to germination of spores. Relative humidity above 95% and temperatures between 25°—35°C are ideal for germination and growth of these moulds.

Samples of contaminated rubber were collected from factories in the Kalutara District and fungi were isolated. Observations on colour and extent of contamination were noted with a view to tracking the predominant species, so that various fungicides could be tested for their control.

Diseases in General

Leaf Diseases: In general, the incidence of leaf fall due to *Oidium* was mild. Leaf fall in our experimental areas indicates that disease incidence had been higher during the refoliation season in 1969 than in 1968, in the Kalutara District.

Leaf fall due to *Phytophthora* was negligible.

Panel Diseases : Bark Rot incidence in general was light with a few exceptions. A questionnaire was sent out to estates, to assess the incidence of Bark Rot. The response was poor.

Most estates use both water-miscible fungicides and water-proof panel dressings, throughout the year. Our experiments and observations show that the use of panel dressings in the control of Bark Rot is not justified. During dry weather the conditions that prevail are not conducive to infection, and application of water-miscible fungicides is not necessary during this period. There are estates which apply fungicides at the time of tapping. This practice may reduce yield (Peries, 1966) and does not afford the necessary protection. Application of fungicides on the cut should be at the time of collection, or later the same evening.

Bark Rot disease has not been reported from a few estates which do not use water-miscible fungicides as a routine practice. These estates do not tap wet trees. If wet trees are not tapped, then the incidence of Bark Rot could be minimised without the use of fungicides. Grooming of trees would help in reducing the incidence of disease by enabling the trunk to dry rapidly, after wet weather. It would also reduce the multiplication of fungal propagules, which can survive for prolonged periods in bark debris as shown in the laboratory studies on Bark Rot.

Root Diseases : White Root disease is prevalent in most of the young replantings, the incidence has been high in areas where the disease has been prevalent in the old stand. Amendment of soil with sulphur does reduce the incidence to a great extent but it does not eradicate the disease, especially in areas where *Fomes* patches exist.

Field Investigations

Oidium *Leaf Disease :* Three *Oidium* leaf disease control experiments were carried out on outside estates during the refoliation season 1969.

(a) *Eladuwa Estate—Clone PB* 86 (*W. C. Dayaratne*) *:* Dusting of sulphur at 10 lb per acre per round significantly reduced the incidence of leaf fall on clone PB 86. Leaf fall usually started on plots adjoining paddy fields or in open areas and spread inwards.

(b) *Culloden Estate—Clone Tjir* 1 (*S. K. Samaraweera*) *:* Clone Tjir 1, being an uneven winterer, the susceptible stage of host leaves is available for most of the period of the refoliation. When sulphur dusting good coverage of foliage is never achieved as the machines available are not capable of carrying the dust to the heights to which this clone grows. Leaf fall is usually heavy on this clone. Sulphur dusting reduces incidence of leaf fall to some extent, but this is not significant.

(c) *Culloden Estate—Clone Tjir* 1 *:* The effect of various rates of dusting on the control of *Oidium* leaf disease was tested on clone Tjir 1, at Culloden Estate, Neboda.

For the reasons discussed in the foregoing experiment, 10 lb of sulphur per acre per round which is thought to be the economic maximum does not give good control of the disease on clone Tjir 1.

Phytophthora *Leaf Disease (W.C. Dayaratne and S.K. Samaraweera):* Preparations were made to conduct two experiments at Eladuwa and Culloden estates, but as there was no incidence of leaf fall in either of these estates, these experiments were called off.

Yield/Control of Leaf Diseases (Z. E. Irugalbandara) : Yield data were collected from Eladuwa and Culloden Estates for the period under review.

Yield data collected so far from Eladuwa Estate do not indicate any significant reduction in yield in the control plots.

Due to practical difficulties, complete control of *Oidium* leaf disease on clone Tjir 1 cannot be achieved; therefore, the experiment to establish the effect of leaf disease on yield, conducted at Culloden Estate, was discontinued at the end of 1969.

Bark Rot Control Experiment—Fungicidal Trial on Clone PB 86 (T. M. Fernando) : Three water-miscible fungicides, Antimucin, Brunolinum Plantarium and Fylomac were tested at four strengths at Malaboda Estate. The incidence of Bark Rot has been negligible in all treatments, including the controls, during the period this experiment was conducted, as such it has been discontinued since December 1969.

White Root Disease Control : 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. The incidence of White Root disease was negligible in all treatments in 1969. Observations will be made on this experimental area for a few more years (S. K. Samaraweera).

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. The census taken in 1969 shows a negligible incidence of White Root disease in all treatments (T.M. Fernando and L. Halangoda).

Observations were made in a small scale field trial at Farnham Estate using the collar protectant Fomac 2 (S. K. Samaraweera).

Xylaria *Root Disease (H. L. Munasinghe and R. D. Sebastian) :* A survey was carried out at Hatbawe Estate to detect the diseased trees and to establish the relation between the dead infected material of the old stand and the incidence of disease in the present stand. The importance of a food base to root infection was established.

Control Measures for Xylaria *Root Disease (H. L. Munasinghe) :* One hundred and fifty diseased trees have been treated by various methods based on the trial laid out in 1968 to control *Xylaria* root disease.

Mould Growth in Factories (W. C. Dayaratne) : Observations were made on the conditions favourable for mould growth on prepared rubber in factories. Natural air and hot air-drying towers were inspected, and records taken from time to time show that any factor that increases humidity would tend to increase mould growth in the drying towers. Some of the factors that contribute to mould growth were the presence of very wet laces, close stacking of laces in the compartment, poor ventilation, continuous rainy weather in the case of natural air-drying towers, and the location of drying towers in low lying areas or close to valleys.

Thick laces tend to remain moist for a longer period and are more susceptible to mould infection; the presence of pieces of contaminated laces in the compartments is a potential source of mould contamination.

Mould growth is greater in natural air-drying towers during prolonged wet weather. Mould growth could be reduced by proper ventilation and wider spacing when stacking the laces.

REVIEW OF THE SOILS CHEMISTRY DEPARTMENT

BY

C. G. SILVA

SUMMARY

The field experiment with different levels of nitrogen, phosphorus and potassium indicates that the optimum levels are those that are being presently recommended and that continued manuring during the mature phase gives economic increases in yield.

The vigorous clones RRIC 7, RRIC 52 and RRIC 45 do not appear to benefit by the use of higher levels of fertilizer.

The use of urea, rock phosphate and dolomite as sources of nitrogen, phosphorus and magnesium respectively seems to be as effective in the growth of *Hevea* when compared to the straight fertilizers that are being currently used in making of fertilizer mixtures. The three compound concentrated fertilizers have shown to be better than the standard fertilizer mixture in the growth of rubber.

Detailed soil surveys of the Alutgama 1 in. map show that there are small pockets of so far unidentified soil series.

The variation in the urease activity of the rubber soils is high between the different great soil groups and the loss of ammonia by volatalization from urea depends on the amounts used and also on the soil moisture status.

The survey of the incidence of wind damage in rubber plantations indicates that while uprooting depends mainly on the environment, trunk and branch snap are to a very great extent clonal characters.

The use of MSMA - based weedicide mixtures appears to be promising as an effective substitute for sodium arsenite even though they will not be as cheap.

DETAILED REVIEW

Staff

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

Mr. R. S. John, the Assistant Soils Chemist continued his post-graduate studies at the University of Aberdeen.

Mr. N. Yogaratnam assumed duties as an Assistant Soils Chemist on 25th March 1969.

The other officers who joined the Department during the year were M. U. J. de Silva (3. 1. 69), A. M. A. Perera (10. 3. 69), G. N. de Silva (15. 3. 69), and P. P. Jayasinghe (14. 3. 69), all Technical Assistants, and A. D. M. Karunaratne (11. 11. 69), Field Assistant.

Visits

	Advisory	*Experimental*	*Others*	*Total*
Acting Head of Department	22	12	25	59
Assistant Soils Chemist	1	102	1	104

The field trips done by the Technical Assistants in connection with soil survey work and the visits by the field staff in connection with field experiments are not included.

Meetings and Conferences etc.

The writer attended the following meetings :-

1. Standing Committee on Agro-chemicals and fertilizers (2)
2. Industrial Development Board Sub-panel for Agro-chemicals and fertilizers (6)
3. Rubber Research Board Scientific Committee (1)
4. District Planters' Associations of Kalutara, Kelani Valley and Sabaragamuwa (5)
5. Annual Sessions of the Ceylon Association for the Advancement of Science 17. 12. 69 to 21. 12. 69
6. Conference on Crop Diversification organised by the Incorporated Society of Planters, Malaysia, 10. 11. 69 to 13. 11. 69

Publications

(a) *For Restricted Circulation*

1. Annual Report of the Soils Chemistry Department for 1968
2. Progress Reports of the Soils Chemistry Department for the 1st, 2nd and 3rd quarters of 1969

3. Report on observations at the Crop Diversification Conference held in Malaysia

(b) *Papers*

A survey of wind damage in rubber plantations. For publication in *Rubb. Res. Inst. Ceylon Bull.*

Advisory Work

A new Advisory Circular on manuring was prepared and it will be released at the Rubber Conference scheduled for September 1970.

Advice on such management practices, as effective control of weeds, mulching and soil conservation was given on request.

Two estates, one in the Ratnapura District and the other in the Kelani-Valley, had planted rubber in former tea areas and had observed certain symptoms of nutrient imbalance in the form of die-back and excessive bending, respectively. Both these maladies were attributed to the previous manuring history of the tea areas.

Visits were made to Nakiadeniya Group for the purpose of advising on problems connected with the cultivation of oil palm.

Surveys

The data gathered on wind damage was collated and analysed during the year and a survey on fertilizer usage in smallholdings was initiated.

Research Investigations

Soil Surveys (F. P. W. Silva and P. P. Jayasinghe)

An area of 381 sq miles of the Alutgama 1 in. map was surveyed in detail. These studies showed that it was possible to identify different categories of soils, differing in profile characters as well as in the type of parent material in this area. The soil was examined on a one - mile grid pattern with the help of a soil auger, up to a depth of 6 ft wherever possible. In addition, roadside cuts and other exposed soil profiles as well as rock outcrops were examined in deciding on the soil boundaries.

Two samples were taken at a depth of 0—3 in. from each of twelve sites, in three separate areas, representative of each of the six different soil series, giving 432 samples. The Agalawatta soil series was sampled to a depth of 0—6 in. and

6—18 in. at five different sites, to obtain 300 samples. Analysis of these samples was started.

Detailed soil surveys were completed on 58 acres of Kiribathgala Estate, Nivitigala, to find a possible cause for low yields and 54 acres of Nakiadeniya Group for oil palm cultivation.

The mechanical analysis, and nitrogen, phosphorus, potassium, calcium and magnesium analyses were done on a few of the soil samples collected during soil surveys.

Leaf Nutrient Status (*H. A. Seemon, M. U. J. de Silva and G. N. de Silva*)

Leaf samples collected from the Department's experimental areas and from those of the Plant Breeding Department, at Kuruwita and Moneragala, were analysed for nitrogen, phosphorus, potasisum, calcium and magnesium. Table 1 shows the number of analyses carried out during the year. This includes a few leaf analyses done in the course of advisory work.

TABLE 1

SUMMARY OF ANALYSES CARRIED OUT DURING 1969

	Leaves		Soil	Fertilizer
	Rubber	Oil Palm		
Nitrogen	410	10	56	-
Phosphorus	445	10	12	1
Potassium	463	10	26	2
Calcium	475	10	66	
Magnesium	418	10	66	
Boron	-	-	2	
Mechanical analysis	-	-	19	

Studies on the Urease Activity of Rubber Soils (*A. M. A. Perera*)

Soil samples from six soil series were analysed for their urease activity. The organic carbon content, moisture status and the pH of these soils were also determined. The soil samples were collected from the first three inches. Three places were selected from each soil series and at each place 12 sites were sampled. Two samples were taken from points about two feet apart, at each site. A paper entitled "The urease activity of the rubber soils of Ceylon" was prepared on the basis of the results obtained.

This work shows that there is a close relationship between urease activity and the pH of the soil. It is highest in the Matale and the Parambe series soils. This

investigation also established that instead of analysing 336 samples, the same degree of variation could have been obtained with 30 samples. More details of this work will be found in the paper.

Volatalization of Ammonia from Urea (T. Kanthasamy)

It was observed in pot experiments that the moisture status of the soil in the pots, the quantity of urea used and its method of application had a direct bearing on the amount of nitrogen lost by volatalization. It was shown that the losses of nitrogen was negligible, when ammonium sulphate is used while the loss from urea could be as high as 30% N, when equivalent quantities of nitrogen in two pounds of the R. 4 : 6 : 3 mixture were used under a moisture regime of 18%. This nitrogen loss was reduced considerably when the fertilizer mixture is forked into the soil.

