

**THE
RUBBER RESEARCH INSTITUTE OF CEYLON**

ANNUAL REVIEW FOR 1964

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THE RUBBER RESEARCH INSTITUTE OF CEYLON

ANNUAL REVIEW FOR 1964

DIRECTOR'S REVIEW FOR 1964

BY

C. A. DE SILVA

GENERAL

Mr. J. W. Craig, C.D.A. (W. of Scot.), F.R.H.S., representative of the Planters' Association of Ceylon on the Rubber Research Board, was elected Chairman of the Board on 23rd January, 1964. He was also nominated to serve on the International Rubber Research & Development Board with effect from 20th February, 1964.

Mr. W. B. Jonklaas was re-nominated as a representative of the Planters' Association of Ceylon for a further period of 3 years with effect from 28th February, 1964.

Messrs. L. Jayasundara, B.A. (Lond.), M.A. (Cantab.), and R. Salgado, B.Sc. Agric. (Cey.), were nominated to represent the Low-Country Products Association with effect from 21-1-64 in place of Messrs. T. C. A. de Soysa and N. Abeygoonewardene, J.P.

Mr. N. Abeygoonewardene, J.P., was nominated by the Hon. Minister of Agriculture, Food & Fisheries to represent smallholders in the Rubber Research Board for a period of 3 years with effect from 1-2-64, in place of the late Mr. W. P. H. Dias, J.P.

Mr. D. C. L. Amarasinghe, (Additional Deputy Secretary to the Treasury), has been nominated to serve on the Rubber Research Board as Treasury Representative with effect from 18-8-64 in place of Mr. T. E. Gooneratne.

Mr. K. D. D. Perera, M.P., had been nominated by the Minister of Agriculture, Food & Fisheries to represent the House of Representatives on the Rubber Research Board for a period of 3 years with effect from 24-10-64 in place of Mr. Leslie Goonewardene, M.P.

It was agreed that the Rubber Research Institute should participate in the Ceylon Government's Industrial Exhibition which is to be held in mid-January 1965, sharing a block with the Tea Research Institute. The general lay-out of the stall and presentation of exhibits were about the best in its class in the exhibition.

A Scientific Committee consisting of the Chairman of the Rubber Research Board, the Director, Mr. W. B. Jonklaas and Mr. L. Jayasundara was appointed to discuss matters relating to the scientific work of the Institute.

There has been close collaboration with the International Rubber Research and Development Board in various aspects of rubber research during the period under review. The Natural Rubber Producers' Research Association has given this Institute the necessary help and advice in connection with problems connected with the biosynthesis of latex.

Staff

Mr. C. A. de Silva, Director, was on duty throughout the year and continued his membership of the International Rubber Research & Development Board and of its Standing Committee.

Mr. V. B. Solomon, Statistician, was confirmed in his appointment with effect from 2-5-64 on satisfactory completion of the probationary period of two years. He was awarded a Smithmundt Fulbright Scholarship from September, 1964 to follow a course in Agricultural Statistics at Iowa State University, U.S.A., where he is pursuing his studies at present.

Dr. Ronald T. Wijewantha, Head of the Botany Division, was away on end-of-contract leave from 14-9-64 to 16-10-64 and again from 2-11-64 to the end of the year.

Dr. O. S. Peries, Head of the Plant Pathology Division, Mr. A. J. Jeevaratnam, Head of the Soil Chemistry Division, Mr. C. D. de Fonseka, Chief Administrative Officer and Secretary to the Board, and Mr. L. Wijeyegunewardene, the Estate Superintendent, were on duty throughout the year.

Mr. M. Nadarajah, Acting Head of the Rubber Chemistry Division, was appointed Head of the Rubber Chemistry Division with effect from 1st March, 1964. He was on duty throughout the year.

Mr. A. B. Dissanayake, Chief Advisory Officer Smallholdings, who was on end-of-contract leave from 16-8-64 and was re-engaged on monthly terms from 16-10-64, was on duty during the rest of the period under review.

Mr. L. B. Chandrasekera, Botanist, was on duty throughout the year and Mr. D. M. Fernando, Plant Breeder, was on end-of-contract leave from 1st December till the end of the year.

Mr. Camillus G. Silva, Soils Chemist, proceeded to India on 18th December to follow a course of training in Soil Biology in New Delhi for three weeks. He was on duty during the period under review.

Mr. R. Satchuthananthavale, Assistant Botanist, and Mrs. V. Satchuthananthavale, Assistant Plant Pathologist, continued their post-graduate studies at the University of Sheffield under the Technical Co-operation Scheme of the Colombo Plan.

Mr. S. W. Karunaratne, Assistant Rubber Chemist, proceeded to United Kingdom on 22nd September, 1964 for post-graduate studies in Rubber Technology at the National College of Rubber Technology, London.

Mr. R. S. John, Assistant Soils Chemist, was confirmed in his appointment with effect from 1-3-64 on satisfactory completion of the probationary period of 2 years and an application for a scholarship has been made to the Colombo Plan authorities to provide him a post-graduate course of overseas training in the use of radio-isotope techniques in the problem of nutrition of *Hevea*.

Mr. N. Nadarajapillai, B.Sc. (Cey.), was appointed Assistant Statistician with effect from 2-12-64.

Mr. B. Cocking, the Visiting Superintendent, R.R.I.C. Kuruwita Sub-station proceeded on furlough and was away from 31st January to 30th June. Mr. J. M. C. Perera, Senior Assistant, Rambukkanda Group, overlooked the Sub-station during this period.

The following Intermediate Staff Officers were on duty :

Mr. D. L. S. Wimalajeewa	Assistant Plant Pathologist
Mrs. S. C. Goonetilleke	Librarian and Publications Officer
Mr. B. C. Moldrich	Assistant Administrative Officer
Mr. P. C. J. F. Keerthisinghe	Works Engineer
Mr. M. R. T. Mendis	Assistant Estate Superintendent
Mr. H. H. Peiris	Senior Assistant Advisory Officer Smallholdings
Mr. K. W. de Silva	Assistant Advisory Officer Smallholdings
Mr. D. E. A. Abeywickrema	Assistant Advisory Officer Smallholdings

Assistant Staff

The Assistant Staff position in the Administrative Department was as follows :—

HEAD OFFICE

<i>Correspondence Section</i>	<i>Accounts Section</i>	<i>Works Section</i>	<i>Library</i>
One Office Assistant	One Accounting Assistant	One Clerk	One Library Assistant
Five Clerk-Typists	One Pay Clerk	One Transport/ Stores Assistant	
One Record Clerk	One Book-keeper	One Electrical Foreman	
One Translator-cum Typist	Three Accounts Clerks	One Mechanical Foreman	
One Junior Clerk	One Clerk-Typist	One Building Foreman	
	One Storekeeper		
	One Stores Assistant		
	One Junior Clerk		

One Personal Assistant to the Director

A number of changes in Assistant and Minor Staff in the Technical, Estate and Smallholdings Departments occurred as shown in the respective departmental reviews.

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

Senior Staff (Heads of Divisions)	8
Senior Staff (non-Heads of Divisions)	3
Intermediate Staff	14
Assistant Staff	151
Minor Staff	73
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	249
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Meetings

The Director attended the following meetings :—

Rubber Research Board	23/1, 20/2, 30/3, 20/5, 23/7, 21/8, 22/10, 13/11, 17/12.
Administrative Committee, R.R.B.	18/1, 20/2, 27/4, 30/6, 2/10, 17/12.
Estate & Experimental Committee, R.R.B.	8/4, 16/9, 2/10.
Smallholdings Selection Committee R.R.B.	9/3, 10/8.
Selection Committee, R.R.B.	20/5, 21/8, 22/10.
Committee appointed to consider the draft Manual of Procedure R.R.B.	15/10, 7/11.
Scientific Committee, R.R.B.	23/7, 2/10.
Industrial Exhibition Committee, R.R.B.	8/4.
Rubber Replanting Advisory Board	18/2, 22/4, 23/6, 25/8, 10/11, 29/12.
Dolomite Conference at Ministry of Internal & External Trade & Supply	20/7.
National Council of Research Meeting, Colombo	16/1, 7/4.
Tea Research Conference	23/1.
Rubber Film Censor Board, Colombo	2/3.
Planters' Association of Ceylon	4/4, 16/6, 18/8.
Ceylon Planters' Society, Kandy	23/5.
Sabaragamuwa Planters' Association	2/6, 3/9.
Visiting Agents' Conference, Colombo	9/10.
Meeting of the Working Group on Export Crops, Dept. of National Planning	20/11.
Smallholdings Field Day — Kosgama Maha Vidyalaya	28/11.
Meeting of the Parliamentary Advisory Committee of the Ministry of Agriculture, Food & Fisheries	1/12.

Visitors

Visitors to the Institute included the following :—

- Hon. Mr. Felix R. Dias Bandaranayake, Minister of Agriculture, Food & Fisheries of Ceylon Government.
- Mr. B. Mahadeva, Permanent Secretary to the Ministry of Agriculture, Food & Fisheries.
- Mr. H. T. C. Reid, Chairman, Dalkeith (Ceylon) Rubber Estates Ltd.
- Mr. G. J. Medley, Technical Development Manager, Tata-Fison Ltd., Bangalore, S. India.
- Mr. L. E. Pickett, U. N. Technical Assistance Programme, Co-operative Marketing (I.L.O.), Colombo.
- Dr. D. H. Constable, F.A.O., Rome.
- Dr. S. Luch, VEB Berlin Chemie, Berlin.
- Mr. K. S. P. Kalpage, Hardy Institute of Technical Training, Amparai.
- Mr. C. R. Warren, Messrs. Carson Cumberbatch & Co., Colombo.
- Mr. G. W. Davies, Messrs. Carson Cumberbatch & Co., Colombo.
- Mr. Soland Theo, C/o Sandoz Ltd., Basle, Switzerland.
- Mr. L. C. Pittaway, Mippadi, Kerala State, India.
- Mr. N. Slorance, Koney Estate, Konni, S. India.
- Mr. K. Pirniss, Vienna 13, Austria.
- Miss Marie Phelan, Boston, Massachusetts, U.S.A.
- Mr. Ravise, Plant Pathologist, O.R.S.T.O.M.
- Mr. Susumu Nishigake, Regional Advisor, IIEA, UN., UNTAB Office, United Nations Ave., Manila.
- Mr. Huttenbach, Farbwerke Hoechst, A.G.,— Germany.
- Mr. F. J. Hall, Tropical Products Institute, 56 Gray's Inn Road, London, W. C. 2.
- Mr. D. J. Goodacre, Messrs. Baur & Co., Colombo.
- Mr. H. Meyer, Sandoz, Switzerland.
- Mr. Hans Roth, Geigy, Agro-Chemicals.
- Mr. Ng Eng Kok, Rubber Research Institute of Malaya, Kuala Lumpur.
- Mr. Lim Hong Hai, Rubber Research Institute of Malaya, S'ban.
- Mr. Koh, Johar Bin Mohd Rashid, Rubber Research Institute of Malaya, Kuala Lumpur.
- Mr. R. Khromin, Council for Economic Affairs of the U.S.S.R. Embassy.
- Dr. Paul Kruse, San Francisco, Columbia.
- Mr. T. Hampel, Deutsche Junner-und Ambanhandel Chemie, Berlin.
- Mr. H. Fromm, Deutsche Junner-und Ambanhandel Chemie, Berlin.
- Mr. G. Hanisch, Zentrale Forschungsstelle der Reitenindustrie Furstenwalde (Spree).

Publications

The following reports and articles were prepared by the Director :—

- (1) For information of the Rubber Research Board :
Director's Review for 1963.
- (2) Contribution to 1963 Annual Report of the Planters' Association of Ceylon :
“ Progress Report of the Rubber Research Institute for 1963.”
- (3) Contribution to the Annual Report of the Low-Country Products Association :
“ Report on the Activities of the Rubber Research Institute for 1963.”

- (4) For presentation at the 17th Meeting of the International Rubber Study Group, Tokyo (May 1964) :
 "Activities of the Rubber Research Institute of Ceylon for 1962/63."
- (5) For information of the General Treasury (Economic Division) :
 "Data for the Handbook on Technical Training Facilities in S..E. Asian Countries."
- (6) For the information of the Food & Agricultural Organization :
 "Report on *Hevea* Cultivation and Production in Ceylon from 1961 to 1963."
- (7) For inclusion in the Ceylon Year Book for 1963 :
 "Report on the Activities of the Rubber Research Institute."

The following publications were issued :—

1st and 2nd Combined Quarterly Journals for 1964.

3rd and 4th Combined Quarterly Journals, Vol. 40, Parts 3 & 4, (Sept./Dec. 1964).

Annual Review for 1963.

Annual Report for 1962 (with audited accounts incorporated) in the press.

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Annual Review of the Smallholdings Department in Sinhala 1963.

Reprint of Reprint No. 2 on 'Budwood Nurseries.'

Rubber Research Institute Bulletin No. 57 — "The Control of Abnormal Leaf-fall disease (*Phytophthora palmivora*, Butler) of *Hevea* in Ceylon" by J. H. Lloyd.

The following roneoed leaflets were issued :—

- (i) Bark Cracking Questionnaire dated 15-2-64.
- (ii) The Conditions for accepting Proprietary Fungicides for Testing by the Rubber Research Institute of Ceylon dated 20th February 1964.
- (iii) R.R.I.C. *Phytophthora* Questionnaire dated 20th May 1964.