Work is being continued, using different soils at various moisture levels.

Field Experiment No. 1 (See index to field experiments)

NPK Interactions : This trial is laid down in a 1952 clearing at Hedigalla Division. The clones used are PB 86, AVROS 255, LCB 870 and PB 86 crown budded with LCB 870.

The yield records for 1969 when analysed statistically show that for the clone PB 86 crown budded with LCB 870, the manure mixture applied after tapping commenced gives a significant increase in yield. Similarly the girth records for 1969 indicate that clone PB 86 responded to the new manure mixture, applied after tapping commenced, with an increase in growth. In the course of statistical analysis an effort was made to eliminate the residual effects of the manurial treatments in the immature phase on present growth and yield.

TABLE 2

MEAN GIRTH AND YIELD OF THE CONVERTED TREATMENTS OF CLONES PB 86 AND PB 86 X LCB 870, RESPECTIVELY

Treatment	Mean girth (in.) PB 86	Critical difference	Mean yield g/tree/tapping PB 86 x LCB 870	Critical difference
O	28.51		21.69	
P	28.67		22.84	
NP	28.94	0.89	26.80*	3.25
PK	27.84		22.55	
NPK	30.02*		27.92*	

The difference between the control and the NPK treatment is 6.23 g/tree/tapping, and would amount to about 288 lb of rubber per acre per year.

Field Experiment No. 2

This experiment is laid down at Eladuwa Estate to investigate the effect of high and low potash. The manure mixtures R. 4 : 6 : 2, R. 4 : 6 : 3, R. 4 : 6 : 5 and R. 4 : 6 : 8 are being tested on six clones in a clone trial area replanted in August 1958. No manure was applied in the planting holes. The first application of manure was made in December 1958.

From the fourth year after planting it has been reported that there is a tendency for the higher levels of potassium to have a depressing effect on the growth. This trend however disappeared in the following years and in 1965, when the area came into tapping, up to four times the amount of potassium contained in the standard R. 4 : 6 : 2 + Mg mixture failed to give any significant response in growth.

Fertilizer applications according to the treatments were stopped from 1965 and the normal estate fertilizer programme was carried out from that time, on the experimental area.

The analysis of yield and girth data for 1969 does not show any significant difference between the treatments. Due to the fact that the clone differences have been confounded with that of the blocks, the effect of the different manurial treatments on the different clones cannot be statistically evaluated.

Field Experiment No. 3

This is a 2 x 2 x 2 NPK experiment, without the nil levels, the first level is equivalent to the dosage of R. 4:6:2 + Mg. The trial is laid down at Kumarawatta Group, Moneragala, the area being planted in November 1958 with Tjir 1 seedlings, with no application of fertilizer in the planting hole. Effective plot size is 40 plants. The trees came into tapping in 1966, and this trial will be abandoned in 1970.

The girth measurements recorded at the end of 1960 showed that there was a significant response to the second level of N, P and K applications which is double the present recommendations. The girth measurements recorded at the end of 1961 and 1962 indicated that manuring with the second level of nitrogen could have a beneficial effect on growth. At the end of four years the best average girth of any plot was ten inches. It is therefore apparent that factors other than the major nutrients are limiting growth in this region.

The girth measurements recorded at the end of the fifth year of growth showed that only nitrogen produced a beneficial effect.

This area was tapped in 1966. The girth and yield data for 1969 do not show any significant response to any of the nutrients.

Field Experiment Nos. 4 *and* 5

This is a 3 x 3 x 3 experiment, testing different levels of K, Mg and various cultivation treatments.

All treatments were given a basic application of nitrogen and phosphorus at rates recommended by the Institute.

K levels were : 0, 1 and 2; level 1 being equivalent to K in R. 4 : 6 : 3

Mg levels were : 0, 1 and 2; level 1 being equivalent to Mg in R. 4 : 6 : 3 + Mg

Cultivation treatments were :

0 = cover crop (*Pueraria phaseoloides*) and no mulching

1 = cover crop (*P. phaseoloides*) and mulching with *Pueraria*

2 = cover crop (*Pueraria* and *Tripsacum laxum*) and mulching with *T. laxum* (Guatemala grass)

From 1963, one of the replicates was changed to 3 x 3 x 3 — N x P x cultivation with basic application of K and Mg.

The girth data recorded in 1969 do not show any response to treatments in the experiment where N and P are basal applications. In the trial where K and Mg are basal applications, the girth data indicate a significant effect of P up to the first level of application only.

Field Experiment Nos. 6 *to* 9

Physiological Diagnosis : In these experiments, the response to the application of fertilizer, on the basis of physiological diagnosis, is compared with the application of different amounts of the standard fertilizer mixture. The details of these four trials are given below :—

Experiment No. 6 — 1959 replanting PB 86 — Nakiadeniya Group, Galle District

Experiment No. 7 — 1960 replanting PB 86 — Gallewatte Estate, Kalutara District

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

Experiment No. 9 — 1949 replanting PB 86 — Eladuwa Estate, Kalutara District

The girth measurements of experiment No. 7 and the yield and girth data of trials Nos. 6, 8 and 9 have been statistically analysed; the treatment effects are not

statistically significant. The absence of any significant difference in growth due to treatment effects is in contrast to the situation reported in Vietnam where substantial increases were observed six months after fertilizer application based on physiological diagnosis. The mean girths of trees in all four experiments and the mean yields of trees in experiments 6, 8 and 9, with the respective treatments are given in Table 3.

TABLE 3

GIRTH AND YIELD RESPONSES TO FERTILIZATION ON THE BASIS OF PHYSIOLOGICAL DIAGNOSIS

Treatment	Mean Girths				Mean Yields		
	No. 6	No. 7	No. 8	No. 9	No. 6	No. 8	No. 9
Control	27.02	21.95	33.60	31.69	33.03	37.03	40.78
D. P.	27.04	22.27	33.94	31.07	36.41	44.99	46.07
1 lb of R. 4 : 6 : 3 + Mg	—	—	—	31.38	—	—	50.25
1 ½ lb of R. 4 : 6 : 3 + Mg	27.64	22.06	—	—	36.34	—	—
2 lb of R. 4 : 6 : 3 + Mg	—	—	34.53	32.03	—	52.31	43.43
3 lb of R. 4 : 6 : 3 + Mg	26.99	22.56	—	32.13	33.11	—	44.21
4	—	—	34.43	—	—	42.39	—
6	—	—	35.28	—	—	52.79	—

The analyses of leaves from these areas show that there is no consistent and regular pattern of difference between the areas getting fertilizer according to DP and those areas getting the different levels of the standard fertilizer mixture and even the control. An attempt is being made however to utilize these leaf analysis data to establish the optimum or critical leaf nutrient values for these areas.

Field Experiment No. 11

Sources of Magnesium : The experiment is laid down on a split-plot randomised block design, the NPK treatments randomised between plots and the two forms of magnesium randomised within plots.

This area was tapped in 1969 and the yield data do not show any statistically significant differences. The analysis of girth data, however, shows a significant response to potassium. The difference between the two forms of magnesium is on the border line of significance in favour of dolomite.

TABLE 4

MEAN GIRTHS PER TREE FOR THE MAIN PLOT AND SUB-PLOT TREATMENT

Treatment	Mean girth in inches	Critical difference
Main Plots		
N_0	21.04	
N_1	21.21	
P_0	20.85	0.81
P_1	21.41	
K_0	20.48	
K_1	21.77*	
Sub-plots		
Mg as commercial epsom salt	20.79	0.73
Mg as dolomite	21.47	

Field Experiments Nos. 12 *and* 13

These two experiments are 3 x 3 x 3 designs laid down in a 1961 replanting at the Kuruwita Sub-station. They are intended to assess the response to NP with cultivation and their interactions at a basal dosage of K and Mg.

The girth data for 1969 indicate a significant response to nitrogen, the optimum level of nitrogen being at the Nlevel. The yield data indicate a significant response to phosphorus, the optimum level being the second level.

TABLE 5

MEAN VALUES FOR GIRTH AND YIELD WITH THE CRITICAL DIFFERENCES

Treatment	Mean girth in inches	Critical difference	Mean yield in grams	Critical difference
N_0	20.29		33.31	
N_1	21.19		33.24	
N_2	20.51	0.83	36.63	5.06
P_0	20.12		31.30	
P_1	21.11		36.13	
P_2	20.76		30.76	

In the experiment where N and P are basal the girth data indicate that the effects of K and Mg are statistically significant, the optimum K level being the second level K_1, and magnesium has a depressing effect at both levels tested. The fact that magnesium has a depressing effect has been reported in 1963, 1965 and 1968.

TABLE 6

MEAN GIRTHS (IN.) AND CRITICAL DIFFERENCES

Treatment	Mean girth in inches	critical difference
K_0	20.00	
K_1	21.29*	
K_2	20.62	0.79
Mg_0	21.25*	
Mg_1	20.31	
Mg_2	20.36	

Field Experiment No. 14

Assessment of Different Fertilizer Materials : This experiment which is designed to assess the growth response of N, P, and Mg, each from three different fertilizer materials, is laid down at Gallawatta Estate, in an area replanted in 1961, with clone PB 86. The experimental details are given in the Annual Review for 1968. The mean girths are given in Table 7.

TABLE 7

GIRTH RESPONSES TO DIFFERENT FERTILIZER MATERIALS

Treatment	Fertilizer element	Mean girth (in.)	Critical difference
Ammonium nitrate	Nitrogen	19.03	
Ammonium sulphate		19.66	
Urea		20.05*	
Super phosphate	Phosphorus	19.96	
Rock phosphate		19.79	0.80
Ammonium phosphate		18.98	
Commercial epsom salt	Magnesium	19.42	
Dolomite		20.04	
Kieserite		19.06	

It is seen that when nitrogen is applied as urea there is an increase of 1.02 in. in girth over the ammonium nitrate treatment. This is statistically significant. The difference between treatments with sulphate of ammonia and urea is only 0.39 in., therefore it could be inferred that these two sources of nitrogen are interchangeable.

In the case of phosphatic fertilizers, both super phosphate and rock phosphate are superior to ammonium phosphate. Dolomite as a source of magnesium is superior to both commercial epsom salt and kieserite.

Field Experiment No. 15

Granulated Compound Fertilizers : The girth measurements recorded in 1969 do not show any significant differences between the three concentrated fertilizers. These data however show that all three compound fertilizers are superior to the standard mixtures. Since two of the compound fertilizers (Sincat and Granumix) were not available at the time of fertlizer application, the standard mixture and Dam Trio were applied at the necessary time and a formulation; 15 : 15 : 15 (KAMPKA) was given subsequently, in place of Granumix.

This area is now being tapped and it would be possible to report effects of the different treatments on yield in the Annual Review for 1970. The response to growth between the standard mixture R. 4 : 6 : 2 + Mg and any of the other compound concentrated fertilizer is highly significant.

TABLE 8

GIRTH RESPONSES TO COMPOUND FERTILIZERS

Treatment up to 1968	Treatment in 1969	Mean girth	Critical difference
R. 4 : 6 : 2 + Mg	R. 4 : 6 : 2 + Mg	18.71	
Dam Trio (8 : 8 : 5)	Dam Trio	21.00	0.96
Sincat (14 : 14 : 5)	Nil	20.96	
Granumix (15 : 15 : 6 : 3)	Kampka (15 : 15 : 15)	21.40	

Field Experiment No. 16

Fertilizers and Wind Damage : The primary objective of this experiment was to study the effect of reduced levels of nitrogen and potassium on the incidence of wind damage in a clone (LCB 1320) rated as susceptible to wind damage. The experiment is laid down at Mirishena Estate, Mahagama, in a 1959 replanting, on a 3 x 3 x 2 N x K x P factorial design.

The fertilizer applications according to treatments started in 1962 and all plots received a basic application of Mg as commercial epsom salt at half the normal rate.

Because the management was reluctant to bring any area in this replanting into tapping in 1964 even though it qualified to be tapped, one of the replicates was tapped in 1965 and the remaining blocks were brought into tapping in 1966.

In 1965 this area suffered severe wind damage losses due to a freak storm and a study of the nature of this damage did not reveal any relationship between manuring and wind damage.

There has been no significant difference in yield and girth up to 1969 even though those areas receiving no potassium showed signs of potassium deficiency. However the analysis of yield data for 1969 indicates that even though N, P and K singly do not have an effect on yield, nitrogen and potassium in combination have a significant effect on yield.

This experiment is to be terminated from 1970.

Field Experiment No. 18

Clonal Response to Fertilizers : The effect of eight levels of the standard NPK + Mg mixture (R. 4 : 6 : 3 + Mg) on four clones RRIC 7, RRIC 45, RRIC 52 and PB 86, are tested in this 1963 replanting at Kuruwita Sub-station.