Correspondence

	<i>Inward</i>	<i>Outward</i>
Director { General	1761*	1772
{ Technical	95	171
Administrative Department	5036	4958
Botany Division	1036	389
Plant Pathology Division	792	613
Soils Chemistry Division	445	329
Rubber Chemistry Division	598	566
Smallholdings { General	8766	10364
Department { with Rubber		
{ Controller	1426†	4011‡
Estate Department	926	1480

* Includes 420 applications for various posts

† Includes New Planting Applications etc.

‡ Includes 1249 Preliminary Reports, 1329 Final Inspection Reports and 1433 Special Reports.

NOTES ON DEPARTMENTAL REVIEWS

Botany Division

The work of this Division as in previous years was concentrated on field experiments connected with breeding and selection work for the evolution of vigorous growing high-yielding clones with good secondary characters.

Selected planting material was screened on Kepitigalla Estate in the Matale District for resistance to *Oidium heveae*, and for growth and yield under local conditions. None of the imported clones resistant to *Dothidella uli* was found to be resistant to *Oidium*; a few clones, however, showed a high degree of tolerance to *Oidium*.

At the testing station for *Phytophthora* on Peenkande Group clones were evaluated for resistance to the disease and for yielding capacity.

A testing station for *Gloeosporium alborubrum* was established on Nakiadeniya Group in the Galle district.

A total of 38,470 hand pollinations were carried out during the 1964 flowering season. 1,631 seedlings were established in nurseries from this pollination programme.

The budgrafts from a prematurely flowering mutant clone H 440 at Nivitigalakele commenced flowering as predicted one year after planting. A note on the further studies of this mutant will be prepared for publication.

Preliminary studies on epiphytotic induction have given encouraging results. A successful method of inducing *Phytophthora* infection in nursery plants has been worked out.

Girth measurements taken in 1964 in the 1962 large-scale clone trial at Kuruwita Sub-station showed that under local conditions of growth in the Ratnapura District clones RRIM 701 and 623, RRIC 14, 41 and 52 ranged in girth from 5.6 to 6.7 inches, while clones RRIC 45 and 51, AVROS 529, WR 101 were just over 5 inches in girth. The average girth recorded in this trial was 4.7 inches. In a small-scale clone trial within the main clone trial recorded an average girth of 4.8 inches.

In the 1954 clone trial, Nivitigalakele, where 25 trees each of clones RRIC 88 and 89 have been test-tapped in the 11th year of tapping, the clone RRIC 88 has yielded 24.1 lb per tree per year, while clone RRIC 89 has yielded 22.1 lb per tree per year.

The two original budgrafts of clone RRIC 52 in the 1944 small-scale clone trial, Nivitigalakele, has given a yield of 43.1 lb per tree per year in 1964, compared with a yield of 29.3 lb per tree per year of the control clone Wagga 6278.

In the 1945 clone trial, Hedigalla, clones RRIC 5 and 7 have given yields of 23.6 and 21.5 lb per tree per year respectively in 1964.

In the 1955 large-scale clone trial, Hedigalla, clones RRIC 40, 41, 46 and 50 are among the best yielding clones with over 35.0 grams per tree per tapping in the 3rd year of tapping.

In the 1953 large-scale clone trial at Nivitigalakele clone RRIC 45 with 588 trees in tapping has given 10.6 lb per tree per year in the 3rd year of tapping; in the same clone trial 498 trees of clone RRIC 44 have yielded 11.7 lb per tree per year. The latter clone has a fluted trunk which however has not unduly interfered with tapping.

A selection of local and foreign clones PR 252, 253, 257, RRIM 617 and 618, IRCI 9, RRIC 39, 48, 55, are among the better yielding clones yielding over 20 grams per tree per tapping in the first 10 months of tapping.

In a clone trial at Dartonfield clones WR 101, GT 1, AVROS 385 and 427 planted in 300-tree monoclonal plots were first tapped in 1963. In a difficult rubber planting terrain with rocky outcrops, clone AVROS 427 is the best yielder in 1964 with 32.9 grams per tree per tapping. Clone WR 101 has yielded 26.0 grams per tree per tapping while clones GT 1 and AVROS 385 yielded 19.9 and 17.9 grams per tree per tapping respectively.

The annual girth measurements in immature areas have been taken in all the experimental stations as well as in clone trials planted in experimental areas on outside estates.

The 1957 small-scale clone trial at Hedigalla includes 171 ten-tree clones, which show marked differences in growing capacity in quick changing terrain, with inherent soil infertility. The annual girth increment for 1963-1964 averaged 2.8" which is not up to required standards of good growth.

In the 1961 large scale clone trial at Dartonfield, spread over 3 separate fields, clones RRIC 7, 52 and RRIM 513 as a North East season replanting showed satisfactory increases in growth for 1963-64 ranging from 3.0 to 3.4 inches. Clones RRIC 45 and 88 have in a South West season replanting shown increased girth figures of 3.4 and 3.6 inches respectively for 1963-64. The control clone PB 86 in the same field showed an increase of only 2.5 inches in girth.

In an isolated and sheltered field of Dartonfield clones PB 28/59 and RRIC 89, planted in the North East season were not up to standards of growth with girth increments of 2.4 and 2.1 inches respectively for 1963/64.

In a clone trial planted on Estate A in the Kalutara District in 1957 on 300-tree plots clones TR 1406, AVROS 529, IRCI 2, IRCI 3 and RRIM 607 attained an average girth of over 20 inches. The control clone PB 86 was below the average growth of 21.9 inches with a girth of 19.8 inches.

In the 1957 clone trial on Estate B, planted in 300-tree plots, clones TR 1548, RRIM 612, AVROS 2037 were above the average growth of 23.7 inches girth in 1964. AVROS 1734 was just below average growth while the girth of the control clone PB 86 was 20.8 inches.

In the 1958 large-scale clone trial on Estate B, planted with foreign and local clones in 300-tree plots clone RRIC 52 was the best grower with an average girth of 22.8 inches. Clones RRIC 22, 36, 37, 39, 41, 54, RRIM 607 and PB 86 showed girth figures ranging from 20.0 to 22.9 inches. The average girth figures for clones RRIM 605 and RRIC 45 were 19.5 and 19.8 inches respectively.

In a tapping experiment initiated in 1954, with 26 clones tapped at heights of 42" and 50" the differential response in yields at the two heights in the 10th year of tapping was not of any practical significance. The tapping at 50" can be carried out satisfactorily with some difficulty in the case of tapping during the first 5 to 6 months. This allows for approximately a 14-year tapping cycle on virgin bark.

A small-scale replicated experiment was initiated in 1964 to investigate any differential response of clones to long-term stimulation with and without winter rest. Twelve-year old clones PB 86 and Nab 15, first tapped in 1958, were tapped under experimental conditions from March 1964. The preliminary results are presented in Table III of the Head of the Botany Division's report. It would be premature to comment on these early results.

The first three experiments on yield stimulation were discontinued. The 4th stimulation experiment in the series was initiated to test RRIC Mixtures I and II and Dilatex together with a control. The applications were made once a year on old seedling rubber. RRIC mixture II gave the best results with an increased yield of 19% over the control. In a 5th yield stimulation experiment in a 30-year old polyclonal block at the Kuruwita Sub-station with a single application per year of Stimulex, Dilatex, RRIC Mixture I and II, the best results were obtained from RRIC Mixture II on groomed bark with an increased yield of 12.3% over the control. This experiment is in its second year of application.

RRIC Mixture II on ungroomed bark gave better results than either Stimulex or Dilatex under the conditions of this experiment.

Plant Pathology

Dr. O. S. Peries continued his duties as co-ordinator of research work carried out on leaf and bark diseases at all the Rubber Research Institutes affiliated to the International Rubber Research and Development Board.

The wintering commenced early this year and was even in most districts, and together with the hot sunny weather prevented the development of *Oidium heveae*. The refoliation without a high incidence of *Oidium* presented a luxuriant foliage canopy in all the rubber-growing districts.

No significant results were obtained from six field experiments carried out on *Oidium* control during the susceptible period in 1964 due to the low incidence of the disease in all experimental areas.

The incidence of *Phytophthora* leaf disease was comparatively heavy in 1964 following the mild attack of *Oidium*, which favoured a heavy pod-set. The favourable weather in July for the propagation of the fungus (*Phytophthora*) was a contributory cause to the spread of the disease.

Pot experiments for the assessment of the value of copper sulphate and sulphur for the biological control of *Fomes* have been concluded. The results indicated that there was a possibility for the biological control of *Fomes* in newly replanted areas with the use of small quantities of sulphur in each planting hole.

Field experiments on *Fomes* for detection of the root disease were carried out. The results have indicated that the disease is best identified by leaf symptoms.

The incidence of Bark Rot was above average during 1964. A field trial for the selection of the best fungicide showed that Fylomac '90' was significantly better than all other fungicides on test, at the correct concentrations for the required toxicity on the causative fungus for effective control.

Studies on the biology of the diseases of rubber of economic importance in Ceylon were continued. The effect of sunlight and ultra-violet light on the germination of spores indicated that both treatments were injurious to the conidia. A short period of less than an hour of exposure to sunlight or ultra-violet light was sufficient to kill the conidia. Detached spores (conidia) succumbed more quickly than spores attached to the mycelium on leaves; the latter were killed after 3 to 4 hours of exposure to sunlight.

It has been found that more than one species of *Phytophthora* are pathogenic to *Hevea* rubber. Some of these can be considered as physiologic races of *Phytophthora meadii*. Further studies on this subject are being carried out with the help of the Commonwealth Mycological Institute, England.

Studies on the perennation of *Phytophthora palmivora* have shown that the fungus can survive for approximately six weeks on detached dry twigs stored in the laboratory and for about 3 weeks on infected twigs in the field.

The minimum time taken for the appearance of *Phytophthora* lesions after artificial inoculation with a zoospore suspension on leaf petioles is 28 hours; the pods are, however, infected with a single inoculation. It has been established that infected pods provide the inoculum for petiole infection entirely by wet splash dispersal; wind dispersal plays a very minor role.

A tentative method of forecasting severe leaf fall has been worked out, which generally occurs following certain weather conditions, with regard to temperature, relative humidity, rainfall, and sunshine prevailing for four consecutive days in the presence of infected pods. Such periods are most likely to occur during the mid-monsoon months of June and July in rubber-growing districts of Ceylon. The results are obtained when control measures are adopted as soon as possible after the observation of such a period.

The studies on the biology of spore germination of *Gloeosporium alborubrum* have been concluded. The concentration of spores in the suspension used for germination studies has an overall effect on spore germination. Germination takes place most rapidly at optimum temperatures; both lower and higher temperatures having a retarding effect. Germination takes place below a relative humidity of 85%.

A field survey of clonal susceptibility of *Gloeosporium* indicates that clones PB 86 and IRCI 7 are highly susceptible. Clones RRIC 7, 52 and RRIM 513 are of average susceptibility while clones RRIC 45, Wagga 6278, Mil 3/2, PR 107, RRIM 605 are below average susceptibility.

One locally prepared fungicide was tested by the Institute as a control for Bark Rot. It was found to be non-toxic at 100% strength. New fungicides should not be used on a commercial scale unless they have been tested by the Institute. A nominal charge of Rs. 300/- is made for testing new fungicides by this Institute.

Detailed studies were carried out on the use of organo-mercurial fungicides on rubber plants. It was found that mercury is very rapidly absorbed and readily translocated from mature to immature leaves of *Hevea*. A spray containing 0.01% Hg W/V will be the threshold phytotoxic limit to young *Hevea* leaves.

Basic investigations on the quantitative evaluation of soil micro-organisms in rubber-growing soils were continued. Soil moisture apparently plays an important role in determining the type and distribution of soil fungi at any particular time. A total of 135 species of fungi representing 102 genera has so far been isolated from the soils and rhizospheres. This work will be continued to cover a full cycle of seasonal variations. The fungi in the rhizosphere will be of particular value in studies on the control of *Fomes* with the use of sulphur and copper sulphate as soil applications.

Soils Division

The Head of the Soils Chemistry Division represented the Institute on the Formulary Committee for Agro-chemicals which was convened by the Ministry of Agriculture, Food & Fisheries.

The Soils Chemist attended the International Training Course in Soil Biology held at the Indian Agricultural Research Institute, New Delhi, for a period of four weeks commencing from 20th December 1964.

Two probationary Assistant Superintendents of surveys from the Survey General's Department were trained in Soil Survey and Soil Classification by the Soils Chemist.

The Division participated in the inter-Institute parallel tests on leaf analyses, which were organized among member countries of the International Rubber Research and Development Board. The assay values obtained at the Institute's laboratories compared favourably with those received subsequently from participating Institutes.

An advisory service which will give more specific recommendations to a limited number of individual estates based on field and laboratory examinations on soil conditions, and tree nutrient status has been initiated.

The problem of wind damage in *Hevea* has been exclusively dealt with by the Head of the Soils Division. The role of nutrition in connection with the incidence of wind damage in mature and immature areas has been of particular interest to rubber producers. A considerable amount of time has been given to the study of this problem from a number of aspects which could be contributory factors to the incidence of heavy wind damage experienced in recent years in certain clones and localities.

Field experiments carried out for vigour of growth with seedlings of clones RRIC 45, 52, GL 1 and Tjir 1 have indicated that seed of clones RRIC 45 and 52 may prove to be better than those of the other clones.