The girth data for 1969 indicate that there is a significant response to the different levels of fertilizer and that no benefits would accrue beyond the third or fourth level in most clones. In the vigorous clones the girth was always higher than in the control clone PB 86 at all levels, as shown in Table 9.

TABLE 9

MEAN GIRTH (IN.) RESPONSES TO DIFFERENT LEVELS OF NPK MIXTURE

Treatment Levels	RRIC 52	RRIC 45	RRIC 7	PB 86
0	17.27	16.47	15.43	13.21
1	20.69	20.09	16.80	15.93
2	19.34	19.60	18.09	15.94
3	20.87	19.21	17.74	15.35
4	21.10	19.91	18.64	16.42
5	21.12	19.23	18.93	15.99
6	21.80	20.07	18.93	16.91
7	20.65	21.42	17.49	17.31

Field Experiment No. 19

The purpose of this trial was to assess the performance of rubber from the time of planting, under a pure legume cover as against natural covers, kept under control by spraying herbicides. The experiment is laid down in a 1963 replanted area at Kuruwita Sub-station.

The girth measurements recorded up to 1969 do not indicate any significant differences between the two cover crop regimes. Since it has been started as a simple trial without much emphasis on a strict statistical design, this trial will be stopped in 1970 and two new trials will be initiated in 1970 in order to evaluate the importance of leguminous covers during the period of immaturity and whether extra doses of nitrogen could compensate for the absence of a legume cover. These two trials will be laid down in the Ratnapura and Kalutara Districts.

Field Experiment No. 20

Effect of Fertilizers on Unmanured Mature Rubber : The effect of two, three and four levels each of the nutrients N, P, K and Mg are being studied on mature PB 86, at Pannila Group, Welipenna. The details of the trials are as follows :—

(*a*) Effect of two levels each of the four nutrients 2^4 N, P, K, Mg. Tapping blocks 2 and 6.

(*b*) Effect of two levels each of the three nutrients N, P, and K with basic application of Mg 3^3 N x P x K. Tapping blocks 1 and 5.

(*c*) Effect of four levels each of two nutrients at a time, with basic application of the other two nutrients.

4 x 4 N x P	(basic application of	K	and	Mg)
4 x 4 K x Mg	(,,	,,	,,	N and P)
4 x 4 P x K	(,,	,,	,,	N and Mg)
4 x 4 N x K	(,,	,,	,,	P and Mg)

Tapping blocks 3, 4, 7 and 8.

The analysis of variance of trials (*a*) and (*b*) indicates that the effect of P on girth and of K on yield is significant. It also indicates that the response to each one of the nutrients N, P and K is dependent on the other two nutrients. The mixture $N_2P_1K_0$ appears to give the maximum growth while the same mixture combined with the NPK mixture appears to give the highest yield.

Field Experiment No. 21

Frequency of Fertilizer Application : The purpose of this experiment, laid down at Pembroke Estate, Kalutara, in a 1969 replanting, clone RRIM 605, is to test five frequencies of application of fertilizer *viz.* 2, 3, 4, 5 and 6 per year, during the first year. The trial is based on a randomised block design with four replicates.

The height measurements taken five months after planting do not show any significant difference. It is obviously too early for any differences to occur.

Nursery Fertilizer Experiments (N. Yogaratnam)

Nursery Experiment A. (Nivitigalakele Division)

The purpose of this experiment is to study the growth response of young seedlings in the nursery to the application of different levels of the major nutrients NPK and Mg. This experiment is based on 3^4 factorial design.

The treatments are as follows :—

N_0				No nitrogen
N_1	four	applications	of	$\frac{1}{2}$ oz of sulphate of ammonia per plant per application
N_2	,,	,,	,,	1 oz of sulphate of ammonia per plant per application
P_0	,,	,,	,,	No phosphorus
P_1	,,	,,	,,	$\frac{1}{2}$ oz of saphos phosphate per plant per application
P_2	,,	,,	,,	1 oz of saphos phosphate per plant per application
K_0	,,	,,	,,	No potash
K_1	,,	,,	,,	$\frac{1}{2}$ oz of muriate of potash per plant per application
K_2	,,	,,	,,	1 oz of muriate of potash per plant per application
Mg_0	,,	,,	,,	No magnesium
Mg_1	,,	,,	,,	$\frac{1}{4}$ oz of epsom salt per plant per application
Mg_2	,,	,,	,,	$\frac{1}{2}$ oz of epsom salt per plant per application

Nursery Experiment B

This experiment, based on a randomised block design with four replicates, was laid down in order to study the effect of five levels of phosphorus on the growth of young seedlings in the nursery.

The treatments are as follows :—

P_0	No phosphorus			
P_1	four	applications	of	$\frac{1}{2}$ oz saphos phosphate per plant per application
P_2	,,	,,	,,	1 oz saphos phosphate per plant per application
P_3	,,	,,	,,	$1\frac{1}{2}$ oz saphos phosphate per plant per application
P_4	,,	,,	,,	2 oz saphos phosphate per plant per application

All plants receive a uniform dressing of :

$\frac{1}{2}$ oz	of	sulphate of ammonia	per	plant	per	application	
$\frac{1}{4}$,,	,,	muriate of potash	,,	,,	,,	,,	
$\frac{1}{4}$,,	,,	epsom salt	,,	,,	,,	,,	

Nursery Experiment C

The purpose of this trial, which is similar to nursery experiment B in design is to study the effect of different frequencies of application of fertilizer on the growth of young seedlings in the nursery.

Treatments :- F_0 — 2 applications per year
F_1 — 3 ,, ,, ,,
F_2 — 4 ,, ,, ,,
F_3 — 5 ,, ,, ,,
F_4 — 6 ,, ,, ,,

Fertilizer levels :- A mixture of—

2 oz of sulphate of ammonia per plant per year
2 oz of saphos phosphate ,, ,, ,, ,,
1 oz of muriate of potash ,, ,, ,, ,,
1 oz of epsom salt ,, ,, ,, ,,

It is yet too early to draw any conclusions from these three nursery field experiments.

Weed Control Experiments (N. Yogaratnam)

(1) Three field experiments were initiated at Malaboda Estate, Matugama, to assess the efficiency of mono sodium methane arsonate (MSMA) in controlling weeds. MSMA was tested alone and in combination with 2, 4—D amine, sodium chlorate, dalapon and aminotriazole at different concentrations. The results so far obtained indicate that MSMA-based mixtures are most effective on the common weeds found in rubber estates.

(2) Another experiment was laid down at Malaboda Estate to determine the efficiency of different levels of sodium arsenite in controlling weeds. The levels used were 2 lb, 4 lb, 6 lb, 8 lb and 10 lb of sodium arsenite per acre per application. It would be necessary for this trial to be continued for a few more months before the economics of using lesser concentrations at greater frequencies could be worked out. The indications are that the effective concentration depends to a large extent on the stage of growth of the weed population; if this growth has been controlled regularly, even the lowest concentration of 2 lb in alternate months could control weeds effectively.

Index to Field Experiments

1. Trial of nitrogen and potassium in the presence of phosphorus on four clonal materials—1952 clearing—Hedigalla

2. Effect of four levels of potassium in the presence of N & P (six clones) 1958 replanting—Eladuwa Estate

3. 2^3 NPK trial—Tjir 1 clonal seedlings—area considered marginal for rubber—1958 replanting—Kumarawatte Group

4. 3^3 N x P x cultivation treatments trial in the presence of K & Mg on clone PB 86—1959 replanting—Parambe Group, Kegalle District

5. 3^3 K x Mg x cultivation treatments trial in the presence of N & P on clone PB 86—1959 replanting——Parambe Group, Kegalle District

6. Galle District—clone PB 86—immature/mature phase—1956 replanting—Nakiadeniya Group

7. Kalutara District—clone PB 86—immature phase—1960 replanting—Gallewatte Estate

8. Kegalle District—clone Gl 1—mature phase—1951 replanting—Parambe Group

9. Kalutara District—clone PB 86—mature phase—1949 replanting—Eladuwa Estate

11. 2^3 NPK trial in the presence of Mg from two sources on clone PB 86—1961 replanting—RRIC Sub-station—Kuruwita

12. 3^3 N x P x cultivation treatments trial in the presence of K & Mg on clone PB 86—1961 replanting—RRIC Sub-station—Kuruwita

13. 3^3 K x Mg x cultivation treatments trial in the presence of N & P on clone PB 86—1961 replanting—RRIC Sub-station—Kuruwita

(N.B. — Same as experiments 4 and 5; but with the difference that loppings of Guatemala grass used for one of the cultivation treatments obtained from within and from outside the experimental plots)

14. Growth response to the three major nutrients N, P & K each from three different fertilizer materials—1961 replanting—Gallewatte Estate

15. Growth response to three brands of complete concentrated fertilizers—1961 replanting—Gallewatte Estate

16. Trial with different levels of N, P & K on clone susceptible to wind damage *viz.* clone LCB 1320—1959 replanting—Mirishena Estate

17. Time of fertilizer application trial—mature phase—clone PB 86—1951 replanting—Dewalakande Estate

18. Effect of 8 levels of standard fertilizer mixture R. 4 : 6 : 3 + Mg on 4 clones—1963 replanting—RRIC Sub-station—Kuruwita

19. Trial on leguminous ground covers vs. natural ground cover kept under control by herbicide spraying—1963 replanting—RRIC Sub-station—Kuruwita

20. Trials with different levels of N, P, K and Mg on clonal rubber that had not been manured for a long period (ten years or more)

21. Frequency of fertilizer application—Pembroke Estate—Kalutara—1969 replanting.

REVIEW OF THE RUBBER CHEMISTRY DEPARTMENT

By

M. Nadarajah

Summary

The Rubber Chemistry Department was understaffed during the first half of the year but had its full complement of staff by the end of the year.

The Department continued to give advice to large estates on problems connected with the manufacture of raw rubber. Advice was given to Peenkande Group and Culloden Group who intend erecting plants in 1970 to produce new process rubbers at 100 tons per month each. Preliminary investigations were carried out to erect a central factory to process latex from smallholders and small estates into new forms of rubber.

Various aspects in the production of viscosity-stabilised rubber from lower grades were investigated. Storage hardening could be successfully inhibited by soaking cup lumps in an aqueous solution of hydroxylamine hydrochloride (0.4% for 16 hours). Soaking of lower grades in rubber serum from acid or assisted biological coagulation gave an improvement in plasticity retention index (PRI). There is a drop in PRI after the accelerated storage hardening test and this appears to be a clonal characteristic. The drop in PRI on storage is more marked with the lower grades.

Increasing the dosage of RPA 3 in the range 0 to 1% based on dry rubber had very little effect on the tensile properties of both unaged and aged vulcanisates based on the ACS 1 formulation and cured for 40 minutes at 140°C. With oxalic acid as the coagulant the aged tensile strength increased as the dosage of RPA 3 was increased from 0 to 1%. When the dosage of RPA 3 (added to latex prior to coagulation) is increased from 0.05 to 1% (on D.R.C.) there is a gradual drop in PRI.

Assessment of wear properties of oil-extended natural rubber (OENR) retreads showed that the wear rating of retreads prepared from OENR is better than from a compound without oil-extension, when due regard is made to compounding.

Investigations on collection of rubber seed kernel have shown that it is possible for estates to make a profit of about Rs. 150/- per ton of rubber seed kernel collected.

The difficulties in Ceylon in the use of field latex for surface dressing of roads is the transportation of latex and mixing it with bitumen at the road site. The use of rubber bitumen masterbatches is a solution to this problem and the optimum percentage of rubber for the masterbatches is about 12.5%.

Vulcastab LW or mixtures of Vulcastab LW and potassium hydroxide or potassium sulphate or sodium carbonate were found to be suitable stabilisers for ammonia-preserved field latex for mixing with cement. If the latex was pre-vulcanised, less stabiliser was adequate and if grafted with methyl methacrylate no stabiliser was necessary.

A clonal variation was established in the tocotrienol content of latex, estimated by thin-layer chromatography.

Formulations based rubber/ZnO/sulphur were tried out for a quick method for monitoring curing characteristics and the following formulation: natural rubber 100, zinc oxide 8.33 and sulphur 1.66 appears promising.

DETAILED REVIEW

Staff

Mr. M. Nadarajah joined the staff as Head of the Rubber Chemistry Department on 1. 7. 69. Mr. S. W. Karunaratne, Rubber Chemist was on duty throughout the year. Dr. (Mrs.) M. Rajasingham, Polymer Chemist and Mr. A. Coomaraswamy, Assistant Development Officer joined the staff on 17. 11. 69 and 1. 6. 69, respectively. Mr. D. S. Muthukuda who was an Assistant Advisory Officer attached to the Estates Advisory Department was transferred to the Rubber Chemistry Department on 1. 9. 69 as an Assistant Development Officer. Mr. M. T. Veerabangsa successfully underwent a course of training leading to the Processing Instructor's Diploma, at the Rubber Research Institute of Malaya from the middle of March to the middle of September. This course places special emphasis on the processing of new forms of rubber. Mr. P. A. J. Yapa left in September for the U.K., on a Colombo Plan scholarship, to read for the degree of Ph.D. in biochemistry at Bedford College, University of London. Mr. R. Tharmalingam also proceeded in September to the U.K. on a Colombo Plan scholarship to do a Diploma course in Chemical Engineering at the University College, University of London.

Meetings, Lectures etc.

The Head of the Rubber Chemistry Department read a paper entitled: "The technology of natural rubber, natural rubber latex and natural rubber derivatives" at the seminar on "The utilization of local raw materials" organized by the Chemical Society of Ceylon. He also delivered a lecture on applied chemistry at the University of Ceylon, Peradeniya, on 5.12.69 on the subject : "Cis-polyisoprene natural and synthetic". He attended five I.R.I. committee meetings and one I.D.B. panel meeting, while the Rubber Chemist attended five I.D.B. panel meetings.

Assistance was given by the Head of the Rubber Chemistry Department (12 lectures) to the Ceylon College of Technology, Katubedde, to conduct classes leading to the L.I.R.I.

The Rubber Chemistry Department gave assistance at the Siyawasa Exhibition with exhibits and practical demonstrations in the manufacture of latex products.

Advisory Service

Estates were given advice on smoke house operation, drying tower operation, sole crepe manufacture, crepe, sheet and scrap manufacture, weighing of latex and precoagulation. Assistance was given to Peenkande Group, Udakarawita and to Culloden Group, Neboda, to set up plants to manufacture 100 tons of new forms of rubber each from fraction rubber and from estate scrap.

The number of advisory visits made by Mr. D. S. Muthukuda, Assistant Development Officer, in 1969 can be classified as follows :-

Sheet manufacture	*Blanket crepe manufacture*	*Sole crepe manufacture*	*Weighing of latex*	*Other visits*	*Total*
31	11	11	9	3	65

It was observed that with the increase in crops during the peak months, most of the estates had difficulties in the weighing of latex. The increase in the market price of sole crepe as against blanket crepe was the reason for some of the blanket crepe producing estates requesting our advice to switch over to sole crepe manufacture.

New Process Rubber Manufacture (M. T. Veerabangsa)

Due to the China contract, which gives a premium of $6\frac{1}{4}$ cents as handling charges for RSS 1, 2 and 3 and also gives the producer of RSS 1 a premium of $2\frac{1}{2}$ cents, there is no immediate incentive for the development of new process rubbers from latex by private enterprise in Ceylon. However, there is a considerable amount of RSS 4 and 5 produced in Ceylon and these do not qualify for a premium. This is mainly produced by smallholders, and in this sector, active development of new process rubber manufacture is necessary.

Preliminary surveys are being conducted to set up a prototype central factory to manufacture new process rubbers and to cater for smallholdings and small estates at distances within eight miles from the factory. It is expected that the experience gained from operating the prototype central factory would give the necessary experience to launch similar factories in all rubber growing districts.

The production of new process rubbers could be usefully developed in crepe producing estates from field scrap, such as cup coagulum and shell scrap and from fraction rubber. The siphoning away of perhaps 15% of an estate's intake by this means could be useful in reducing capital commitments for increasing drying accommodation and the installation of new machinery. Since the capacity of the minimum commercial unit for new process rubbers is about 100 tons a month,

such pale crepe manufacturing estates should obtain the balance raw material from the adjoining large estates, small estates and smallholders. Advice was given to the crepe producing estates, Peenkande Group and Culloden Group, who intend erecting plants in 1970 to produce new process rubbers at the rate of 100 tons each per month.

The most suitable area for the active development of new process rubbers in Ceylon is by remillers. Of the 20,000 tons of scrap raw rubber available, about 10,000 tons should be converted with the minimum delay into new process rubbers. It is suggested that remillers in the first instance use cup coagulum as the raw material, segregating it from other field scrap, such as trec lace. Advice was given to two remillers interested in erecting new process rubber factories.

Peenkande Group, Udakarawita, exported about 60 tons of crumbled rubber produced at the RRIC pilot plant sited on that estate.

Publications

(1) Karunaratne, S. W. and M. W. Thompson. Experimental crumb rubber project at Peenkande. *R.R.I.C Bull.* (New series) 4, 1—5.

(2) Nadarajah, M. The use of oil-extended natural rubber (OENR) in passenger car retreads in Ceylon. *Rubb. Res. Inst. Ceylon Quart. J.* 45,1—13.

(3) Karunaratne, S. W. Use of oil-extended natural rubber in passenger car retreads in Ceylon—performance of retreads based on OENR and OENRM. *R.R.I.C. Bull.* (New series) 4, Nos. 3 & 4 (in press).

(4) Nadarajah, M. The collection and utilization of rubber seed in Ceylon. *R.R.I.C. Bull.* (New series) 4, Nos. 3 & 4 (in press).

Research Investigations

Studies on the Production of Constant Viscosity (CV) Rubber
(S. W. Karunaratne and P. A. J. Yapa)

Storage hardening could be successfully inhibited by soaking cup lumps in an aqueous solution of hydroxylamine hydrochloride (0.4%) for 19 hours. Soaking in a granulated or comminuted form is the most effective method of treatment.

Clonal separation, although it has an effect on the final product, seems practically impossible even in the large estates in Ceylon.

Clonal mixing which suppresses poor characteristics, such as discolouration, present in some clones, can be carried out successfully to manufacture rubbers with predetermined viscosity.

The addition of oxalic acid to the soaking medium results in a product with improved PRI, but phosphoric acid tends to lower the PRI.

Hydroxylamine hydrochloride improves the colour of the dry rubber of most of the clones. The colour-improving ability of hydroxylamine hydrochloride is further enhanced with the addition of oxalic acid. The use of hydroxylamine hydrochloride for producing (CV) rubbers is covered by a RRIM patent.

Upgrading of Low Grade Rubber (P. A. J. Yapa and S. W. Karunaratne)

The use of oxalic acid solutions for soaking is recommended for low grade rubbers. Direct soaking of cup lumps in phosphoric acid in a range of concentrations from 0 to 5% does not improve the PRI. Soaking in water prior to soaking in phosphoric acid leads to an improvement in the PRI if the period of soaking in water is less than 24 hours. Excessive soaking in water, however, reduced the PRI. The most effective concentration of phosphoric acid is in the range of 0.4 to to 0.8%. The PRI is adversely affected if the concentration of oxalic acid is increased above 1%. A 0.5% solution of phosphoric acid could be used for the two successive soakings satisfactorily. The use of phosphoric acid to improve PRI is covered by a RRIM patent. The PRI of low grade rubbers can also be improved by soaking in initial concentration rubber, acid-coagulated serum or in rubber serum obtained by assisted biological coagulation using coconut water.

Vulcanisate Properties of Crepe Rubber (R. Tharmalingam and S. W. Karunaratne)

An increase in the dosage of RPA 3 in the range 0 to 1.0% based on dry rubber had no effect on the tensile properties of both unaged and aged vulcanisates based on the ACS 1 formulation and cured for 40 minutes at 140°C. When oxalic acid is used as the coagulant the aged tensile properties show an improvement when the dosage of RPA 3 is increased from 0 to 1%. It is probable that the peptising effect of RPA 3 is negligible in this range of activity but it may have an antioxidant effect under these conditions.

Oxidative Degradation of Raw Rubber (S. W. Karunaratne and K. A. Piyadasa)

The interaction of additives used in raw rubber manufacture and its effect on raw rubber oxidation is being studied. Nonox B and Nonox EXN are reported as effective antioxidants in preventing oxidative degradation of raw rubber. The effect of these antioxidant additives and their interplay with natural antioxidants in the presence of thiols is being investigated. In the absence of any other additives it is confirmed that the raw rubber PRI is improved when the coagulant additive is changed from acetic acid to formic acid or oxalic acid. When the dosage of thiol compound RPA 3, added to latex prior to coagulation, is increased from 0.05% (based on dry rubber) to 0.2% there is a gradual drop in the PRI, but with oxalic acid, PRI shows a peak when the RPA 3 concentration is 0.1%, confirming the results obtained on aged vulcanisate properties using the same coagulant additive.

In the absence of RPA 3, Nonox B is more effective than Nonox EXN in improving the PRI irrespective of the nature of the coagulant additive.

In the presence of RPA 3, Nonox B is more effective when the coagulant additive is oxalic acid, but the phenolic antioxidant Nonox EXN is more effective than Nonox B when the coagulant additive is formic acid. It appears that both antagonistic and synergistic mechanisms could operate depending on the specific interaction of additives.

Use of Oil-Extended Natural Rubber in the Retreading of Tyres (*M. Nadarajah and S. W. Karunaratne*)

A paper on this subject presented on behalf of Mr. M. Nadarajah by Dr. B. G. Joshi at the Fourth Technical Seminar of the Indian Rubber Manufacturers' Research Association held in New Delhi in February was published in the R.R.I.C. Quarterly Journal. Messrs. Associated Motorways Ltd. are now manufacturing oil-extended natural rubber passenger car retreads in Ceylon.

Assessment of wear rating of oil-extended natural rubber (OENR) retreads was completed and the general conclusion is that the wear rating of retreads prepared from OENR is better than from a compound without oil-extension, when due regard is made to compounding. However, the wear rating of dry mixed oil-extended natural rubber is better than the oil-extended rubber masterbatch, where oil is added to the rubber at the latex stage. This may be due to the fact that the dispersion of black may not be so good in the compound where the oil is added in the latex stage.

Cure Rate Determination (*S. W. Karunaratne and L. Goonawardena*)

A quick method for monitoring curing characteristics, using simpler formulations in the lines suggested by Greensmith & Watson (1969) at NRPRA has been worked out. Formulations based on NR/ZnO/S and NR/zinc stearate/S were tried out and the most effective formulation has been based on NR/ZnO/S combination in the following ratio:-

Rubber	100
ZnO	8.33
S	1.66

Cure rate is determined by the change in Wallace plasticity, when a test button is heated for one minute at 180°C in the plattens of a Shawbury curometer. In the preparation of the compound a 50/50 masterbatch of rubber/ZnO and rubber/S is homogenised with the test sample of rubber after reducing its Wallace plasticity to 30 $\pm$ 1.

*Curing Characteristics of Ceylon Rubber** (*S. W. Karunaratne and D. D. Medagama*)

A survey was undertaken to determine the curing characteristics of the different grades of crepe rubber produced in ten estates selected at random in the Kalutara District (Table 1).

Latex Cement Mixes (*A. Coomaraswamy and M. Nadarajah*)

For more than 30 years intensive work has been carried out in many parts of the world on the combined use of latex and hydraulic binders. Though a slurry of cement and water is alkaline it coagulates unstabilised field latex. This has been explained on the basis of two factors: (*a*) the cement hydrates with the water in latex and the latex thus coagulates, (b) on hydration of cement, cations such as Ca + + are released which causes the latex to coagulate.

The stabilisers and their amounts for field latex that were found necessary are as follows :-

(1) Vulcastab LW at 5%
(2) Vulcastab LW at 4% and potassium hydroxide at 2%
(3) Vulcastab LW at 2% and potassium hydroxide at 4%
(4) Vulcastab LW at 4% and potassium sulphate at 2%
(5) Vulcastab LW at 2% and potassium sulphate at 5%
(6) Vulcastab LW at 2% and sodium carbonate at 5%

If the latex was pre-vulcanised less stabiliser was adequate, e.g. latex pre-vulcanised with sulphur (1.5%) or with cumene hydroperoxide or with TMTD needed only 2% Vulcastab LW as stabiliser. Graft-polymerised field latex with 25% methyl methacrylate did not coagulate when mixed with cement even in the absence of a stabiliser.

Rubber in Roads (*A. Coomaraswamy, M. Nadarajah and E. G. Mendis*)

The difficulties in Ceylon in the use of field latex as an ingredient in surface dressing of roads is the transportation of latex and mixing it with bitumen at the road site. The use of rubber bitumen masterbatches is a solution to this problem and the optimum percentage of rubber for the masterbatch is about 12.5%. Colas which is an anionic emulsion of bitumen is used in rubber estate roads. The addition of stabilised field latex to colas so that the rubber content is about 2.5% on the bitumen would give better roads. The stabilisers can be ammonia at 1% or sodium carbonate at 2.5% on the latex.

*Greensmith, H. W. and A. A. Watson (1969). Studies on the curing characteristics of natural rubber. *J. Rubb. Res. Inst. Malaya* **22**, 120–134.