Foliar spraying with Urea or a complete liquid fertilizer like 'Fertil-Rei' has given very encouraging results as a means of accelerating the growth of plants in seedling nurseries.

Girth measurements taken at the end of the 6th year of growth indicating the effect of four levels of potassium with NPK mixtures on six clones showed no significant differences compared with the control R 4 : 6 : 2 mixture under the conditions of the experiment on Eladuwa Estate in the Kalutara District. Clone PB 86 was below average growth compared with clone RRIC 45 which was above the average growth of 19.2 inches in this experiment.

Clone PB 86 planted in 1961 manured with the major nutrients N, P, K in combination and singly showed no differential response in growth to magnesium applied as commercial Epsom Salts or Dolomite.

Manurial experiments in the mature phase in the 5th year of tapping in 1964 indicated a positive response to manuring after the commencement of tapping. Yield trends in laterite soils from the commencement of tapping indicate that N and P are the more important nutrients at the immature phase, while the inclusion of K is essential only from the commencement of tapping.

In one of the experiments with four clones the plots that received N and P during the immature period and N, P and K from the time of the commencement of tapping gave a mean yield of 33.1 grams per tree per tapping compared with 28.4 grams from plots that received the complete mixture in the immature and mature phase.

Studies on the comparative merits of different cover crops in the past proved that *Pueraria phaseoloides* was by far the best. A well established ground cover of *Pueraria* before planting the rubber could however be more competitive to the rubber than the natural cover which it has replaced. The replacement of the natural vegetation with a beneficial ground cover is best effected gradually without clean weeding.

The soil survey programme initiated in 1963 was continued. A programme of a more detailed nature than that adopted hitherto was initiated during the second half of the year and a semi-detail reconnaissance survey of the soils and land forms of the Alutgama, Panadura and Horana 1" maps was completed. Similar information on surveys of the Avissawella and Gampaha 1" maps is also available. With the completion of the Kandy and Kurunegala 1" maps the major rubber-growing areas would have been covered at the semi-detail reconnaissance level for soils and land forms.

Rubber Chemistry Division

The Rubber Chemistry Division has conducted refresher courses for Rubber-Makers in the Kalutara and Ratnapura Districts under the auspices of Planters' Associations of these districts. The Head of the Rubber Chemistry Division and the Senior Technical Assistant addressed the Estate Superintendents of the Kalutara and Kelani Valley Districts on rubber making at the respective district clubs on applications made by Planters' Associations of these districts.

The Head of the Rubber Chemistry Division and Mr. O.M.R. Sirisena have assisted the Institute of Rubber Industry (Ceylon Section) in conducting part-time lectures for training 28 persons, drawn from the rubber industry in Ceylon, to cover the L.I.R.I. syllabus in 18 months.

Latex collected from trees with increased tapping intensities has a lower dry rubber content than that obtained from the more normal intensities of tapping. Double-tapping for increasing crop is a case in point where latex with a reduced d.r.c. presents difficulties in the weighing and determination of the correct d.r.c. for the payment of tappers.

Samples of latex from clones PB 186, RRIM 501, and Nab 12 collected in vessels surrounded by ice have been sent monthly in polythene containers packed in ice in a thermos flask to the Natural Rubber Producers' Research Association, England for purposes of research.

The average values of nitrogen content in samples of latex and rubber from 28 clones collected monthly in 1962 are presented in the report for 1964.

Trees stimulated for increased yields lead to late-dripping conditions. The results obtained on the calcium content and yield of stimulated and intensively tapped trees compared with normal yields are recorded in Table II of the report. It has been suggested that there might be a relationship between calcium content and yield and that an increase in a high concentration of calcium ions is connected with the cessation of latex exudation presumably by the coagulation of latex at the cut ends of the latex vessels.

Samples of oil-extended ribbed smoked sheet containing 25% naphthenic (Sun Rubber Process Oil 596) and 25% high aromatic (Sundex 1,585) oil were despatched to the Sun Oil Company, U.S.A. for testing. Both oils are suitable when extending natural rubber up to 25%.

The soaking of panel scrap in fresh serum for 1 or 2 days reduces the copper content below the specification limit of 8 p.p.m. but not the manganese with a specification limit of 10 p.p.m.

No. 3 Pale Crepe which is fractioned yellow crepe contains a higher mineral content than No. IX Pale Crepe, which is fractioned white crepe.

The physical properties of crepe samples made from 21 clones have been determined and presented in Tables 8 and 9. The crepe from clone AVROS 352 gives fast curing crepe (Blue circle) while those of PB 86, PR 107, Nab 15, RRIC 5, 7, 52, 86, Mil 3/2, and Wagga 6278 give medium curing crepe (Yellow circle).

The phenol content of latex from high upward cuts is about double compared with that of latex from the normal cuts. Discolouration of rubber manufactured from high cuts may be due to the excess of phenol.

Preliminary investigations have been carried out on the effect of the absorption of phenyl-mercuric-acetate present in Antimucin on yield output. Applications of Antimucin before tapping increased the yields of clone Nab 15, while those of clone RRIM 501 were depressed. These findings will be checked in balanced field experiments with control plots with applications of fungicides with and without mercury compounds by the Plant Pathology Division.

Smallholdings Department

Dr. McCarthy and Dr. Constable of the F.A.O. visited the Smallholdings Department on 8-7-64 and obtained information from the Chief Advisory Officer of this department on the use of fertilizers and the general attitude of peasants on manuring rubber. Two officers of the Smallholdings Department of the Rubber Research Institute of Malaya visited Ceylon to see the rubber smallholdings and to study the methods of cultivation adopted in Ceylon. A United Nation Technical Assistant called at the Smallholdings Headquarters in Colombo on 14-2-64 and discussed matters concerning the department with the Chief Advisory Officer.

During the year a total of 121 publicity meetings and exhibitions were conducted in the ranges by the Publicity Unit. Slides on *Oidium*, *Fomes* root disease, soil conservation and tapping were shown supported by tape-recorded commentaries.

The Department participated in 6 exhibitions. In some of the school exhibitions cine films were shown to visitors and smallholders.

Considerable assistance was given to smallholders. 1,588 locally made aluminium coagulating pans were sold to smallholders at a reduced price of Rs. 3.50 a pan.

The Annual Field Day of the Department was held at Kosgama. The Chairman, Mr. J. W. Craig, and the Director, Mr. C. A. de Silva, were present and the former addressed the meeting. Mr. A. J. Jeevaratnam, Head of the Soils Division was also present as the guest-speaker.

4,487 smallholdings replanted on permits from the Rubber Replanting Subsidy Schemes were visited by Rubber Instructors. 37,906 visits were made during the year to replanted smallholdings, and 32,978 trees in 558 smallholdings were marked for tapping according to the Rubber Research Institute's recommendations.

Rubber Instructors conducted 1,008 sheet making demonstrations and 1,007 tapping, 493 disease control and 455 miscellaneous demonstrations on other planting topics in 1964.

A scheme of training smallholders in rubber tapping and manufacture of smoked sheet was undertaken by the Department. 44 classes for 1,402 applicants were successfully conducted. 697 were successful in obtaining certificates issued by the Department.

4,289 special inspections were undertaken by the Department, on the request of the Rubber Controller, on new planting, subsidy replanting, and the checking of planting material distributed to smallholders.

The State-aided Sulphur Dusting Scheme, organised by the Department, was only partially completed due to a shortage of sulphur during the dusting season. The incidence of *Oidium* was, however, generally mild in 1964. Some late wintering undusted smallholdings were badly affected with *Oidium*.

The cost in the second year of planting was collated from data obtained from 46 smallholdings; the cost worked out at approximately Rs. 243/- per acre. In the 3rd year of planting the cost was Rs. 203/- per acre. Variable costs from individual smallholdings indicated the attention given by smallholders to some or all the items of expenditure included in the costing for the 2nd and 3rd years of planting; the maximum costs for carrying out all the items of expenditure worked out at Rs. 330/- and Rs. 293/- per acre respectively.

The yields obtained on 8 holdings in each of 48 ranges in 4 villages were used for calculating the average yield per acre per tapping with the use of the metrolac for determining the dry weight of rubber. Yields per acre per year were calculated on 140 tapping days on the S/2, d/2, 100% tapping system, as well as on the actual weight of smoked sheets. The results of the yield survey generally indicated a yield of 880 lb per acre per year for clonal seedlings and just over 1,000 lb per acre per year for budded rubber; the major proportion of the budded rubber acreage surveyed was planted with the high-yielding clone PB 86.

Statistics

The Statistician, Mr. V. B. Solomon, was sent abroad in September 1964 to follow a post-graduate course in his subject at the Iowa State University, U.S.A. He was awarded a Smithmundt Fulbright Scholarship in 1964.

Mr. N. Nadarajapillai, B.Sc. was appointed as Assistant Statistician in December 1964. He will be undergoing a preliminary training under the Director and the Heads of the Research Divisions. He will also have the opportunity of discussing statistical problems of general interest on field experimentation with the statisticians of other agricultural research institutions in Ceylon before he attends to the collation of the data and the statistical analysis of the field experiments laid down by the Research Divisions.

Estate Department

The total acreage of Dartonfield Group consisting of three stations Dartonfield, Nivitigalakele and Hedigalla in the Kalutara District is 1,491 acres approximately. A further sub-station is situated at Kuruwita, in the Ratnapura District with a total acreage of 248½. About 163½ acres have been replanted up to 1964 for clone trials and manuring experiments. The manuring experiments comprise a collection of the most promising high-yielding clones, which will be recommended for commercial planting in the future.

It is not possible to plant up the research stations exclusively with the best selected high-yielding local and foreign planting material. A considerable acreage has been planted with large and small-scale clone trials consisting of material which has not been finally selected for commercial planting, hence the average yields per acre per year cannot be brought up to the standard of good commercial estates which are planted with the best selected clones recommended from time to time by the Institute.

At the Kuruwita Sub-station the balance acreage of old seedling rubber of approximately 18½ acres has been cleared and felled for planting in 1965. This station will now have only about 40 acres of a polyclone area for tapping in 1965. A further area of 10 acres will be in preparation for replanting in 1965 with the intensive tapping of the trees before uprooting. The Visiting Agent has paid two visits to the Sub-station during 1964. His report indicates that this station is now in very good condition.

REVIEW OF THE BOTANY DIVISION

BY

RONALD T. WIJEWANTHA

SUMMARY

Plant Breeding

The selected planting materials under test against *Oidium* at Kepitigalla were screened for resistance to this disease and also evaluated for growth and an early index of yield. It would appear that none of the imported *Dothidella*-resistant clones are fully resistant to *Oidium*, though a few showed a high degree of tolerance.

The clones at the *Phytophthora* testing station at Peenkande Group were evaluated for resistance to this disease and also tested for yield. Girth measurements were also taken.

Selections were made in both the above areas for establishment in clone trials in 1965.

A test planting for the evaluation of selected clones against *Gloeosporium* was successfully completed during the S. W. monsoon season at Nakiadeniya Group in the Galle District.

Two new clone trials were set down at Kuruwita Sub-station during the year under review.

Girth measurements were continued in the small and medium-scale clone trials at Kuruwita, and also commenced in the 1962 large-scale clone trial.

A total of 38,470 hand pollinations giving 1,631 seedlings were carried out in 1964. The hand pollination programme was extended to estates outside Dartonfield Group. The very warm weather during the flowering period however contributed to a short-fall in the number of pollinations possible in certain specific crosses.

Preliminary studies on epiphytotic induction of *Oidium*, *Gloeosporium* and *Phytophthora* leaf diseases have given encouraging results.

Further genetic and physiological experiments have been initiated in respect of the early flowering clone H 440.

Botanical

Advisory : As in previous years, advice was sought on the choice of new high-yielding clones for use in replanting programmes and tapping problems connected with methods of obtaining increased yields from low-yielding seedling and budded areas with the use of yield stimulants and intensive tapping systems.

Yield Stimulation Experiments : Results in 1964 from the 4th yield stimulation experiment indicate the superiority of the RRIC mixture II over the others tested. These results were further confirmed by the data obtained from the yield stimulation experiment 5. In this trial, RRIC mixture II applied on ungroomed bark as well as on groomed bark gave considerably higher yields than other treatments, the latter being even superior to the former.

Tapping Experiments : The tapping experiment set down in 1954 to test the suitability of the Michie-Golledge tapping knife to a tapping height of 50" from the union as opposed to the standard height of 42" continues to furnish interesting results.

A replicated experiment was set down in 1964 to evaluate the long-term effects of stimulation with and without winter tapping. Preliminary yield figures have been recorded.

Clone Evaluation Trials : Clones RRIC 88 and 89 continue to maintain high yields and show good morphological characteristics with age.

Once again PB 28/59 continued to outyield all other clones in the 1954 clone trial at Nivitigalakele. This clone is recommended for planting on a limited scale.

The local clones RRIC 40, 50, 46 and 41 have given promising yields in the 1955 large-scale clone trial at Hedigalla.

Clone RRIC 44 over the last 3 years continues to outyield RRIC 45 in the 1953 large-scale clone trial at Nivitigalakele. The yield of 11.7 lb per tree in the 3rd year of tapping is outstanding. The former has a fluted trunk which, however, has not interfered with tapping.

Most clones in the 1949 large-scale clone trial, have suffered heavy casualties due to various factors over the last few years. Once again RRIC 86 outyielded the rest, with a yield of 20.9 lb per tree per year. RR 29 was a clone second with a yield of 20.2 lb per tree per year with a larger number of trees in tapping.

Yield Trials : The first of the yield trials to assess the suitability of 'announced' clones to particular areas was set down on Salawa Estate, Hanwella. In this replicated yield trial the performance of RRIC 86, 88 and Nab 15 will be tested against RRIC 45 as the control.

The question of the feasibility of economically inter-cropping rubber with cocoa or coffee in marginal areas has to be resolved from exploratory trials. A dual purpose replicated inter-cropping-cum-yield trial was set down on Rosebury Estate, Koslanda during the year under review.

DETAILED REVIEW

GENERAL

Staff

Dr. Ronald T. Wijewantha, Head of the Botany Division, was on duty throughout the year except when he was on end-of-contract leave from 14-9-64 to 16-10-64 and again from 2-11-64 to 31-12-64. During this latter period the Director was in overall charge of the Botany Division.

Mr. D. M. Fernando, the Plant Breeder, was on end-of-contract leave from 1-12-64 to 31-12-64.

Mr. I. B. Chandrasekera, Botanist, was on duty throughout the year.

Mr. R. Satchuthananthavale, Assistant Botanist, continued his post-graduate studies overseas.

Advisory Work

Advisory work has been confined to recommendations of planting material, tapping problems, and the correct use of yield stimulants for obtaining increased economic yields. To cope with the increased requests for advisory visits by commercial estates, it became necessary to limit laboratory investigations to the minimum.

Publications

- (i) Annual Review of the Botanical Section for 1963.
- (ii) Annual Review of the Plant Breeding Section for 1963.
- (iii) Pre-treatment of cover crop seeds for improved germination. *Rubb. Res. Inst. Ceylon Quart. J.* **40**, 21-26.
- * (iv) Developmental and biochemical effects of the agropyroides mutation in barley. *Genetics* **50**, 65-80.
- (v) Influence of environment on incidence of *Fomes lignosus* in rubber replantations in Ceylon. *Rubb. Res. Inst. Ceylon Quart. J.* **40**, 56-63. (Reprinted from Tropical Agriculture, Trinidad).
- (vi) Some breeding problems in *Hevea brasiliensis* (to be read at the Biennial Rubber Conference).
- (vii) Recommended clones and some factors that affect their performance in Ceylon (to be read at the Biennial Rubber Conference).
- (viii) Recommended planting material, (Revised circular for 1964).

EXPERIMENTS OF THE PLANT BREEDING SECTION

RESISTANCE BREEDING

Breeding for Oidium resistance

a. *Oidium* Testing Station — *Kepitigalla Group* — *Matale*. This experimental area was once again screened for resistance by the Head of the Division as well as by the Plant Breeder. Certain tentative conclusions are now possible on the basis of the screenings carried out over these last few years. It would appear that none of the imported *Dothidella*-resistant clones are fully resistant to *Oidium*. The results of this assessment will be reported elsewhere¹.

Towards the latter part of the year a modified *Hamaker-Morris-Mann* early tapping test was conducted at Kepitigalla. On the basis of this test combined with the results of the screening tests, experimental clones which had been planted originally at a close spacing will be selectively thinned. A complete set of girth measurements was also taken. A few of the *Dothidella*-resistant clones with relatively satisfactory *Oidium* tolerance also showed promising preliminary yield potentials. It was observed that the weaker trees of even tolerant clones could show some susceptibility during periods of optimum infection.

1. Wijewantha, Ronald T. Some breeding problems in *Hevea brasiliensis*. *Rubb. Res. Inst. Ceylon Quart J.* **41** (In press).

* Based on research studies elsewhere.

Other clones which showed favourable growth and yield when tested on this modified *Hamaker-Morris-Mann* system were :—

Clone	Parentage
444	RRIC 52 × PB 86
451	“ × “
566	“ × “
815	PB 5/139 × RRIC 52
828	“ × “
864	“ × “
1004	T 170 × RRIC 52
1010	T 170 × RRIC 52
1103	RRIC 52 × RRIC 7
1108	“ × “

b. Oidium Testing Station — Clodagh Group — Matala.— This testing station was established in 1963. The growth in this area was noted to be satisfactory although adverse weather conditions shortly after planting had resulted in an initial retardation in growth. The preliminary screening scheduled for late 1964 was postponed due to the absence of the Head of the Botany Division on end-of-contract leave during this period.

Breeding for Phytophthora resistance

a. Phytophthora Testing Station — Peenkande Group — Nivitigala. A modified *Hamaker-Morris-Mann* test as well as a full series of girth measurements was conducted in this area, and the following clones were selected for further trial.

Clone No.	Parentage
690 —	PB 86 × RRIC 52
691 —	“ × “
777 —	RRIC 52 × Tjir 1
788 —	PB 5/139 × RRIC 52
1067 —	T 792 × RRIC 52
1142 —	LCB 1320 × RRIC 45
1279 —	Ch 26 × RRIC 52
1289 —	RRIC 52 × RRIC 86
1330 —	RRIC 52 × PB 86
1460 —	RRIC 52 × T 792
1461 —	“ × “

With further screening of all the clones established at Peenkande, it has now been possible to select for further experimentation a certain number of *Phytophthora*-resistant clones which are at the same time resistant to *Dothidella*.

Breeding for Gloeosporium resistance

A *Gloeosporium* test planting was successfully carried out during the South West monsoon at Nakiadeniya Group in the Galle District. The test clones were planted alternately between plants of PB 86 in a double density planting of 6' × 20' spacing. On the basis of yield and secondary characters a preferential thinning will be carried out as in other test areas. The clones used were relatively few in number and selected mainly from material which had already shown very favourable secondary characters or yield in other trials.

The material planted was as follows :—

Established clones on test	RRIC 50
<i>Oidium</i> -resistant Selections	759, 815, 864, 1108
Selections from 1961 N. E. Planting at Kuruwita	79, 2040, 2018, 1923
Selections from <i>Phytophthora</i> Test Station at Peenkande	687, 1114, 739, 1067
<i>Phytophthora</i> screened <i>Dothidella</i> -resistant clone	IAN 6585
Nursery selections from 1961 H. P. Programme	3189, 3202, 3221, 3220
Nursery selections from 1962 H. P. Programme	6338
Alternate clone used throughout	PB 86

Preliminary observations on *Gloeosporium* susceptibility made towards the end of the year, showed about 50% more attack on PB 86 plants than on the test plants.

Hevea Breeding Stations — Monaragala District

a. Crown-Budded Area — Nakkala Estate. One tree of RRIC 7 was observed to flower and set seed. It is expected that more crown budded tops will come into flower next year. Distinctive labelling was maintained throughout the year.

b. Supplementary Station — Kumrarawatte Group. The clones established in this trial continued to show satisfactory growth and it was possible to carry out a preliminary yield test towards the end of the year. On the basis of this test a few of the more promising clones will be selected for a larger scale trial.

CLONE TRIALS

1961 — Small Scale Clone Trial — Kuruwita.

An average girth of 8.9 inches was recorded for this area.

1961 — Medium and Small Scale Clone Trial — Kuruwita.

This area, with routine maintenance continued to show satisfactory growth and an average girth of 7.9 inches was recorded.

1962 — Large Scale Clone Trial — Kuruwita.

The girth measurements for this area were as follows :—

Clone	No. of plants	Girth in inches	Clone	No. of plants	Girth in inches
RRIC 14	229	6.7	TR 3702	205	3.5
RRIM 623	256	6.3	RRIM 628	110	3.4
RRIC 51	249	5.2	PR 259	125	3.5
PB 86	227	5.3	TR 1548	197	4.0
AVROS 529	120	5.1	IAN 6497	115	3.8
RRIC 41	127	5.9	RRIC 7	109	4.3
WR 101	82	5.3	RRIC 52	269	5.6
RRIC 37	132	4.6	RRIM 701	253	6.2
Harbel 1	260	5.3	RRIC 36'	238	4.7
RRIC 45	262	5.3	RRIM 607	233	3.9
RRIM 707	246	3.6	AVROS 2037	240	4.9
IAN 45—717	227	4.8	PR 228	121	4.2
IRCI 7	124	4.2	PR 251	124	4.2
IRCI 9	120	3.7			—
Mean	—	—			4.7

In the small-scale clone trial within the above large-scale trial, and comprising 30 clones planted in 10-tree plots, an average girth of 4.8 inches was recorded.

1963 Small-scale Clone Trial — Kuruwita. A set of clones selected from hand-pollinated material for high yields and vigour was set down in a small-scale trial in 1963. The clones were as follows :—

Parentage	Clones
BD 10 × PR 107	108
RRIC 52 × PB 5/139	276
RRIC 52 × PB 86	466, 470, 1330
Tjir 1 × LCB 1320	1635, 3278, 3279, 3282, 1620, 1628
RRIC 52 × Tjir 1	739, 777, 779
Ch 26 × RRIC 52	1273, 1281
RRIM 513 × LCB 1320	2220, 2228, 2232, 2205
RRIC 45 × GPM 1	1501, 1516
RRIC 45 × LCB 1320	1831, 1866, 3570, 3606, 3607
RRIC 51 × LCB 1320	1894
RRIC 52 × RRIC 7	2011, 2029, 2044, 2053
RRIC 52 × Wagga 6278	2114, 2120, 2122, 2123, 2127

Parentage—(Contd.)	Clones—(Contd.)
RRIC 36 × RRIC 52	2133
RRIC 51 × PR 107	1714, 1729
PB 86 × RRIC 7	2135
RRIC 45 × RRIC 36	2163, 2164
PB 86 × RRIC 52	2169, 2170
RRIC 52 × LCB 1320	2265, 2268, 2270
RRIC 52 × RRIC 36	2273, 2275
RRIM 513 × RRIC 36	2276, 2284, 2286, 2298, 2299
RRIC 52 × AVROS 157	2303, 2305, 2309, 2317
RRIC 36 × RRIC 88	2974
RRIC 36 × Ch 26	2992, 2994, 2996
Ch 26 × Wagga 6278	3059, 3060
RRIC 45 × Wagga 6278	3071, 3076, 3101, 3106
LCB 1320 × Wagga 6278	3131, 3137
LCB 1320 × LCB 1320	3147, 3148, 3151
Tjir 1 × Ch 26	3180, 3182
Ch 26 × RRIC 36	3313, 3333, 3351
RRIC 52 × RRIC 52	4008, 4010, 4011
F 4542 × AVROS 363	FX 3925
PR 107 × Nab 20	T 57
RRIC 37 × Wagga 6278	T 132, T 140
Wagga 6278 × LCB 1320	3183, 3185, 3186
RRIC 88 × RRIC 36	3787, 3800
—	PB 86
—	IAN 6505
—	GT 711

This trial, unfortunately received a set-back during the course of the year as a result of the wanton destruction of certain clones during periods of labour unrest on this estate.

1964 — Clone Trial — Kuruwita — (S. W. Planting)

The following clones were planted in an 8-acre area lined at 12' × 20' with one or more replications of each clone.

Clone	Parentage
RRIC 55	PB 86 × Wagga 6278
RRIC 59	RRIC 8 × Hil 28
RRIC 60	RRIC 8 × Hil 28
RRIC 50	Tjir 1 × PB 86

PB 86 was planted as the control clone.

Between 50 to 100 plants each of the following clones were planted to fill in areas between replications and also broken areas.

Clone	Parentage
864	PB 5/139 × RRIC 52
759	RRIC 52 × Tjir 1
815	PB 5/139 × RRIC 52
6338	LCB 1320 × RRIC 7
1108	RRIC 52 × RRIC 7

1964 Clone Trial—Kuruwita—(N. E. Planting)

12 Acres were planted with the following clones on a large-scale trial with several replications of each clone.

Clone	Parentage
1108	RRIC 52 × RRIC 7
1103	×
864	PB 5/139 × RRIC 52
566	RRIC 52 × PB 86
784	PB 5/139 × RRIC 52
815	PB 5/139 × RRIC 52
PB 86	Control.

Planting was commenced on September 29th and completed on October 7th, 1964.

Two more small separate areas were planted with 47 plants of RRIC 50 and 54 plants of RRIC 55. PB 86 was planted as the control clone.

Approximately 15 plants each of the following hand-pollinated progeny selections were also planted during the N.E. Season.

Parentage	Clone Nos.
RRIC 36 × RRIC 52	2981, 1988, 1987
Ch 26 × RRIC 52	1269
LCB 1320 × RRIC 7	6308, 6333, 6336, 6309, 6327, 6310, 6323, 6328, 6326

Approximately 15 plants each of the following clones from the 1961 clone trials at Kuruwita and selected on the basis of growth were also planted.

Parentage	Clone Nos.
RRIC 45 × RRIC 51	1361
PB 5/139 × RRIC 52	885
Mil 3/2 × Tjir 1	266, 258
RRIC 52 × PB 86	506, 513
Wagga 6278 × Tjir 1	279
Tjir 1 × RRIC 50	359
RRIC 52 × RRIC 86	1290
RRIC 45 × RRIC 13	1152

HAND POLLINATION PROGRAMME

The hand pollination programme was extended this year to estates outside Dartonfield Group. Very warm weather during the early part of the year resulted in early flowering. The flowering period was considerably shortened due to premature fall, and as a result the number of pollinations made in a given cross fell short of expectations. The success of fruit set in key clones selfed for purposes of homozygosity and long-term projects, was nil in some cases, demonstrating perhaps complete or nearly complete self-sterility. A few late pollinations were made at Peenkande Group between IAN 45-710 and RRIC 52. The detailed results of the 1964 hand pollination programme are shown in Appendix I, and the summarised results in respect of the number of pollinations carried out are shown in Table I.