TABLE 1

SURVEY OF CURING CHARACTERISTICS OF CEYLON RUBBER

	Fractionated Pale Crepe			Unfractionated Pale Crepe			Fraction Pale Crepe			Cup Lump/Tree Lace			White Cup Lump			Tree Lace			Earth Scrap			Black Shell Scrap		
	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.
M 100% (Kg/Cm^2)	7.4	5.9	6.6	8.7	6.5	7.4	11.3	8.4	9.9	7.3	7.3	7.3	9.2	5.2	7.9	8.3	6.8	7.4	7.7	5.3	6.6	8.6	7.0	7.6
M 300% (Kg/Cm^2)	14.2	11.5	12.8	16.8	12.5	14.4	25.7	16.7	20.3	15.2	15.2	15.2	18.3	15.7	16.7	17.3	13.7	15.4	16.1	11.0	13.5	16.7	14.8	15.7
M 600% (Kg/Cm^2)	40.7	29.7	33.6	52.5	33.3	39.8	100.3	49.3	71.5	43.4	43.4	43.4	64.2	44.7	49.7	59.2	37.1	46.1	48.0	29.2	37.0	53.3	38.1	45.5
T.S. (Kg/Cm^2)	183.0	131.5	158.0	180.0	139.9	165.3	215.4	141.2	192.0	183.3	183.3	183.3	198.4	170.3	182.8	171.5	138.1	154.1	114.1	114.1	114.1	189.6	146.9	167.4
E.B. %	850.0	750.0	819.5	845.0	760.0	796.6	825.0	680.0	753.8	770.0	770.0	770.0	820.0	740.0	774.9	845.0	738.0	776.0	815.0	815.0	815.0	830.0	740.0	795.8
T.C. strain	113.5	76.5	97.5	91.0	68.5	82.7	65.5	42.5	51.3	80.5	80.5	80.5	80.5	60.0	67.3	137.0	68.0	85.3	137.0	82.5	103.2	85.0	66.0	73.0
X 90% minutes			15.3			13.8			10.7			12.0			10.1			9.1			8.2			9.6
X 95% minutes			18.0			16.8			12.8			15.0			12.3			10.9			9.7			11.4

Note: Results are based on ACS 1 formula cured at 140°C for 40 minutes.
X 90% (or x 95%) refers to the time in minutes for 90% (or 95%) crosslinks to form when the compound is cured at 140°C under the shearing stresses in a Shawbury curometer.

Latex Collection (M. Nadarajah and E. G. Mendis)

Coconut shells are used to collect latex in Ceylon. As the cups cannot be kept clean and they are porous there is a greater tendency for precoagulation. The coating of the inside of coconut shells with a plastic material reduces this tendency for precoagulation.

Natural Antioxidants in Field Latex (M. Nadarajah, A. Coomaraswamy and S. Kasinathan)

This work is being done in collaboration with the C.I.S.I.R. (Dr. A. S. L. Tirimanne). Semi-quantitative studies of natural rubber field latex has shown the presence of α γ and σ tocotrienols and traces of tocopherols. These are naturally occurring antioxidants.

Extraction and isolation of tocopherols and tocotrienols were done by the Folch method. Thin-layer chromatography was used in the separation of the tocopherols and the trienols. The chromatogram consisted of a silica gel layer of 0.25 mm thickness on a glass plate. The plate was activated for 30 minutes at 110°C. The chromatogram was developed first with chloroform and then with 20% V/V of di-isopropyl ether and light petroleum ether (B.P. 60-80°C).

The spraying reagent used was either Emmeri and Engel reagent or diazotised ortho anizidine; with the former reagent reddish pink spots and with the latter reagent purple blue spots were obtained.

The clonal variation of these antioxidants in natural rubber latex obtained by visual estimation is given in Table 2.

The PRI values obtained for the latex is also given in Table 2. There appears to be a relationship between PRI which is a measure of the oxidation resistance of the raw rubber and the total tocotrienol content.

TABLE 2

VISUAL ESTIMATION OF TOCOTRIENOLS IN LATEX OF VARIOUS CLONES

Tocotrienol / Tocopherol	RRIM 513	RRIC 45	PB 86	RRIC 52	RRIC 88	RRIC 7	Nab 15
σ — Tocotrienol	2	1	1	1	1	1	1
γ — Tocotrienol	10	7	7	6	6	6	5
α — Tocotrienol	3	3	8	8	5	2	2
α — Tocopherol	T	T	T	T	T	T	T
PRI of total solids	133	120	120	113	105	102	88
PRI of coagulated rubber	100	96	86	78	85	81	75

Routine Investigations

Survey of PRI of Ceylon Rubber (A. S. Dekumpitiya)

The results of PRI obtained from 270 samples of RSS (72 are Grade 2 and below) and 395 samples of estate brown crepe are given in Table 3.

TABLE 3

SURVEY OF PRI OF CEYLON RUBBER

PRI levels	*Estate RSS* (corner samples)	*Estate RSS* (centre sample)	*Estate Brown Crepe*
90 — 100	2	11	—
80 — 90	95	101	5
70 — 80	101	149	51
80 — 70	3	8	173
50 — 60	1	1	120
40 — 50	—	—	11
30 — 40	—	—	9
20 — 30	—	—	15

Rubber Seed Collection (M. Nadarajah and P. A. J. Yapa)

It is possible for estates to make a profit of about Rs. 150/- per ton of rubber seed kernel collected. Most estates did not collect rubber seed kernel during 1969 and collection was done by agents. The collection target of rubber seed kernel by Messrs. Lever Brothers (Ceylon) Ltd. was 800 tons and their requirement was that the kernel should contain less than 5% moisture. This target was met and the price paid for the kernel was Rs. 500/- per ton delivered to Jaela Oil Mills, Jaela.

Technical Specification Testing (A. S. Dekumpitiya)

Analyses for technical specifications of Heveacrumb from first fraction rubber and from cup lump and tree lace materials received from Peenkande Group were done. Certificates were issued to export ten five-ton lots of first fraction rubber and two five-ton lots of cup lump and tree lace material.

REVIEW OF THE ESTATES ADVISORY DEPARTMENT

By

A. B. Dissanayake

Summary

The Estates Advisory Department gives advice to estates ranging from 25 acres to 500 acres, which are not managed by Agency Houses. As such it caters to nearly 35.3% of the island's acreage under rubber. To improve the service two new Assistant Advisory Officers were recruited and are under training now. In addition, an Agricultural Economist was also recruited to study costs of production of rubber.

Advice is given by advisory letters in reply to queries, routine advisory visits to small and medium estates and advisory visits on request. The officers of this Department carried out a total of 342 routine advisory visits and a total of 166 visits on request for the year 1969. Each visit was followed by a report to the Superintendent or Conductor of the estate visited with a copy to the owner.

In the field of economic research, a questionnaire to collect data on all the costs incurred in a rubber estate was prepared and circulated to all estates of 100 acres and over. As the majority of small estates and smallholdings do not maintain accurate records, this questionnaire was not sent to these categories of plantations. About 25% of the estates have so far responded and their data are being studied with the idea of working out average costs in order to be able to advise estates later, on ways and means of cutting down their cost of production.

Detailed Review

General

The Estates Advisory Department gives advice to all small estates of 25 acres and over and all medium estates ranging from 100 acres to 500 acres, which are not managed by Agency Houses. According to available statistics this Department therefore caters to about 35.3% of the island's acreage under rubber.

Table 1

AREA ADVISED BY THE ESTATES ADVISORY DEPARTMENT

Category of estates		*No. of estates*	*Acreage*	*Percentage*
Small estates	25—100	1,728	89,998	13.4
Medium estates	100—500	665	147,308	21.9
Total		2,393	237,306	35.3

Staff

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

One Assistant Advisory Officer was transferred to the Rubber Chemistry Department as an Assistant Development Officer.

Two new Assistant Advisory Officers were recruited and took up appointment during the last quarter of the year.

A new Agricultural Economist was also recruited during the last quarter of the year. Arrangements have been finalised to station two Assistant Advisory Officers in the field, one at Galle and the other at Kegalle, in early 1970.

Training of Staff

Training of the two new Assistant Advisory Officers and the Agricultural Economist recruited during the last quarter of the year was started. They were attached to the scientific departments for periods ranging from a week to ten days to study the research work done and discuss all aspects of the rubber industry. They were also taken to the field on estate visits by research officers. It is expected that their training will last another 2 — 3 months before they are stationed in the field. The Agricultural Economist will be stationed at Dartonfield.

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 raised by estates and Agency Houses.

Visits

(*a*) *Routine Visits :* A total of 342 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 2.

TABLE 2

ROUTINE VISITS TO ESTATES

Category of estate	*No. of visits*
Medium	87
Small	255
Total	342

In routine visits, the visiting officers look into all aspects of the working of the estate from planting to manufacture and the preparation of smoked sheets and give advice. The visit is followed by a report to the owner of the estate as well as the Superintendent or Conductor-in-charge so that they may have on record the advice given and act on it as and when necessary. Along with these reports the necessary advisory circulars are also sent for their guidance. In cases where the caretaker of the estate is not conversant with English, a copy of the advisory report is sent in Sinhala.

(*b*) *Visits on Request :* In addition to the routine visits mentioned, a total of 166 visits were made by the officers of this Department on request. A break-up of such visits is given in Table 3.

TABLE 3

VISITS TO ESTATES ON REQUEST

Category of estate	*No. of visits*
Large estates	32
Medium estates	53
Small estates	81
Total	166

The visits on request were made in connection with specific problems referred to the Institute by the estates. All these visits too were followed by reports to the Superintendent or Agents or the owners, giving the nature of the problem, the causes and the recommendations.

In the case of small and medium estates, after looking into the specific problem, other aspects of the plantation were looked into and recommendations to improve the condition and working of the estate were discussed and incorporated in the report.

(*c*) *Other Visits :* In addition to these, a total of 105 visits were made to institutions, the Smallholdings Department, meetings and conferences etc. during the period under review.

Observations

It has been observed during our visits that there is inadequate supervision of the work of conductors and caretakers by the owners of small estates. This Department is therefore making an effort to solicit the interest of the owner in the supervision of the work of his estate by sending copies of reports, advisory circulars and the Institute's Bulletin.

Visitors

Discussions were held with three visiting scientists and a trade delegation during the period.

Economic Research

A questionnaire was prepared and circulated to all estates of 100 acres and over in extent, in order to study the cost of production of rubber. This questionnaire was not sent to small estates and smallholdings as the majority of these do not maintain records sufficiently accurately. The response to this questionnaire has not been as good as expected and is in the region of about 25%. The data are being studied by the Agricultural Economist for reference.

Publications

The following articles were published during the year under review.

1. The development of the rubber plantation industry in Ceylon. *R.R.I.C. Bull.* December 1968.

2. The development of the synthetic rubber industry. *R. R. I. C. Bull.* June 1969.

3. The economic life span of the rubber tree in smallholdings. *Rubb. Res. Inst. Ceylon Quart. J.* September/December 1968.

4. A study of the future possiblities of the rubber industry
   Part I. Supply prospects
   Part II. Demand prospects
   Part III. Outlook
   Rubb. Res. Inst. Ceylon Quart. J. September/December 1969 (in press).

Visit to Malaysia

The author along with two other Heads of Departments attended the Malaysian Crop Diversification Conference organised by the Incorporated Society of Planters, Malaysia and the Rubber Research Institute of Malaya.

The author also took this opportunity of visiting the Rubber Research Scheme Thailand and making a study of the Economics & Planning, Estates Advisory and Smallholdings Departments of the R.R.I.M. Two reports on this visit have been submitted along with recommendations.

Lastly I wish 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

The main task of the Department during the year was to improve the smallholders' sheet rubber to Grade I RSS. Attempts were made to organise group processing centres as Rubber Co-operative Societies, as it was considered that this is the best way to improve smallholders' rubber to Grade I. Due consideration was also given to new planting work in spite of other important work of the Department.

The "crash programme" initiated some time back, to improve smallholders' sheet rubber to Grade I RSS, was continued during this year and the usual assistance was provided. Colour posters were printed depicting important points in good sheet making and distributed among smallholders. Various other measures were also taken to induce smallholders to improve their sheet to Grade I RSS. The increase of the grant given for demonstration smokehouses was a special feature.

The State-aided Co-operative Sulphur Dusting Scheme was carried out successfully during the year under review. Control dusting groups too were operated to ascertain whether adequate control of *Oidium* leaf disease could be obtained while cutting down the cost of dusting with the reduction of one dusting round.

A survey of rubber smallholdings at Teppanawa and Batapola villages was conducted to ascertain reasons for the declining rate of subsidy replanting in Galle and Ratnapura Districts. A fertilizer survey too was conducted. Another survey was started at three ranges to find out the feasibility of organising central rubber factories for producing block rubber from smallholders' latex.