TABLE I
No. of Pollinations
No. of first successes

	IAN 6497	IAN 6584	IAN 6587	H. <i>spru- ccana</i>	LCB 1320	PB 28/59	PB 86	RRIC 45	RRIC 52	W.J. 1	IAN 6500	IAN 45-710	IAN 45-717
IAN 6497	—	—	—	<u>708</u> 23	—	—	—	—	<u>4215</u> 295	—	—	—	—
IAN 6584	—	—	—	<u>183</u> 5	—	—	—	—	<u>1616</u> 146	—	—	—	—
IAN 6587	—	—	—	<u>478</u> 37	—	—	—	—	<u>1538</u> 206	—	—	—	—
<i>H. spruceana</i>	—	<u>289</u> 22	<u>86</u> 1	<u>743</u> 10	—	—	—	—	<u>1223</u> 61	—	—	—	—
LCB 1320	—	—	—	—	<u>1300</u> 24	—	—	—	—	—	<u>148</u> 5	—	—
PB 28/59	<u>45</u> 1	—	—	—	—	<u>278</u> 1	—	—	<u>222</u> 5	—	—	—	—
PB 86	—	—	—	—	—	—	—	—	<u>2299</u> 82	<u>1090</u> 1	—	—	—
RRIC 45	<u>69</u> 3	—	—	—	—	<u>143</u> 23	—	<u>50</u> 1	<u>24</u> 6	—	—	—	—
RRIC 52	<u>237</u> 6	—	—	<u>1730</u> 11	—	—	<u>4344</u> 283	—	<u>5332</u> 38	<u>670</u> 6	<u>334</u> 2	<u>159</u> 1	<u>713</u> 7
W. J. 1	—	—	—	—	—	—	—	—	<u>2740</u> 6	—	—	—	—

Number of unsuccessful crosses = 4796

FLOWER INDUCEMENT

As in the previous year general care and labelling of the pollarded areas at Nivitigalakele was continued. It was found possible to utilize flowers of the IAN 6000 series to a fair extent from trees in this area. The concentration of hand-pollinated flowers here made after-care easier and more effective.

Further experiments using extended day-length and multiple budgrafting for the induction of flowering were curtailed because of an uncertain and interrupted electricity supply.

The grafts of the prematurely flowering mutant clone H 440 at Nivitigalakele commenced flowering as predicted, one year after planting. This supports our suspicion that earliness in this clone is a result of a mutation. For confirmation the suspected mutant has been selfed and also crossed to its putative parents. A note on this is under preparation for publication.²

EPIPHYTIC INDUCTION

In order to conduct very early preliminary screening, attempts were made to induce epiphytotic diseases at nursery level. It was found that the use of movable sheds constructed of aluminium angle and covered with jute hessian facilitated the spread and intensity of *Oidium* and, in some cases, *Gloeosporium* attack. In order to conduct these trials on a bigger scale cheaper shading materials such as cadjans were found satisfactory. Different spreading and sticking agents were also found to have an appreciable effect on the spread of disease under these conditions. These investigations are being continued.

In another experiment it was found that *Phytophthora* leaf disease could be invariably induced in nursery plants by suspending over them infected *Hevea* pods in a nylon mesh bag or on a nylon mesh tray, followed by regular watering each day for a few days to wash down spores on to the plants below. A more detailed note on this is under preparation for publication elsewhere.³

A large nursery of Tjir 1 seedlings was set down for purposes of initiating a series of other experiments in which it was intended to standardise epiphytotic induction of all or individual leaf diseases.

EXPERIMENTS OF THE BOTANICAL SECTION

YIELD STIMULATION EXPERIMENTS

With the closing down of the first three experiments on yield stimulation by the end of 1963, there are only two further experiments to be reported on in this review.

Experiment No. 4 in this series was set down in January 1962 in an old seedling rubber area with a view to comparing the efficacy of 3 proprietary products. In December 1962 one of these (Ready Rub) was replaced with RRIC Mixture I due to the non-availability of the former in Ceylon at that time. For a similar reason RRIC Mixture II was substituted for Stimulex in January 1964.

As in previous years only one application of stimulant per year was possible owing to rainy weather. The results for 1964 are represented in the form of histograms in Fig. 1 and in detail in Appendix II.

2. Wijewantha, Ronald T. & D. M. Fernando. An early flowering mutant of rubber *Hevea brasiliensis* Muell. Arg. (In preparation).

3. Fernando, D. M. & Ronald T. Wijewantha. A method for inducing *Phytophthora palmivora* (Butl.) infection of *Hevea* clones. (In preparation).

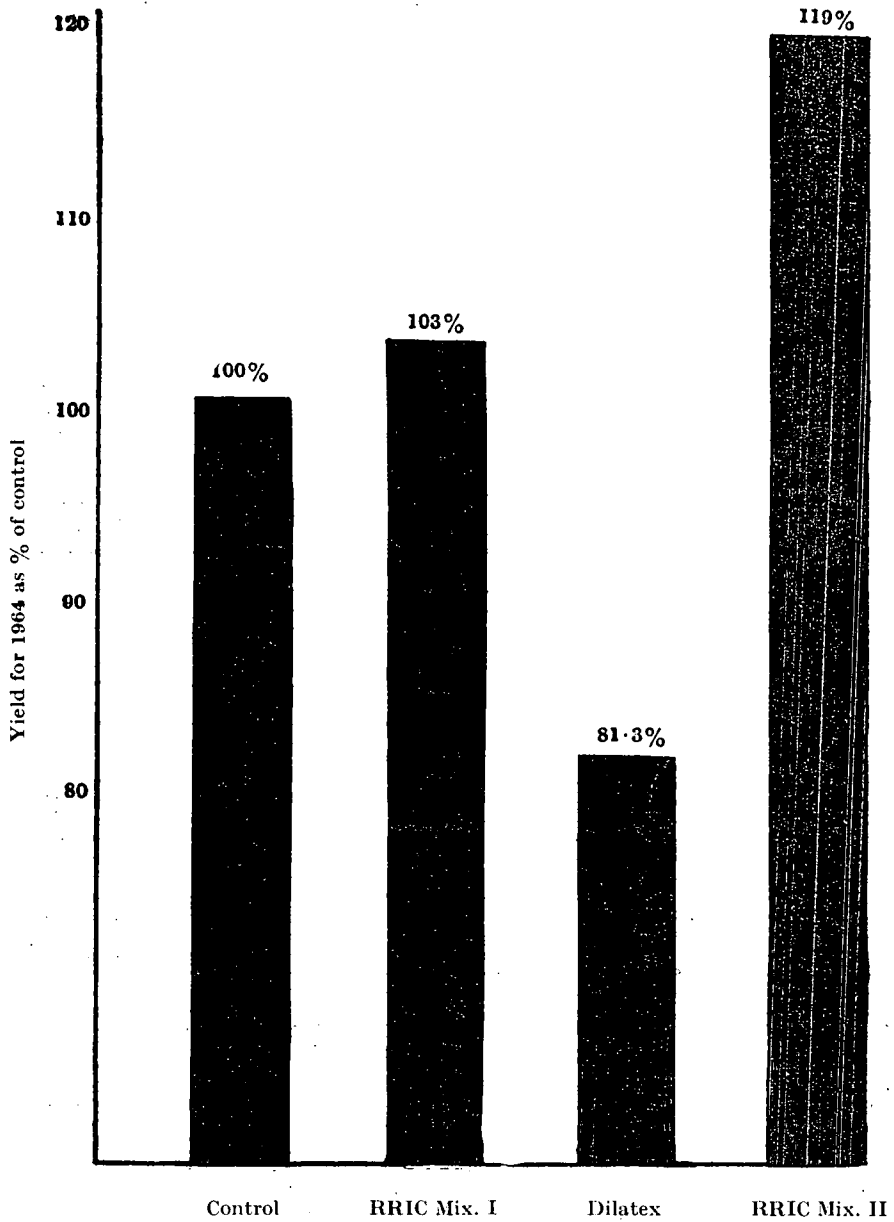


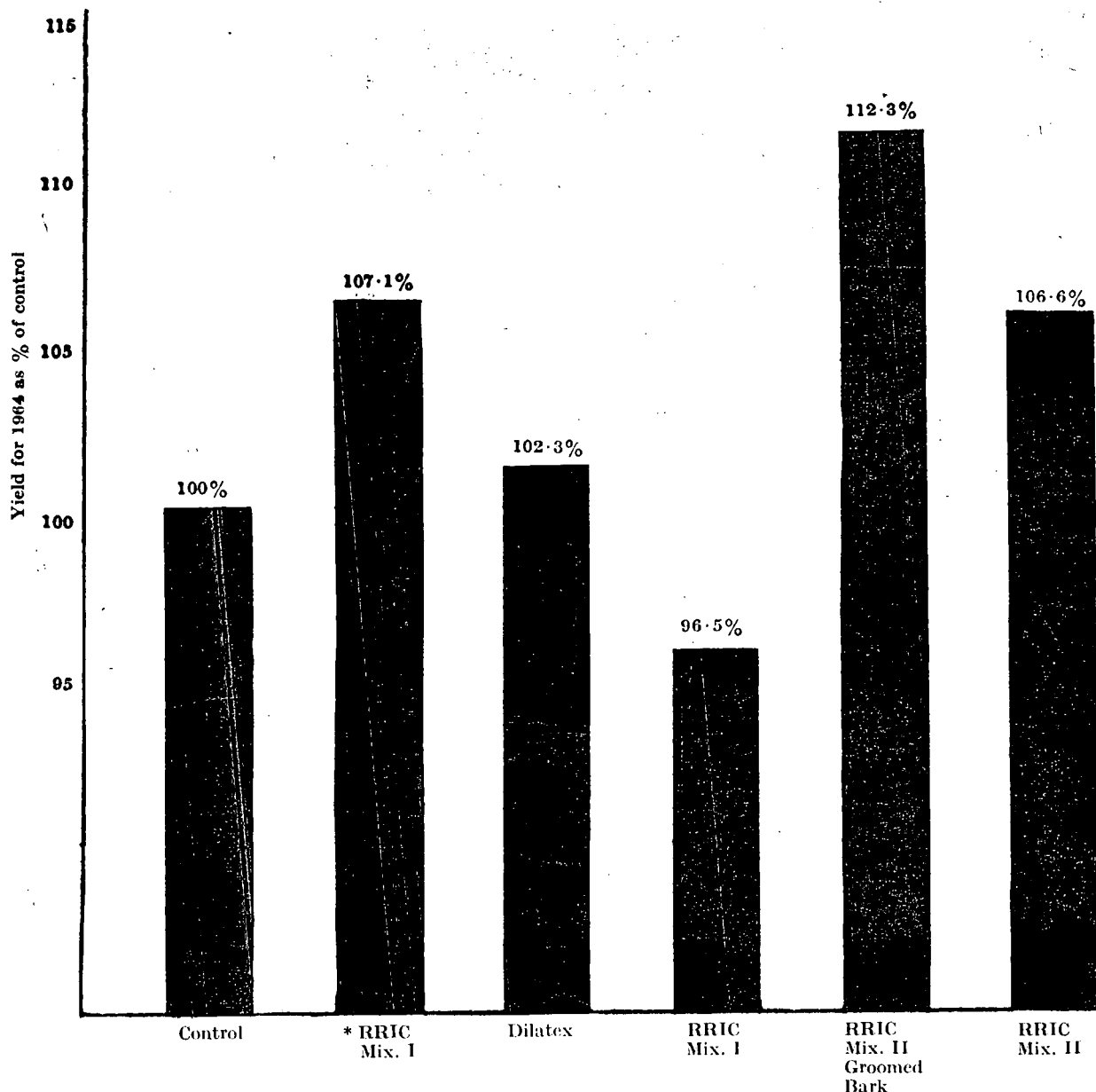
FIG. 1—YIELD STIMULATION EXPERIMENT 4

This experiment was discontinued in July 1964 as this area had to be released for intensive tapping prior to replanting.

In experiment No. 5 sited in a polyclone block of 30-year old rubber at Kuruwita Sub-station, the treatments were as follows :—

1. Stimulex applied on 1½" width scraped bark below the tapping cut.
2. Dilatex " " " " " " " " " " "
3. RRIC Mixture I " " " " " " " " " "
4. RRIC Mixture II on 1½" width bark below tapping cut groomed with a wire brush.
5. RRIC Mixture II 1½" width bark below tapping cut on ungroomed bark.

Although the plan was to make applications at 6 monthly intervals in both 1963 and 1964, only one application per year was possible owing to heavy rains. The results are represented graphically in Fig. 2 and in detail in Appendix III. RRIC Mixture II applied on ungroomed bark was found to be superior to the other stimulants, while application of Mixture II on to groomed bark gave even better results (Fig 2).



* Originally Stimulex but replaced by RRIC Mix. 1 in January 1964.

FIG. 2—YIELD STIMULATION EXPERIMENT 5

TAPPING EXPERIMENTS

1954 *Tapping Experiments — Dartonfield*: This experiment was initiated at Dartonfield in 1954 and consists of two treatments.

(a) Tapping at 42" from the union.

(b) Tapping at 50" from the union.

The yield figures for 1964 are presented in Table II.

TABLE II
1954 TAPPING EXPERIMENT — DARTONFIELD

Tapped S/2, d/2, 100%

Yield in grams per tree per tapping

		Tapping height 42"			Tapping height 50"		
		Virgin bark thickness in mm.	Girth in inches at 5 ft	Yield in grams	Virgin bark thickness in mm.	Girth in inches at 5 ft	Yield in grams
RRIC	8	7.6	26.3	21.1	8.0	26.6	16.5
"	16	7.2	28.9	21.8	8.0	30.5	22.3
"	17	7.4	26.8	21.8	8.0	29.0	26.2
"	18	7.6	26.3	17.5	7.2	26.4	18.3
"	20	8.0	24.6	19.1	7.6	25.2	21.9
"	21	5.6	25.5	25.4	6.6	26.0	12.7
"	22	7.5	27.4	25.7	7.7	25.2	24.2
"	23	7.0	23.8	13.9	7.0	24.9	16.2
"	24	7.6	29.1	21.2	7.2	30.4	18.9
"	25	7.0	23.2	8.1	6.8	24.3	10.3
"	26	7.2	25.2	15.6	7.4	25.5	18.1
"	27	7.5	20.3	8.2	7.4	21.1	6.6
"	28	7.2	26.2	26.0	7.5	27.6	30.0
"	30	8.0	27.4	20.3	9.5	25.6	29.4
"	31	6.5	25.6	27.7	7.0	27.9	23.1
"	32	7.0	21.4	17.7	6.5	21.1	18.2
"	33	7.0	22.2	24.0	7.4	23.8	30.3
"	34	9.3	22.1	22.2	9.2	23.5	27.0
"	35	7.3	24.5	25.4	8.2	24.2	26.8
"	36	9.5	27.3	34.4	10.2	29.8	36.0
"	37	8.0	22.6	22.2	8.0	25.9	23.5
"	54	8.2	27.2	29.5	8.4	28.7	31.5
"	57	7.4	24.5	24.4	7.5	27.6	35.5
PBT	207	9.7	29.1	21.5	7.7	28.8	25.3
PB	24/3	8.0	24.4	27.0	8.0	24.2	26.2
PB	24/51	8.0	22.2	17.3	6.3	22.2	12.7
Mean		7.7	25.2	21.5	7.7	26.0	22.6

1964 *Winter Tapping-cum-Yield Stimulation Trial*

A small-scale replicated experiment was set down in 1964 to investigate the differential response of clones to long-term stimulation with and without winter rest. This trial is sited in the 1952 clearing of PB 86 and Nab 15 at Dartonfield which had first come into tapping in March 1958. The preliminary results are presented in Table III.

TABLE III
WINTER TAPPING AND YIELD STIMULATION EXPERIMENT
CROWN BUDDED AREA — DARTONFIELD

Yield in grams per tree per tapping
Test-tapped from March 1964

Block	RED			WHITE			BLUE			GREEN		
	No. of trees	Yield 1964	Girth in inches	No. of trees	Yield 1964	Girth in inches	No. of trees	Yield 1964	Girth in inches	No. of trees	Yield 1964	Girth in inches
	(Nab 12)											
I	20	39.0	25.9	20	34.6	25.6	20	33.6	26.1	18	33.3	25.9
II	20	64.8	27.8	20	67.1	28.3	20	45.0	26.4	18	47.6	27.4
III	20	59.4	28.9	18	54.3	29.9	15	74.0	24.7	20	67.4	28.9
	60	54.4	27.5	58	52.0	27.9	55	50.9	27.5	56	49.4	27.4
	(PB 86)											
I	20	38.1	26.9	20	45.4	27.9	20	34.8	28.0	20	46.6	28.6
II	20	44.4	26.8	18	45.4	26.6	15	34.8	25.9	17	44.3	28.7
III	20	34.6	27.3	20	39.8	26.9	20	37.4	27.1	20	34.2	26.3
	60	39.0	27.0	58	43.5	27.1	55	35.7	27.0	57	41.7	27.9

Red — Yield stimulation of virgin bark/tapping without winter rest.

White — Yield stimulation of virgin bark/tapping with winter rest.

Blue — No stimulation and tapping without winter rest.

Green — No stimulation and tapping with winter rest.

In trees stimulated, RRIC Mixture I was applied on a $1\frac{1}{2}$ " strip of scraped bark below the tapping cuts twice a year at 6-month intervals.

CLONE EVALUATION TRIALS

H. P. Seedlings and Derivatives

The test tapping of clones established in a small-scale trial from hand-pollinated seedlings derived from the 1939-41 and 1943-45 hand pollination programmes was continued in 1964 (Appendix IV). In this trial 3-5 trees of the original bud-grafts are test-tapped. While the results are of interest, a confirmation and final assessment of the better yielding clones will be possible only from observations in large-scale replicated clone trials.

RRIC 88 & 89

These two clones were established from two selected high-yielding Prang Besar clonal seedlings. They continue to maintain high yields and have good morphological characteristics which are more pronounced with age (Fig 3).

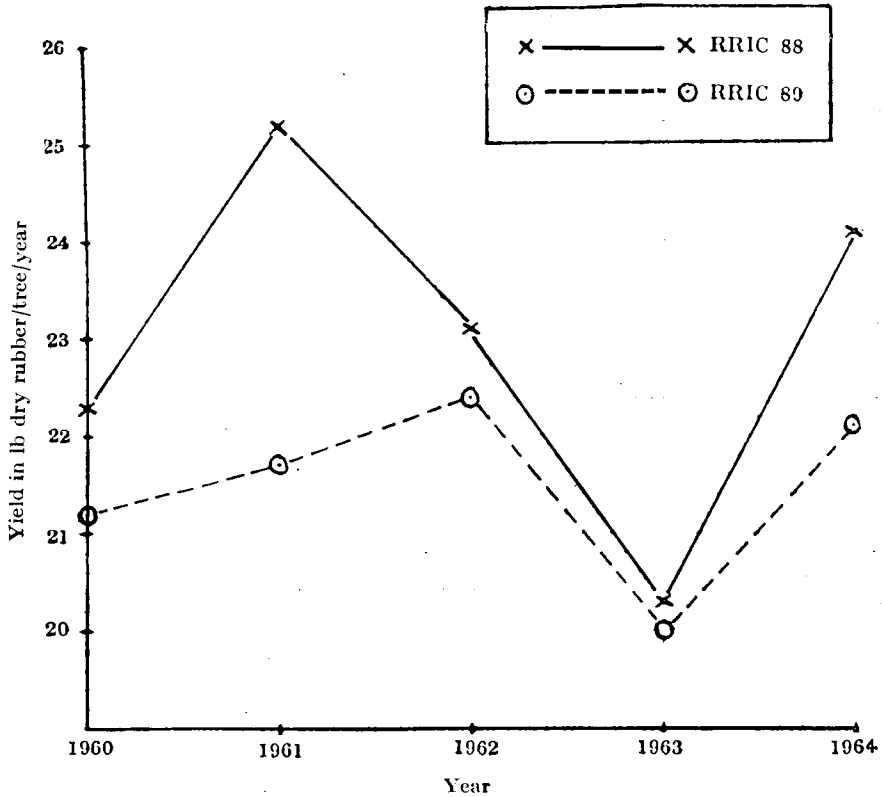


FIG. 3 — CLONE EVALUATION TRIAL — RRIC 88 & 89

The fluctuations in yield are due to various factors and are accentuated by the fact that these clones have not been set down in a replicated fashion.

Clone trial of selections from among the 1945 Hand-Pollinated Seedlings—Hedigalla.

The yield figures for 1964 in respect of the 6 clones which now remain in this 1952 5-tree trial after rigorous selections are depicted below (Fig 4).

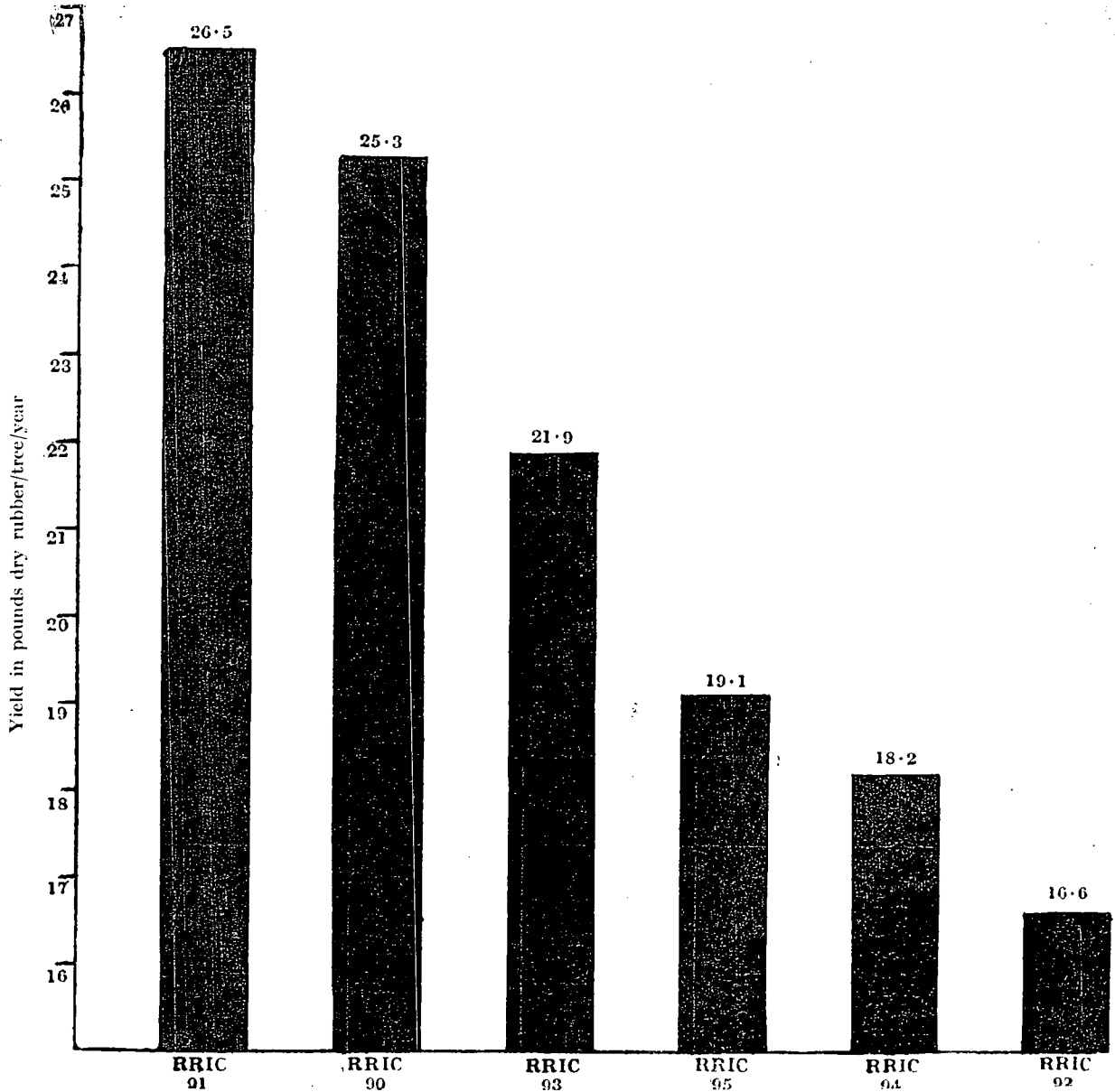


FIG. 4—CLONE TRIAL OF HAND-POLLINATED SEEDLINGS 1945—HEDIGALLA

[The Histograms represent yields in the 5th year of tapping.]

1939 Clone trial — Nivitigalakele. This trial will be abandoned in 1965 as the control clone PB 86 continues to considerably outyield the test clones Nab 12 and Nab 15.

1940 Clone trial — Nivitigalakele. In this unreplicated yield trial the control clone Wagga 6278 outyielded all other clones (Table IV).

TABLE IV
1940 CLONE TRIAL — NIVITIGALAKELE
Tapped S/2, d/2, 100%
Yield in lb dry rubber per tree per year

Clone	No. of trees tapped	Yield			No. of trees affected			Mean girth in inches 1964	Bark thickness in mm.	
		1962	1963	1964	Canker and Bark Rot	Brown Bast	Wind damage		Virgin	Re-newed
RRIC 1*	16—14	19.4	19.1	15.1	3	9	1	47.2	14.3	11.6
PR 107	19—18	15.1	14.8	15.5	12	4	2	33.3	12.5	9.9
RRIM 501*	9— 8	15.1	15.7	15.9	2	7	13	28.9	11.9	9.3
RRIM 513	18—16	10.0	9.3	9.0	2	9	—	27.7	10.9	8.3
Control Wagga 6278	17—14	18.1	18.4	19.1	5	1	6	34.8	14.1	11.7
Tjir 1*	13	13.6	12.5	14.0	1	10	6	32.7	12.3	9.3

* Test tapping stopped from 1-12-64

1954 Clone trial — Nivitigalakele. PB 28/59 once again proved itself superior to all other clones in this trial (Table V). This clone is already included in our list of other clones recommended for planting on a limited scale.