Detailed Review

General

The attention of the Department was focussed on the improvement of smallholders' sheet rubber to Grade I RSS during the period under review. It was considered that the best way to improve the quality of smallholders' sheet rubber was by means of group processing centres organised as Rubber Co-operative Societies. The Department also directed its attention to organise central rubber factories for production of sheet or new forms of rubber. A survey has been launched at Mawa-

nella and Undugoda Ranges to ascertain the feasibility of organising a central rubber factory there for producing block rubber.

A crash programme financed by the Government to improve the smallholders' sheet rubber to Grade I RSS, was undertaken during the period. A sulphur dusting scheme to dust smallholdings and small estates was successfully carried out. A scheme of training smallholders in the correct methods of tapping and allied subjects was organised and classes were conducted in many ranges. The normal routine advisory work in smallholdings to assist smallholders in planting, maintaining, disease control and manufacture of their rubber was carried out by the field staff.

Staff

The Chief Advisory Officer Smallholdings was on duty throughout the year. Mr. R. B. Madawala, Rubber Instructor, Gampaha and Mr. P. B. Fernando, Rubber Instructor, Baduraliya, retired from service on 20. 1. 69 and 10. 5. 69 respectively. Mr. Madawala's retirement was after a service of 20 years while Mr. Fernando had served the Department for 19 years at his retirement. Mr. W. A. J. de S. Goonatilake, the newly appointed temporary Rubber Instructor, left the Department after a service of six months. Mr. L. S. Kasturiratne was appointed temporary Rubber Instructor with effect from 3. 1. 69. Miss K. S. N. de S. Abeysinghe was appointed Typist/Clerk with effect from 5. 11. 69. Mr. L. Subasinghe, daily-paid casual labourer was made permanent with effect from 15. 8. 69 and posted to the Publicity Unit. The post of Deputy Chief Advisory Officer Smallholdings was not filled.

Correspondence

General :

Inward	—	5,962
Outward	—	8,797

With Rubber Controller :

Inward — 1,701 (applications for new planting and unregistered rubber lands and new planting permits etc.)

Outward — 2,628 (preliminary reports, final inspection reports and special reports etc.)

From Rubber Controller to permit holders — 2,475 letters.

Visits

(*a*) *New Planting :* Due consideration was given to new planting work done by smallholders in spite of the other important work of the Department. A fair

portion of Rubber Instructors' time was spent in visiting new planting lands and advising smallholders in planting their holdings in keeping with the Rubber Control regulations.

All new rubber planting applications that are received by the Rubber Controller are referred to this Department for a report as to the suitability of such lands for new planting before a permit is issued by him. These applications are in turn referred to the respective Rubber Instructors for a preliminary report after a visit to such lands and 522 preliminary reports have been submitted to the Rubber Controller during the period. A further 278 final inspection reports and 1,828 special reports on new rubber planted lands too have been furnished to the Rubber Controller at his request. In all 369 new planting permits covering an extent of 605 acres have been issued by the Rubber Controller during the period to new planting smallholders.

Rubber Instructors line new planting and replanting smallholdings for soil conservation works and planting points free of charge at the request of the owners. Accordingly they have lined a total of 65 new planting permit areas for 1969, covering an extent of 122 acres for soil conservation works and 89 permit areas covering an extent of 146 acres for planting points. They have also lined a further total of 20 permit areas of previous year's permits covering an extent of 29 acres for soil conservation works and 18 permit areas covering an extent of 20 acres for planting points.

One hundred and thirty three first visits and 753 subsequent visits were made by Rubber Instructors to new planting and new planted permit areas of this and the previous year. Further, a total of 4,750 subsequent visits too were made by them to permit areas for which permits have been issued prior to 1968.

Rubber Instructors have marked a total of 2,864 tappable trees in 47 new rubber planted smallholdings as demonstrations and marking for tapping.

(*b*) *Soil Conservation :* A sum of Rs. 1117/- has been paid to 28 peasant-class permit holders for conserving soil in their lands.

A total of 36 peasant-class permit areas, covering an extent of 34 acres, have been measured and 28 of these permit areas, covering an extent of 25 acres, have been checked in the field by Divisional Advisory Officers during the period, for payment.

(*c*) *Replanting :* The field and office work connected with subsidy replanting work increases every year. Random inspections of smallholdings replanted during the first two years in Kegalle District have been undertaken at the request of the Rubber Controller. These inspections might be extended to other divisions as well in the near future. Prescribed forms have been issued to the Instructors of the

Kegalle District to enable them to submit their reports in this connection and 155 such reports have been submitted to the Rubber Controller during the third and fourth quarters. A total of 222 special reports on subsidy replanting and replanted areas have been submitted to the Rubber Controller.

A total of 2,435 Rubber Replanting Subsidy Scheme permits covering an extent of 3,458 acres have been issued by the Rubber Controller in respect of smallholdings during the year. Copies of these permits have been received by this Department from time to time from the Rubber Controller and were in turn forwarded to the respective Rubber Instructors to visit these lands and give necessary advice and assistance to the owners. Every one of these permit areas has been visited by an Instructor.

In all 5,711 visits to subsidy replanting permit areas of this year and 26,279 visits to subsidy replanted permit areas of the previous years have been made by Rubber Instructors during the period.

Rubber Instructors have lined a total of 970 subsidy replanting permit areas of this year covering an extent of 1,319 acres for soil conservation works and 1,315 subsidy replanting permit areas covering an extent of 1,847 acres for planting holes. A further 334 subsidy permit areas covering an extent of 528 acres and 390 subsidy permit areas covering an extent of 610 acres of previous year's permits were lined by Rubber Instructors for soil conservation works and planting holes, respectively, during the period.

A total of 10,721 tappable trees in 221 subsidy replanted holdings have been marked by Rubber Instructors as demonstrations.

Random checks on planting material issued to subsidy replanting smallholders by Rubber Controller at various Commodity Purchase Depots were carried out by the Rubber Instructors at their visits to Depots. A total of 12,361 plants were checked at 42 such random inspections carried out by Instructors during the two planting seasons May/June and October/November this year.

(*d*) *Mature Holdings :* Visits to mature holdings are now being done only on request from owners or for special reasons such as sulphur dusting work.

(*e*) *Special Inspections for Rubber Control Department :*

Visits for preliminary reports	—	522
Visits for final inspection reports	—	278
Visits for special reports (new planting)	—	1,828
Visits for special reports (replanting)	—	222
Visits for random inspection reports	—	155

Meetings and Conferences

(*a*) *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 arranged in Instructors' ranges according to a programme set out by this Department, and Instructors select the venues in their ranges and inform the respective Rubber Instructor of the Publicity Unit. A public meeting is preceeded by the film show presided over by the local Rubber Instructor. 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 I RSS. The two films of the Department "This is Rubber" and "Naturally it is Rubber" were screened at these meetings along with other films of agricultural interest borrowed from various foreign embassies.

A total of 146 publicity meetings cum film shows and 35 publicity meetings cum colour slide shows were held by the two Publicity Units of the Department during the year.

These two Publicity Units were also sent to the following two exhibitions in which the Department participated and screened films including the two films of the Department :-

1. Twenty First Anniversary of Independence Exhibition and Fair — Kandy.

2. Matara District Agricultural and Industrial Exhibition — Matara.

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.

16 *mm Documentary Colour Film :* The shooting of the documentary colour film on rubber replanting, manufacture and sale of smoked sheet was completed during the year. The editing and the incorporation of the commentary in Sinhala have now to be done. Thereafter the film will be screened by the producer, before being shown, to the Board for final approval and printing in England. The film after printing is expected to be ready for pre-release screening before the Board early in 1970.

(*b*) *Meetings and Conferences Attended by Chief Advisory Officer and Field Staff :* The Chief Advisory Officer Smallholdings attended the following meetings and conferences during the year :-

(i) Two meetings held at Rubber Research Institute Headquarters on 5. 1. 69 and 6. 1. 69.

(ii) A staff conference held at Rubber Research Institute Headquarters on 13. 3. 69 presided over by the Acting Director to discuss an incentive scheme for smallholders to produce Grade I RSS.

(iii) A supervisory staff conference held on 31.3.69 at Smallholdings Department Headquarters to discuss the 1969 crash programme.

(iv) A staff conference held on 11. 4. 69 at Smallholdings Department Headquarters attended by the Director, Rubber Controller, Acting Head of Rubber Chemistry Department, Head of Estates Advisory Department, Works Foreman and the eight Divisional Advisory Officers.

(v) Opening of a rubber purchasing depot at Galle on 4. 6. 69.

(vi) Opening of a rubber purchasing depot at Aranayake on 1. 7. 69.

(vii) A meeting presided over by the Chairman to discuss matters connected with extension services on 2. 7. 69.

(viii) Two Selection Committee meetings on 25. 8. 69 and 28. 9. 69.

The Chief Advisory Officer Smallholdings also attended a refresher course conducted by the Heads of the Scientific Departments at Dartonfield along with the field staff.

Publications

Smallholdings leaflets Nos. 2, 3, 5, 6 and 9 were revised and reprinted in Sinhala. The Annual Reviews for years 1966, 1967 and 1968 were printed in Sinhala and issued to field officers for distribution among smallholders.

Experiments

(*a*) *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 1969. 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 of 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 10 acres. The Rubber Instructors and the supervisory staff supervise dusting althroughout the dusting operations.

Necessary instructions on the 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 96 sulphur dusting groups for the 1969 dusting season covering an acreage of 9,474½ acres (Table 1).

TABLE 1

District	Acreage		Holdings and Groups	
	1968	1969	1968	1969
Kalutara	1912½	1803	409(19)	430(18)
Colombo	2071	2316¼	644(22)	717(23)
Kegalle	1876	2169¼	490(21)	581(26)
Ratnapura	1590¼	1609¼	471(13)	463(15)
Galle	1055	1114¼	239(9)	228(10)
Matara	387	462½	53(3)	58(4)
Total	8891¾	9474½	2306(87)	2477(96)

The number of sulphur dusting groups in each district is given in paranthesis.

Out of the 96 dusting groups organised, 3 groups had to be dropped as some of the members did not pay for their sulphur dust owing to the favourable weather which prevailed there. Waharaka Dusting Group was also not dusted during this season. Finally dusting operations were carried out in 92 dusting groups comprising of 8,845¼ acres.

The smallest holding to be dusted was ¼ acre while the largest holding dusted was 31 acres. The total acreage dusted consisted of 7,520 acres of budded rubber, 1,283¾ acres of clonal seedling rubber and 41½ acres of ordinary unselected seedling rubber. Of the total acreage, 7,132 acres (80%) were provided with subsidised sulphur while 1,713¼ 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, hot climatic conditions prevailing during refoliation. But it has been observed that the late winterers had light attacks while the undusted areas showed relatively more severe attacks.

It is proposed to dust 103 groups comprising of 10,300 acres in the forthcoming 1970 dusting season. Rubber Instructors have made a total of 13,620 visits to sulphur dusting areas during this period.

(*b*) *Trial Dusting Groups to Ascertain Efficiency of Control in Oidium Infection by Leaf Counts :* The number of test and control groups was increased in 1969 dusting season. Three pairs of test and control groups were organised in the eight Divisional Advisory Officers' Divisions making 24 pairs for the season. However, 22 pairs were operated as two pairs in two divisions were dropped. The test dusting groups were dusted with only three weekly rounds while the control groups had their normal four weekly rounds. The object was to see whether adequate control of *Oidium* leaf disease could be obtained while cutting down the cost of dusting with the reduction of one dusting round. As the weather during wintering and refoliation this season was generally fine, there was no significant difference in the control of *Oidium* leaf disease obtained between the three-round test groups and the four-round control groups.

(*c*) *Improvement of Smallholders' Sheet :* The "crash programme" to improve the smallholders' sheet rubber to Grade I RSS was launched during the period. The attention of this Department was focussed on this subject and the whole Department was kept busy throughout the year. Much propaganda was given to this scheme in the field by the two Publicity Units of the Department and the field staff.

Three sets of colour posters were printed, depicting important points on good sheet making, these were distributed among smallholders and also posted in prominent places. Colour slides were screened in various cinemas in rubber growing districts for inducing smallholders to make good quality sheets. Sheet competitions were also organised at range and divisional levels and prizes were awarded to winners during the period under review. A total of 8,847 aluminium pans and 1,508 strainers fitted with monel metal mesh, purchased under this scheme, were distributed among the Rubber Instructors to be sold to smallholders, at a subsidised rate, as an encouragement for them to produce good quality sheets. The grants paid to demonstration smoke houses-cum-curing sheds were increased as follows :-

(i) 120 lb capacity house increased from Rs. 125/- to Rs. 150/-
(ii) 225 lb capacity house increased from Rs. 150/- to Rs. 300/-
(iii) 350 lb capacity house increased from Rs. 200/- to Rs. 400/-

Of the five Co-operative Societies organised under this scheme one is already registered in the Co-operative Development Department. It is likely that two more societies would be registered in the near future. The Milleniya Rubber Co-operative Society, the first society to be registered, is presently building its 1,500 lb smoke house and curing shed. A grant of Rs. 2,000/- and a pair of rubber rollers were given to this society by the Institute.