TABLE V
1954 CLONE TRIAL — NIVITIGALAKELE
Tapped S/2, d/2, 100% from March 1960
Yield in lb dry rubber per tree per year

	IRCI 10	IRCI 7	PB T-207	PB 6/5	PB 24/3	PB 28/59	PB 24/51	RRIM 501
Yield in 1961	18.8	10.2	7.0	8.9	8.6	14.2	7.6	9.7
„ „ 1962	10.5	9.2	9.5	10.2	9.0	15.3	8.3	11.9
„ „ 1963	8.4	8.8	9.1	10.3	10.5	14.2	9.0	12.6
„ „ 1964	9.1	9.5	10.7	11.9	12.0	15.1	10.3	13.6
No. of trees tapped in 1964	111-95	159-150	106-74	157-147	149-138	139-136	159-155	159-140
Canker and Bark Rot cases	2	3	5	1	3	3	—	4
Brown Bast cases	20	7	11	15	16	17	9	13
Wind damage cases	68	22	98	15	17	21	7	35
Total casualties to date	90	32	114	31	36	41	16	52
Mean Girth in inches 1964	22.8 /	26.7	24.9 /	23.5 /	25.5 /	26.0 /	26.4 /	24.7 /
Virgin bark thickness in mm.	6.8	7.7	8.6	7.9	7.9	8.8	7.6	8.2

1944 Small-scale clone trial — Hedigalla. In this clone trial the test tapping of the 3 original budgrafts of RRIC 52 was continued. The results are presented in Table VI.

TABLE VI
1944 SMALL-SCALE CLONE TRIAL — HEDIGALLA
Tapped S/2, d/2 100%
Yield in lb dry rubber per tree per year

Clone	No. of trees tapped in 1964	Yield					
		1959	1960	1961	1962	1963	1964
PB 5/122	3	23.8	35.5	29.8	22.8	30.2	31.1
RRIC 52	2	25.1	31.2	35.6	33.0	41.4	43.1
Control Wagga 6278	5	20.1	26.7	25.9	21.7	23.2	29.3

Chemara clones — 1950 Clone trial — Hedigalla. Ch 26 in this replicated yield trial outyielded the control PB 86 in 1964. The results so far brings out a considerable fluctuation in clonal behaviour (Table VII) from season to season.

TABLE VII
CHEMARA CLONE TRIAL, 1950 — HEDIGALLA
Tapped S/2, d/3 67% from March, 1957
Tapped S/2, d/2 100% from 1960
Yield in lb dry rubber per tree per year

	Ch 26	Ch 3	Ch 31	PB 86 Control
Yield 1961	24.7	16.6	9.6	14.3
Yield 1962	27.0	19.4	13.1	18.1
Yield 1963	20.1	26.7	11.8	20.1
Yield 1964	22.6	19.2	13.6	20.7
No. of trees tapped, 1964	31—29	50—41	64—61	70—68
Bark Rot and Canker cases	—	1	—	2
Brown Bast cases	—	—	—	—
Wind damage cases	—	8	3	—

Test tapping of RRIC clones 2-7

These clones were early selections from 190 three-tree clones established from Prang Besar seedlings in 1937. The test tapping results of clones finally selected for further trial are presented in Table VIII.

TABLE VIII

1945 CLONE TRIAL — HEDIGALLA
Tapped S/2, d/2, 100% from 1956
Yield in lb dry rubber per tree per year

	RRIC 4	RRIC 5	RRIC 7	Tjir 1 Control
Yield 1960	17.5	18.8	21.0	17.6
Yield 1961	14.2	18.9	18.4	16.6
Yield 1962	18.0	22.7	28.7	19.5
Yield 1963	14.4	20.2	19.5	15.5
Yield 1964	11.4	23.6	21.5	17.5
No. of trees tapped in 1964	49	55	69	66
Brown Bast Cases	—	—	—	—
Wind damage Cases	—	—	—	—

1949 Clone trial — Hedigalla. The test tapping of the major proportion of the 31 clones originally planted in this clone trial has been discontinued for a number of years on the basis of growth, yield, and secondary characters. The test tapping figures in respect of the more promising clones for the period 1962-1964 are given below (Table IX).

TABLE IX

1949 LARGE-SCALE CLONE TRIAL — HEDIGALLA
Tapped S/2, d/2, 100%
Yield in lb dry rubber per tree per year

Clone	No. of trees tapped 1964	Yield			% Casualties upto 1964
		1962	1963	1964	
RRIC 86	76—74	21.0	19.3	20.9	50.7
RR 29	114—113	16.9	16.7	20.2	24.7
Nab 20	69	20.2	17.5	18.9	54.0
RRIM 501	74—67	17.7	13.8	18.2	55.3
PB 86	108	15.6	15.7	18.1	28.0
RRIC 52	106—105	15.6	14.9	17.4	30.0
Dar. 38	105—104	11.6	12.5	16.5	30.7
RRIC 87	120—119	13.6	12.6	13.5	20.7
RRIM 513	111—109	13.4	11.6	13.0	27.3
RR 44	118—100	—	8.9	6.6	33.3

This clone trial is sited in an area exposed to strong monsoon storms and big losses of trees have been noted. The casualties resulting from storm damage as well as diseases are very high as can be seen from the table. In certain clones it is observed that less than half of the original planting of 150 trees per clone remain in tapping at the present time.

1954 Clone trial — Hedigalla. Test tapping in this trial is commenced in each clone as it reaches tappable girth. A few more clones came into tapping in 1964 so that in all 31 clones are presently under yield test. Of these clones, 7 reached tappable girth in 1961, 10 more in 1962, a further 11 in 1963 and 3 more clones in 1964. The results of test tapping in this trial area (Table X) are therefore not strictly comparable and comments and conclusions could be usefully delayed for the present.

TABLE X
1954 LARGE-SCALE CLONE TRIAL — HEDIGALLA
First tapped in July 1961 on S/2, d/2, 100%
Yield in grams per tree per tapping

Clone	No. of trees tapped 1964	Yield		
		1962	1963	1964
RRIC 36	677—539	33.0	41.1	41.8
RRIM 501	681—662	28.2	39.6	39.7
RRIC 35	764—563	33.5	32.2	30.6
„ 28	510—493	32.0	29.5	28.6
„ 37	579—547	28.8	23.0	28.4
„ 18	669—569	24.1	27.7	26.8
„ 22	713—645	25.1	21.7	26.8
„ 34	590—581	36.3	32.3	26.3
„ 19	568—551	16.0	18.5	25.3
AVROS 255	898—821	21.3	23.6	24.5
RRIC 16	697—660	16.8	14.4	22.4
„ 29	511—415	16.7	18.3	21.9
„ 26	593—532	14.6	13.3	15.7
„ 31	695—620	21.0	14.7	15.6
„ 21	654—551	14.4	10.4	15.4
„ 24	687—653	10.7	10.9	14.2
„ 25	554—526	16.7	12.7	13.4
PB 86*	528—467	—	32.9	31.0
PR 107*	673—591	—	31.8	25.6
RRIC 33*	520—442	—	34.3	24.9
„ 32*	594—574	—	21.4	23.6
„ 17*	548—500	—	21.7	19.7
„ 23*	640—497	—	16.6	15.5
'H' Block Seedlings *	1968—1936	—	27.9	30.4
LCB 870 × Tjir 1 (B) *	186—168	—	19.3	19.6
„ × Mill 3/2 *	196—185	—	14.3	17.1
„ × PR 107 *	198—188	—	16.0	16.3
„ × Tjir 1 *	177—167	—	16.2	17.6
IRCI 10 **	480—455	—	—	17.6
NL 1 **	54—50	—	—	17.4
PR 107 'K' Block **	83—72	—	—	10.3

* First tapped May 1963

** First tapped March 1964

1955 Clone trial — Hedigalla. This clone trial includes 12 RRIC clones in large mono-clonal blocks of 750 trees each. Test tapping was commenced in June 1962 when the trees reached a tappable girth of 20 inches and over. The results are presented in Table XI.

TABLE XI

1955 LARGE-SCALE CLONE TRIAL — HEDIGALLA
Yield in grams per tree per tapping

Clone	No. of trees tapped 1964	Yield			Girth in inches 1964	Bark Rot and Canker	Brown Bast	Wind damage	
		1962	1963	1964				Branch and Stem	Up-rooted
RRIC 40	510—488	28.5	32.4	42.0	23.8	—	—	6	10
„ 50	568—549	17.7	33.2	38.4	21.6	—	13	—	6
„ 46	554—513	31.1	36.0	36.2	20.8	—	—	23	18
„ 41	568—566	30.3	31.3	35.0	22.4	—	—	—	2
„ 13	603—591	30.3	33.1	34.8	21.6	—	3	2	7
„ 11	530—500	21.6	24.8	27.4	23.8	—	5	—	25
„ 47	594—585	20.3	27.0	26.2	21.3	—	4	—	5
„ 12	559—514	15.2	18.9	24.1	25.6	—	13	—	32
„ 43	591—576	25.4	23.7	23.0	21.8	—	—	—	15
„ 9	609—597	19.5	21.4	22.6	24.2	—	4	3	5
„ 49	579—552	23.1	20.0	20.1	23.5	—	16	1	10
„ 14	657—630	21.3	17.2	19.8	23.3	—	4	—	23
Mean		23.6	26.6	29.1					

1953 Clone trial — Nivigalake. The hybrid clones RRIC 44 and 45 were budded in the field in 1955 on to two-year old stocks. There are approximately 700 trees each of the two clones in this clearing. The mature trees were brought into tapping in January 1962 for an early confirmation of the high-yielding characteristics of these clones. The yield figures and girth measurements for 1964 are presented in Table XII.

TABLE XII

1953 LARGE-SCALE CLONE TRIAL—NIVITIGALAKELE
Tapped S/2, d/2, 100%
Yield in lb dry rubber per tree per year

	RRIC 45	RRIC 44
No. of trees tapped in 1964	588—548	476—498
Yield 1962	8.9	10.8
Yield 1963	10.2	11.3
Yield 1964	10.6	11.7
Brown Bast cases	5	7
Bark Rot and Canker cases	1	9
Wind damage cases	27	5
Mean girth in inches, 1964	24.3	22.7
Thickness of Virgin Bark in mm.	7.5	7.2

1956 Clone trial — *Hedigalla*. Local and foreign clones were planted in 300-tree monoclonal blocks in this trial and brought into tapping as individual clones reached tappable girth (Table XIII).

TABLE XIII
1956 LARGE-SCALE CLONE TRIAL—HEDIGALLA

Yield in grams per tree per tapping

Clone	No. of trees tapped	Average girth in inches	Yield in grams per tree per tapping
	1964	1964**	1964
PR 257 -	153—152	22.5	20.5
RRIM 618 ✓	236	22.4	29.7
PR 252 .	202—195	22.0	24.5
IRCI 9 -	219—205	23.2	23.7
RRIC 55 -	169—167	21.3	22.2
PB 86 -	226—238	22.8	20.6
IRCI 5 ..	238	21.2	19.6
AVROS 1191 -	195—183	21.0	19.5
PR 228 ✓	217—214	21.2	18.8
RRIM 603 ✓	239—246	21.5	15.9
RRIM 605 -	219—216	22.3	14.7
RRIM 612 -	253—244	25.1	9.8
RRIC 48 *	152	21.2	26.0
PR 253 * ✓	154—156	20.4	25.7
RRIC 39 * -	160	21.1	21.7
RRIM 617 * ✓	227—228	22.6	20.3
AVROS 1447 *	158	21.1	17.3
RRIC 54 * -	192—195	21.2	15.8
RRIC 59 * -	152—162	21.8	15.9
PR 258 * ✓	141—150	20.0	15.5

* First tapped March 1964.

** of trees in tapping

1956 Clone trial — Dartonfield. Clones GT 1, WR 101, AVROS 385 and AVROS 427 were planted in 300-tree monoclonal blocks at Dartonfield in 1956 and came into tapping in 1963. The yield figures for 1964 are represented graphically in Fig. 5.