One hundred and fifty four demonstration and 70 ordinary smoke houses were commenced by smallholders on the advice of the field staff and 101 demonstration and 41 ordinary smoke houses were completed during the year. Instructors have paid 2,253 visits to demonstration smoke houses and 9,479 visits to ordinary smoke

houses to advise on sheet making or on construction and improvement of smoke houses. A total of 239 visits to Rubber Co-operative Societies and 488 visits to Commodity Purchase Depots too were made by the field staff to advise smallholders for avoiding defects in their sheets. Smallholders were given 1,740 sheet making demonstrations. A total of 8,315 aluminium pans and 1,051 strainers fitted with monel metal mesh were sold during this year by Instructors to smallholders at subsidised rates as an encouragement for them to produce good quality sheets.

(*d*) *Tapping Training Classes :* The scheme of training smallholders in rubber tapping, manufacture and other allied subjects was organised during this year too. Twenty four training classes were organised in 23 ranges with two classes held in the Dehiowita Range. Eight of those classes had to be discontinued due to very poor attendance. A total of 305 trainees participated in 16 classes and finally 175 trainees were successful and certificates will be awarded to them.

TABLE 2

SMALLHOLDER TRAINEES SUCCESSFUL IN THE TRAINING SCHEME IN TAPPING CLASSIFIED ACCORDING TO DIVISIONS

Division	No. of trainees accepted	No. of trainees participated	No. successful
Kegalle	—	—	—
Pasyala	30	16	7
Homagama	34	34	13
Avissawella	116	107	68
Ratnapura	38	32	19
Panadura	13	13	10
Matugama	16	16	10
Galle	100	87	48
Total	347	305	175

(*e*) *Exhibitions :* This Department participated in the following exhibitions during the year :-

(1) Twenty First Anniversary of Independence Exhibition and Fair at Kandy from 3rd to 17th February.

(2) Matara District Agricultural and Industrial Exhibition, Matara from 15th to 22nd March.

(3) Siyawasa Exhibition at Royal College from 1st to 31st August.

(4) Kegalle District National Exhibition at Kegalle from 5th to 8th December.

(5) Galle District National Exhibition at Galle from 20th to 23rd December.

Exhibits were also supplied to Siyawasa Exhibition held at Southlands Balika Maha Vidyalaya, Galle.

(*f*) *Demonstrations :* The following demonstrations were given by the field staff during the year :-

Sheet making	..	1,740
Tapping	..	654
Disease control	..	374
Miscellaneous	..	1,384

(*g*) *General Assistance :* General advice and assistance are given by Instructors to smallholders in planting and maintaining their lands according to the rubber control regulations.

One ton of R. 4 : 6 : 5 + Mg manure mixture was purchased by a smallholder through this Department at a discount.

(*h*) *Survey of Rubber Smallholdings in Teppanawa and Batapola Villages :* A survey of smallholders' rubber lands at Teppanawa and Batapola villages in Dodampe and Batapola ranges was begun at the request of the Rubber Controller and Mr. S. Hansen, UN Adviser on the rubber industry at the Ministry of Industries and Fisheries. The Rubber Control Department and Mr. Hansen had found that the rate of subsidy replanting in Ratnapura and Galle Districts was declining and therefore this survey was initiated to ascertain the reasons for this decline. This survey was started in the third quarter and was completed during the fourth quarter.

(*i*) *Surveys :* A fertilizer consumption survey was undertaken at the request of the Head of the Soils Chemistry Department.

A survey was also started at Undugoda, Mawanella and Kamburupitiya ranges to find out the feasibility of organising central rubber factories. The survey has not yet been completed.

(*j*) *Visitors :* The Chairman and Board Members visited all divisions of the Divisional Advisory Officers in June.

Mr. S. Hansen, UN Adviser called on the Chief Advisory Officer Smallholdings on several occasions throughout the year.

REVIEW OF THE ESTATE DEPARTMENT

By

S. de S. Daluwatta

Summary

The Institute's Research Stations — Dartonfield in Agalawatta; Nivitigalakele in Matugama and Hedigalla in Lathpandura, also known as Dartonfield Group— have an extent of 1,548 acres 0 roods and 30 perches, which include 377 acres 3 roods and 38 perches of jungle. The planted acreage is 1,004 acres, of which 802 $\frac{3}{4}$ acres were in tapping during the year. The immature acreage stood at 118 acres 0 roods and 31 perches.

The weather conditions were not favourable for the harvesting of crop. The prolonged drought in February and heavy rainfalls in May, June, October, November and December hampered the collection of crop. The crop harvested was 526,098 lb representing an average yield of 655.4 lb per acre. The crop so secured fell short of the estimate by 15.82%.

The incidence of *Oidium heveae* was light in general, but, the late-wintered clones registered a fairly heavy leaf fall. Sulphur dusting operations carried out controlled the spread of the disease.

Phytophthora leaf fall was very mild this season.

The incidence of *Gloeosporium* in young clearings and Bark Rot among the better known clones was negligible this year.

Budwood of the RRIC clones, specially RRIC 100 and RRIC 101, continued to be much in demand and nucleus supplies were made to estates and smallholdings on request.

Routine weeding, manuring and other agricultural operations were carried out in both mature and immature areas of the Group.

Estimates for 1970 connected with the working of the Group, including field and technological experiments, etc., were prepared and submitted to the Rubber Research Board for approval.

Staff

Mr. L. Wijeyagunawardena, Estate Superintendent, retired on 31st August 1969 after a long spell of service in the Institute, and Mr. S. de S. Daluwatta succeeded him on 1st October 1969. He is presently stationed at Hedigalla Division. The Assistant Estate Superintendent, Mr. M. R. T. Mendis, who was on duty throughout the year was transferred to Dartonfield Division from Hedigalla Division with the assumption of duties by the new Estate Superintendent.

Mr. P. H. A. Perera, Apothecary, stationed at Dartonfield, resigned on 30th June 1969. Mr. M. C. Peiris succeeded him and assumed duties on 28th September 1969.

Mr. D. D. H. de Alwis, K. P. at Hedigalla, who was due for retirement on 3rd January 1970, resigned from the post on 31st August 1969 to take up an appointment elsewhere. The post remained vacant till the end of the year.

Mr. G. A. Kannangara assumed duties as Correspondence Clerk on 5th November 1969 replacing Mr. D. C. Thambawita who was transferred to the Library on 1st October 1966. Mr. G. S. Doolwella assumed duties as Junior Clerk in Hedigalla Division on 11th November 1969 succeeding Mr. A. L. Ratnayake who was transferred to the Accounts Section in March 1969. The salary scale attached to these two new officers is based on the Collective Agreement between the C.E.E.F. and C.E.S.U.

The Estate Department cadre stood at 27 at the close of the year, made up as follows :-

Senior Staff	..	1
Intermediate Staff	..	1
Assistant Staff	..	18
Minor Staff	..	7
Total	..	27

Correspondence

Inward	..	369
Outward	..	861

Acreage Summary — Dartonfield Group

Rubber	Dartonfield			Nivitigalakele			Hedigalla			Total		
	A.	R.	P.	A.	R.	P.	A.	R.	P.	A.	R.	P.
Mature	104	1	07	62	1	23	636	0	13	802	3	03
Immature	11	2	12	50	3	29	55	2	30	118	0	31
Nurseries	3	2	00	8	3	07	21	0	00	33	1	07
Total	119	1	19	122	0	19	712	3	03	954	1	01
Abandoned	11	2	00	33	1	07	74	1	04	119	0	11
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
	178	1	26	174	1	12	1,195	1	32	*1,548	0	30

*includes 57 acres taken over from the Rubber Replanting Subsidy Scheme.

Visiting Agent

Mr. M. W. Thompson paid one visit to the Institute's properties on 21st and 22nd March 1969.

Weather (Estate Gauge)

Comparative rainfall figures (in inches) for 1969 are given below :-

Month	Dartonfield		Nivitigalakele		Hedigalla	
	1969	1968	1969	1968	1969	1968
January	6.39	6.09	5.25	7.47	5.65	6.27
February	5.77	2.87	1.93	1.97	4.68	2.67
March	7.16	10.29	11.19	11.14	6.11	10.40
April	7.37	14.41	14.13	13.86	9.31	15.15
May	47.36	16.08	40.40	18.78	32.05	11.52
June	13.00	28.62	10.94	28.54	11.89	26.05
July	2.83	20.25	2.42	19.57	2.94	18.49
August	12.86	6.52	9.50	6.00	9.60	7.60
September	9.79	19.84	8.98	14.98	8.26	18.01
October	22.86	18.34	24.06	15.45	20.27	12.73
November	18.46	13.05	13.48	12.66	25.77	10.07
December	23.42	14.85	20.51	10.90	27.23	10.16
	177.26	171.21	162.79	161.32	163.76	149.12
Average (5-year period)	177.61"		158.24"		163.62"	
Total No. of wet days	219	231	213	223	234	239

The rainfall for the year at Dartonfield, Nivitigalakele and Hedigalla Divisions amounted to 177.26", 162.79" and 163.76" on 219, 213 and 234 days respectively. The rainfall was above quinquennial averages at Nivitigalakele and Hedigalla Divi-

sions, but below at Dartonfield Division. The fourth quarter of the year received heavier falls and the month of May recorded the highest rainfall.

Crop

The major factors contributing to the deficit in crop this season are : (*a*) the prolonged dry weather, which coincided with the refoliation of the rubber trees and delay in the picking up of crop intakes, (*b*) the second and fourth quarters of the year recorded heavier rainfalls which hampered the making up of the heavy crop deficit.

	1969	1968
Estimated ...	625,000 lb	683,000 lb
Harvested ...	526,098 „	557,483 „
Decrease ...	98,902 „	125,517 „

The crop harvested for the year 1969 is 84.18% of the season's estimate.

Comparative Yield Records of Individual Fields

Dartonfield	*Acreage in tapping*	*Total yield in lb* 1969	1968	*Yield in lb per acre* 1969	1968
1950/51 replanted area ...	25¾	11,836	13,888	459.7	539.3
1952 „ „	27	19,489	22,861	721.8	846.7
1953 „ „ ...	8	5,078	5,800	634.8	725.0
1954 „ „ ...	2½	2,348	2,697	939.2	1,078.8
1955 „ „ ...	5	3,544	3,775	708.8	755.0
1955/56 „ „ ...	4¾	2,935	3,301	617.9	694.9
1960/61 „ „ ...	31⅛	16,045	11,162	509.4	744.1
	104¼	61,275	63,484	586.4	764.9
Nivitigalakele					
1940 and 1942 clearings	—	—	681	—	—
1941 clearing	—	3,251	7,440	—	1,062.8
1943 „	—	2,689	5,953	—	850.4
1944 „	4½	2,749	2,836	610.9	630.2
1946 „	21	21,987	28,074	1,047.0	1,336.8
1953 „	10	10,270	11,262	1,027.0	1,126.2
1954 „	10	9,100	9,767	910.0	976.7
1962 replanted area	16¾	7,819	—	466.8	—
	62¼	57,865	66,013	929.6	1,109.5

Hedigalla	*Acreage in tapping*	*Total yield in lb* 1969	1968	*Yield in lb per acre* 1969	1968
1946 clearing	—	4,218	6,502	330.9	510.0
1947 ,, ...	45	16,614	16,422	369.2	364.9
1949 ,, ...	34¾	24,792	24,562	713.4	706.8
1950/51 ,, ...	18	12,814	13,531	711.9	751.7
1952 ,, ...	79½	54,381	58,593	684.0	737.0
1953 ,, ...	132½	90,616	100,568	683.9	759.0
1954 ,, ...	171	99,266	105,685	580.5	618.0
1955 ,, ...	78	55,469	55,472	711.1	711.2
1956 ,, ...	60	41,011	40,040	683.5	667.3
1957 ,, ...	17¼	7,777	6,611	450.9	383.2
	636	406,958	427,986	639.9	659.7
Total for the Group ...	802¾	526,098	557,483	655.4	704.6
Other sources		2,892	1,228		
Total		528,990	558,711		

Tapping

Dartonfield : Tapping was continued throughout on non-experimental areas. The experimental areas were rested for wintering from 11. 2. 69 and resumed tapping on 25.2.69.

Nivitigalakele : Owing to the very severe drought experienced, tapping was stopped on 23. 2. 69 in all areas and resumed on 5. 3. 69.

Hedigalla : Tapping was stopped for wintering on 22. 2. 69 on experimental areas. The non-experimental areas were stopped on 26. 2. 69 as it was uneconomical to continue tapping owing to very low intakes per tapper. Tapping was resumed in all areas on 8. 3. 69.

Tapping panels were marked with appropriate bark consumption.

Analysis of tapping rounds on Dartonfield Group for 1969 (1968 *figures in brackets*)

Dartonfield	*Early tapping*		*Late tapping*		*Winter rest*		*No tapping* *Rain*		*Holidays*	
1st quarter	76	(76)	11	(14)	—	(—)	2	(—)	1	(1)
2nd ,,	35	(39)	15	(18)	—	(—)	36	(29)	5	(5)
3rd ,,	57	(39)	17	(20)	—	(—)	18	(33)	—	(—)
4th ,,	45	(53)	26	(29)	—	(—)	21	(10)	—	(—)
	213	(207)	69	(81)	—	(—)	77	(72)	6	(6)

Nivitigalakele	*Early tapping*		*Late tapping*		*Winter rest*		*Rain*	*No tapping*		*Holidays*
1st quarter	66	(83)	11	(10)	12	(9)	1	(1)	—	(3)
2nd „	35	(42)	18	(12)	—	(—)	32	(27)	6	(7)
3rd „	61	(36)	14	(17)	—	(—)	17	(30)	—	(—)
4th „	45	(55)	26	(24)	—	(—)	21	(9)	—	(—)
	207	(216)	69	(63)	12	(9)	71	(67)	6	(10)

Hedigalla	*Early tapping*		*Late tapping*		*Winter rest*		*Rain*	*No tapping*		*Holidays*
1st quarter	63	(68)	9	(10)	14	(9)	1	(1)	3	(3)
2nd „	37	(45)	11	(12)	—	(—)	41	(27)	2	(7)
3rd „	69	(45)	12	(17)	—	(—)	11	(30)	—	(—)
4th „	45	(59)	22	(24)	—	(—)	25	(9)	—	(—)
	214	(217)	54	(63)	14	(9)	78	(67)	5	(10)

Manufacture

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

Latex Grades		*Total lb*	*Percentage*
Pale crepe No. 1	...	369,896	70.31
Pale crepe No. 2	...	13,216	2.51
Pale crepe No. 3	...	73,927	14.05
Latex for experiments	...	3,166	0.60
		460,205	87.47
Scrap Grades			
Scrap crepe No. 1	...	40,101	7.62
Scrap crepe No. 2	...	18,821	3.58
Scrap crepe No. 3	...	6,515	1.24
Scrap for experiments	...	456	0.09
		65,893	12.53
Total	...	526,098	100.00
From outside sources	...	2,892	
		528,990	

The production of a high percentage of uniform crepe No. 1 was made increasingly difficult with acreages of experimental areas of a multiplicity of clones under test with different latices in production.

Factory Machinery

Mill No. 1 — 26" x 14" (*Grooved*) : This mill was repaired during the year. The rolls reground and regrooved. The end gears machined and adjusted to fit. The main bearings rebushed.

Mill No. 5 — 26" x 14" (*Grooved*) : This mill was sent to Messrs. Colombo Commercial Co. Ltd., for regrooving and for rebushing main bearings.

Mill No. 7 — 26" x 14" (*Smooth*) : The bearings were remetalled during the year.

Mill No. 8 — 26" x 14" (*Smooth*) : In this mill, replacing of layshaft bearings was carried out.

Field and Factory Experiments

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

Estimates

Estimates of capital and revenue expenditure for 1970 in respect of Dartonfield Group, were prepared and submitted by the writer to the Rubber Research Board, for approval.

Estate Roads

All motorable roads within the Group were maintained in fair order throughout the year.

Pests and Diseases

Oidium heveae : The weather conditions were not favourable for the growth and spread of the fungus *Oidium heveae*. Wintering was early at Hedigalla and confined to scattered plots. Evening showers and misty mornings prevailed during the first two weeks in February, but the latter part of the month was sunny and dry. The defoliation was rather protracted due to the multiplicity of clones and late winterers suffered a mild attack, but a satisfactory control was however achieved by sulphur dusting.

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

Phytophthora palmivora : The attack of *Phytophthora palmivora* was very mild and there was no marked leaf fall.

Bark Rot : The incidence of Bark Rot in the Group was negligible.

Wind Damage : The loss of trees due to wind damage on Dartonfield, Nivitigalakele and Hedigalla were 49, 42 and 1,343 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	
1964	,, ,,	..	8	
1965	,, ,,	..	10	
1966	,, ,,	..	$5\frac{3}{4}$	
1967	,, ,,	..	$8\frac{3}{4}$	
1969	,, ,,	..	$4\frac{1}{2}$	
1970	replanting	..	$22\frac{1}{2}$	.. $73\frac{1}{2}$ acres

Hedigalla Division — Immature Areas

1965	replanted area	..	$11\frac{1}{2}$	
1967	,, ,,	..	$21\frac{1}{4}$	
1969	,, ,,	..	$22\frac{1}{4}$	
1970	replanting	..	$26\frac{1}{4}$	.. $81\frac{1}{4}$ acres

Routine weeding, cultivation and other agricultural operations were carried out. The immature areas are in good condition and were maintained up to the required standards of sound agricultural practice.

1963 *Replanted Area* (14 *acres*) *at Nivitigalekele :* This is planted with eight clones of RRIC series and with the controlling clone of PB 86. Growth, though uneven, is satisfactory.

1964 *Replanted Area* (8 *acres*) *at Nivitigalakele :* Clones of RRIC 41, RRIC 45, RRIC 52 and RRIC 86 are planted in this area. Plants are growing vigorously and are expected to reach the required girth for tapping in 1970.

1965 *Replanted Areas*

(*a*) $11\frac{1}{2}$ *acres at Dartonfield :* This is planted with 5-point buddings of H.P. seedlings, 5 clones of RRIC series and RRIM 600. Growth is uneven. Close attention was paid to weeding, manuring and root diseases.

(*b*) 10 *acres at Nivitigalakele :* This area consists of a monoclonal block of RRIC 45. Plants are growing well. Routine agricultural operations were carried out.

(*c*) $11\frac{1}{2}$ *acres at Hedigalla :* This area carries plants of RRIC 52. Growth is fairly satisfactory.

1966 *Replanted Area*

$5\frac{3}{4}$ *acres at Nivitigalakele :* This is planted with nine series of RRIC clones, J 1, *Hevea spruceana* and clone Nos. 451 and 1000. Routine weeding, manuring and other agricultural operations were carried out. Plants are coming up well.

1967 *Replanted Areas*

(*a*) $8\frac{3}{4}$ *acres at Nivitigalakele :* The plants in this area are growing satisfactorily and consist of clones 1174, 1103, 815 and RRIM 623.

(*b*) $21\frac{1}{4}$ *acres at Hedigalla :* This area which was planted by the Botany and Genetics & Plant Breeding Departments in 1967 and 1968 contains the following clones : RRIC 45 and experimental material Nos. 451, 1004, 1152, 1174 and 1305. Plants are vigorously growing. Routine agricultural operations were done.

1969 *Replanted Areas*

(*a*) 13 *acres at Nivitigalakele :* Approximately half an acre of this area was planted by the Botany Department during November 1968 with different stocks of experimental material. A further acreage, approximately 4 acres, was planted by the Botany Department during 1969 North East planting period, with promising experimental material. The plants are coming up well. The planting of balance area, *viz*, $8\frac{1}{2}$ acres, is postponed to 1970.

(*b*) $22\frac{1}{4}$ *acres at Hedigalla :* A total of 3,655 budded stumps consisting of various vigorous growing stocks of experimental material were planted in this area by the Genetics & Plant Breeding Department during November 1969.

Nurseries

Budwood Nurseries—Dartonfield

(*a*) Routine weeding and clearing of drains were carried out. All plants were manured in accordance with the Institute's recommendations.

(*b*) Over-matured budwood plants were lopped off for fresh budwood.

Seedling and Budwood Nurseries—Nivitigalakele

(*a*) Weeding, manuring and clearing of drains were done.

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

Budwood Issues

(*a*) To outside estates	..	3,271 yards
(*b*) To Rubber Control Department	..	10 ,,
(*c*) For Genetics & Plant Breeding Department experiments	..	38 ,,
(*d*) For Botany Department experiments	..	569 ,,
		3,888 ,,

Budded Stumps Issues

For Botany Department experiments	..	248 budded stumps

Budwood Multiplication Nursery, Hedigalla : This nursery was planted with 14 acres of budwood nursery and 5 acres of seedling stock nursery. The budwood nursery was planted with clones of RRIC, RRIM, AVROS, PR and IRCI series and also Nab 17. The seedling stock nursery was further increased by another two acres during the year.

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

Labour and Health

Labour Force : The regular labour force was generally adequate and settled. Temporary casual labour was employed, specially during paddy cultivation periods when village labour was not regular. The Works Section labour force was separated from the Group labour and all payments were effected by the Accounts Section of the Institute.

Line Rooms : Line-room accommodation was satisfactory.

Wages : Wages were paid during the year in accordance with the Wages Boards Ordinance in force.

Dartonfield Group

Working Ceylonese	Resident	Non-resident	Total
Men ..	106	163	269
Women ..	76	179	255
Children ..	—	—	—
Working Immigrants			
Men ..	33	1	34
Women ..	22	1	23
Children ..	—	—	—
	237	344	581

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

Maternity Benefits : In all 34 full and 4 alternative maternity benefit payments were made.

Feeding Children : Free rations and ¼ lb bread were issued to each non-working child.

Health : The health of the members of the Institute's staff and of the estate labourers was satisfactory during the year.

Anti-mosquito Measures : DDT spraying was carried out throughout the year at regular intervals, in and around the bungalows and lines, under the supervision of the Institute's Apothecary.

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

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

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

Influenza ..	1,024
Ulcers ..	318
Roundworm ..	748
Diarrhoea and Enteritis ..	232
Eye and ear diseases ..	102
Other diseases ..	4,658
Total ..	7,082

REVIEW OF R.R.I.C. SUB-STATION, KURUWITA

By

A. Q. Jinadasa

Acreage Statement

	A.	R.	P.
Mature Rubber			
1961 Clearing	84	0	00
1962 ,, ...	38	3	00
1963 ,, ...	7	2	00
1964 ,, ...	6	0	00
Total mature acreage	136	1	00
Immature Rubber			
1963 Clearing	15	0	00
1964 ,, ...	12	2	00
1965 ,, ...	19	0	00
1966 ,, ...	10	0	00
1967 ,, ...	10	0	00
1968 ,, ...	10	0	00
1969 ,, ...	10	0	00
Total immature acreage	86	2	00
Total rubber	222	3	00
Nurseries	2	0	20
Paddy fields	5	2	00
Roads, deniya and buildings	17	1	10
Grand Total	247	2	30

The balance 10 acres of old rubber remaining on the Sub-station were uprooted and replanted in the South West monsoon of 1969 bringing the total immature acreage to 86 $\frac{1}{2}$ acres.

Weather

Rainfall	1968	157.22"
,,	1969	160.01"
Increase		2.79"

The months of January to March 1969 and July 1969 recorded low rainfall and during the rest of the year rainfall was fairly well distributed with the exception of May 1969 when a total of 42.29" was recorded of which 17.68" fell in two days.

Crop

	1968	1969
Estimate ..	38,600 lb	70,000 lb
Secured ..	41,277 ,,	71,516 ,,
Increase ..	2,677 ,,	1,516 ,,

The season's estimate of 70,000 lb was exceeded by 1,516 lb giving an overall yield per acre of 550 lb compared with 446 lb yield per acre for the previous year.

Manufacture

A Guthrie Cadet mill which was previously on Dartonfield Group was installed on the Sub-station in November/December 1969 and one new DCL tank was purchased at a cost of Rs. 3,717/35. These facilities have greatly helped in the manufacture of the increased crop on the Sub-station.

Buildings

The six twin cottages provided for the resident labour force were white-washed and roofs tarred and also repairs to ramps and drains effected. The rear windows of the new office block were guarded with welded mesh. The manure and sulphur stores which are in poor condition are due for renovation in the new season. The rest of the buildings on the Sub-station are in satisfactory condition.

General

A new motorable road was opened to connect the road through the 1961 replanting with the existing centre road through the Sub-station and directional sign boards erected at the two main entrances to the property.

Messrs. Rajah Salgado, L. C. De Mel and E. D. De Alwis of the Estates & Experimental Committee paid a visit to the Sub-station during the year.

I would like to thank Mr. M. W. Thompson, our Visiting Agent, for the valuable advice given at his biannual visits to the property.

The staff on the Sub-station have continued to give their best during the year.