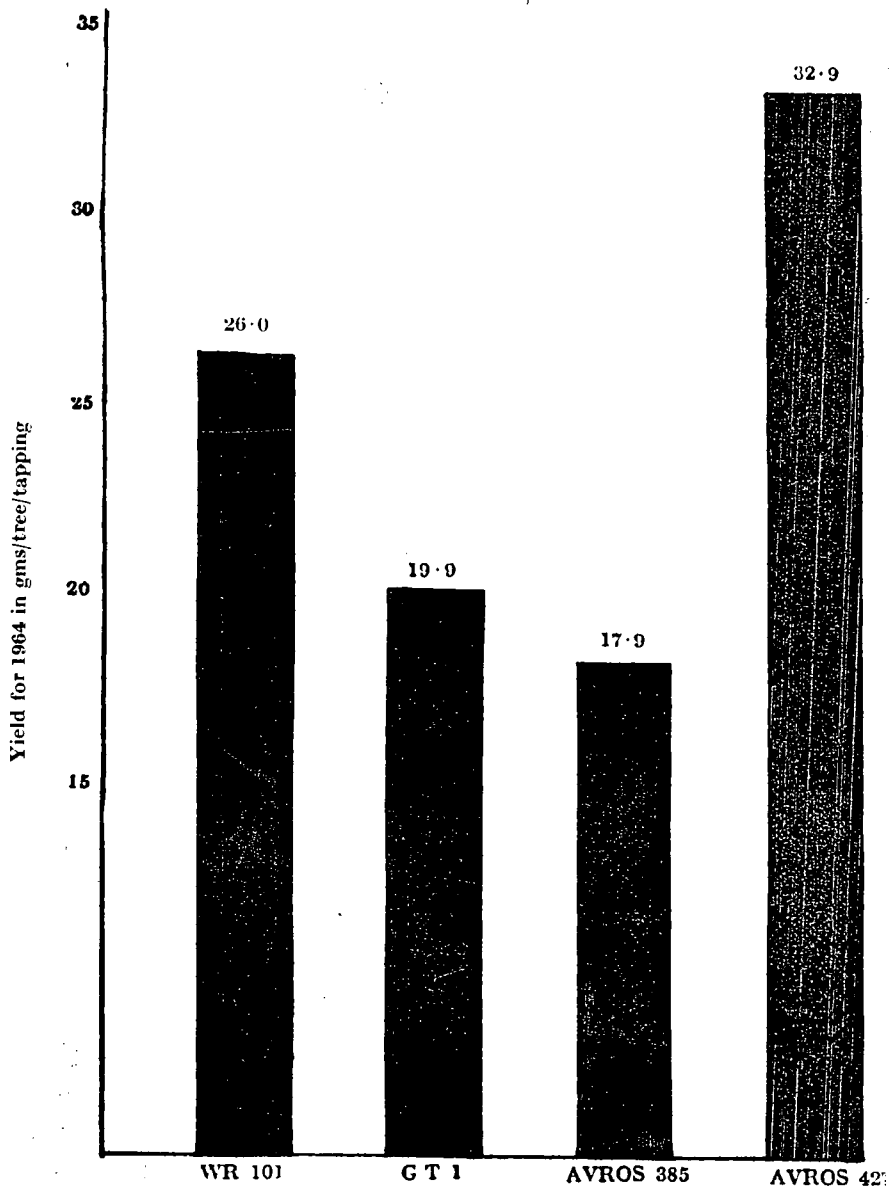


FIG. 5—1956 CLONE TRIAL—DARTONFIELD

GROWTH MEASUREMENTS IN IMMATURE AREAS

The annual review for 1963 details the reasons for taking girth measurements as well as the procedure adopted.

1957 Clone trial — Hedigalla. This trial area contains a large number of clones which were planted in September/October 1957. Over the entire area, the annual girth increment averaged only 2.3" per tree as compared with a girth increment of 2.6" per tree in 1963. This once again confirms the earlier observations regarding poor growing conditions in this area as well as inherent soil infertility.

1961 Large Scale Clone trial — Dartonfield. This clone trial was planted in 1961. Two tapping tasks of clones RRIC 88 and 89, PB 28/59 and PB 86 were planted in the South-West monsoon season, while the rest of the clones were planted in the North-East monsoon season. A summary of the girth measurements for 1964 as well as the recorded girth increments for 1963/64 are presented in Table XIV.

TABLE XIV

1961 LARGE-SCALE CLONE TRIAL — DARTONFIELD

Average girth in inches

	RRIC 52*	RRIC 7*	RRIM 513*	RRIC 45*	PB 86**	RRIC 88**	PB 28/59**	RRIC 89**
No. of trees	516	470	527	558	559	531	558	507
Average girth in 1963	5.1	4.6	4.4	5.8	5.2	4.7	4.9	4.0
Average girth in 1964	8.4	7.6	7.7	9.2	7.7	8.3	7.3	6.1
Girth increase 1963/64	3.3	3.0	3.3	3.4	2.5	3.6	2.4	2.1

* Planted in 1961 N.E.

** Planted in 1961 S.W.

EXPERIMENTS ON COMMERCIAL ESTATES

1957 Clone trial — Estate A — Kalutara District. This clone trial was planted in May-June 1957. It consists of clones set down in 300-tree monoclonal blocks for tapping as separate tasks in later years. A summary of the girth measurements taken in 1964 are presented in Table XV.

TABLE XV

1957 SMALL-SCALE CLONE TRIAL — ESTATE A — KALUTARA DISTRICT

Average girth in inches

	TR 1406	AVROS 529	IRCI 2	IRCI 3	RRIM 607	PB 86 control	Mean
Girth 1964	23.4	21.8	23.0	21.3	22.3	19.8	21.9
„ 1963	21.1	19.3	20.6	19.0	19.6	17.6	19.5
„ 1962	17.5	15.6	16.8	15.5	16.2	14.4	16.0
„ 1961	13.5	12.0	12.5	11.5	11.8	11.0	12.0
Increase 1963/64	2.3	2.5	2.4	2.3	2.7	2.2	2.4

1957 Clone trial — Estate B — Kalutara District. In a trial similar to the above, 5 other promising clones were set down for testing against PB 86 in a 10-acre block, and 11 others against PB 86 in a 20-acre block. The girth data in respect of this trial are given in Tables XVI & XVII.

TABLE XVI

1957 CLONE TRIAL — ESTATE B — KALUTARA DISTRICT (10-ACRE BLOCK)

Average girth in inches

	TR 1548	RRIM 612	AVROS 2037	AVROS 1734	PR 254	PB 86 control	Mean
Girth 1964	24.7	25.5	25.1	23.5	22.6	20.8	23.7
„ 1963	22.4	22.3	21.7	21.0	20.5	18.9	21.1
„ 1962	19.3	19.2	18.4	18.3	17.5	16.3	18.1
„ 1961	15.5	15.5	15.0	15.0	14.3	13.3	14.8
Increase 1963/64	2.3	3.2	3.2	2.5	2.1	1.9	2.6

TABLE XVII

1957 CLONE TRIAL — ESTATE B — KALUTARA DISTRICT (20-ACRE BLOCK)

Average girth in inches

	RRIC 75	RRIM 603	RRIM 602	RRIC 76	RRIM 623	RRIM 622	RRIC 60	TR 1542	RRIC 61	WR 101	PR 248	PB control	Mean
Girth 1964	24.5	22.5	22.5	22.0	22.6	21.7	22.4	20.9	21.1	21.8	22.2	19.8	22.0
„ 1963	22.0	20.0	20.3	19.9	20.6	19.9	19.8	19.2	19.1	19.8	18.9	18.3	19.8
„ 1962	19.0	16.8	17.6	17.4	17.3	17.0	16.7	16.5	16.5	17.1	15.8	15.3	16.9
„ 1961	15.5	14.0	14.1	14.0	14.3	14.0	14.0	13.8	13.8	13.8	12.5	12.4	13.9
Increase 1963/64	2.5	2.5	2.2	2.1	2.0	1.8	2.6	1.7	2.0	2.0	3.3	1.5	2.2

1958 Clone trial — Estate B — Kalutara District. A summary of the girth measurement data of 18 foreign and local clones planted in 300-tree monoclonal blocks is presented below (Table XVIII).

TABLE XVIII
1958 CLONE TRIAL — ESTATE B — KALUTARA DISTRICT
Average girth in inches

	RRIC 52	RRIC 54	RRIC 41	IRCI 2	RRIC 22	RRIC 28	GT 1	RRIC 45	RRIC 55	AVROS 385	RRIM 605	RRIC 37	IRCI 6	RRIC 39	AVROS 427	RRIC 36
Girth 1961	9.3	10.3	11.0	10.0	10.0	8.3	10.0	10.3	8.3	9.3	9.8	10.0	9.0	8.0	9.3	8.8
„ 1962	16.2	14.7	14.8	13.9	14.2	13.8	13.8	14.2	12.1	13.5	13.6	14.0	13.1	14.9	12.8	13.5
„ 1963	20.8	18.0	18.0	17.3	17.6	16.8	17.4	17.7	15.3	16.6	16.8	17.5	16.2	18.9	15.8	17.2
„ 1964	22.8	20.7	21.1	20.0	20.8	19.1	20.3	19.8	18.0	19.7	19.5	20.2	19.3	22.1	18.5	20.4
Increase 1963/64	2.0	2.7	3.1	2.7	3.2	2.3	2.9	2.1	2.7	3.1	2.7	2.7	3.1	3.2	2.7	3.2

	RRIM 607	Waljapala 1	PB 86 control	Mean
Girth 1961	10.0	8.5	8.3	9.4
„ 1962	14.6	12.2	12.3	13.8
„ 1963	18.7	15.4	15.4	17.2
„ 1964	21.9	18.6	18.1	20.0
Increase 1963/64	3.2	3.2	2.7	2.8

Salawa Estate — Yield trial 1964. A randomised yield trial to evaluate the yield potentials of clones RRIC 45, 86, 88 and Nab 15 under commercial planting conditions in the Avissawella District was set down on Salawa Estate during the 1964 N. E. monsoon season. 150-tree plots of each clone were replicated 3 times and planted at a spacing of 8' x 30' to give an initial stand of 180 trees per acre.

Rosebury Estate — Yield-cum-Interplanting trial 1964. A replicated yield trial similar to the above was set down during the same season on Rosebury Estate, Koslanda. The clones under trial are RRIC 45, 52 and PR 137. Sub-plots in all replications within each clone will be interplanted with cocoa at a later stage.

APPENDIX I

HEVEA HAND POLLINATION PROGRAMME — 1964

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Estate	Cross made	Parentage/Origin	No. of pollinations	1st Exam. success	% success	No. of seeds collected	No. of seeds germinated	% germination
Nivitigalakele	IAN 6497 × <i>H. spruceana</i>	(IAN 2818 × PB 86) × (SS)	768	23	3.0	42	31	73.8
"	" × RRIC 52	(" × ") × (")	1819	227	12.4	498	441	88.5
"	" × "	(" × ") × (")	2396	68	2.8	—	—	—
"	IAN 6584 × <i>H. spruceana</i>	(FX 43—651 × AVROS 183) × (SS)	183	5	3.0	15	11	73.3
"	" × RRIC 52	(" × ") × (")	1616	146	9.0	383	222	57.9
"	IAN 6587 × <i>H. spruceana</i>	(" × ") × (")	478	37	7.7	90	85	94.4
"	" × RRIC 52	(" × ") × (")	1538	206	13.4	565	513	90.7
Dartonfield	<i>H. spruceana</i> × <i>H. spruceana</i>	(SS) × (")	743	10	1.3	1	—	—
"	" × IAN 6584	(SS) × (FX 43—651 × AVROS 183)	289	22	7.6	18	17	94.4
"	" × IAN 6587	(") × (FX 43—651 × AVROS 183)	86	1	1.1	—	—	—
"	" × RRIC 52	(") × (SS)	1223	61	5.0	3	3	100.0
Hedigalla	LCB 1320 × LCB 1320	(") × (SS)	1300	24	1.8	33	33	100.0
"	LCB 1320 × IAN 6500	(") × (IAN 2818 × PB 86)	148	5	3.3	15	12	80.0
Nivitigalakele	PB 28/59 × IAN 6497	(") × (IAN 2818 × PB 86)	45	1	2.2	—	—	—
"	PB 28/59 × PB 28/59	(") × (SS)	278	1	.3	3	—	—
"	PB 28/59 × RRIC 52	(") × (SS)	222	5	2.2	6	4	66.6
Hedigalla	PB 86 × RRIC 52	(") × (SS)	2299	82	3.5	196	149	76.0
Nivitigalakele	PB 86 × WJ 1	(") × (SS)	608	5	.8	9	9	100.0
Eladuwa	PB 86 × WJ 1	(") × (SS)	1090	1	.9	12	4	33.3
Nivitigalakele	RRIC 45 × PB 28/59	(RRIC 8 × Mil 3/2) × (SS)	143	23	16.1	50	46	92.0
"	" × IAN 6497	(" × ") × (IAN 2818 × PB 86)	69	3	4.3	9	5	55.5
"	" × RRIC 52	(" × ") × (SS)	24	6	25.0	19	17	89.4
"	" × RRIC 45	(" × ") × (RRIC 8 × Mil 3/2)	50	1	2.0	3	3	100.0
Hedigalla	RRIC 52 × IAN 45—710	(SS) × (PB 86 × F 409)	159	1	.6	—	—	—

APPENDIX I (Contd.)

Estate	Cross made	Parentage/Origin	No. of pollinations	1st Exam. success	% success	No. of seeds collected	No. of seeds germinated	% germination
Hedigalla	RRIC 52 × IAN 6497	(SS) × (IAN 2818 × PB 86)	237	6	2.5	3	3	100.0
"	" × IAN 6500	(SS) × (IAN 2818 × PB 86)	334	2	.6	3	1	33.3
"	" × IAN 45—717	(SS) × (PB 86 × F 4542)	713	7	.9	9	9	100.0
"	" × <i>H. spruceana</i>	(SS) × (SS)	1032	9	.9	3	3	100.0
Dartonfield	" × <i>H. spruceana</i>	(SS) × (SS)	698	2	.3	3	3	100.0
"	" × PB 86	(SS) × (SS)	4344	283	6.5	—	—	—
"	" × RRIC 52	(SS) × (SS)	3969	26	.6	3	3	100.0
"	" × RRIC 52	(SS) × (SS)	1363	12	.8	—	—	—
"	" × W.J 1	(SS) × (SS)	670	6	.9	—	—	—
Eladuwa	W.J 1 × RRIC 52	(SS) × (SS)	2740	6	.2	12	4	33.3
	Unsuccessful crosses		4796	—	—	—	—	—
Total			38470	1323	3.4	2006	1631	81.3

(SS) denotes selected seedling origin of unknown parentage.

APPENDIX II

YIELD STIMULATION EXPERIMENT NO. 4 — KURUWITA

(Yield from December 1963 to July 1964 in grams per tree per tapping)

	Control	RRIC Mixture I	Dilatex	*RRIC Mixture II
Yield in grams per tree per tapping	31.5	34.9	30.0	37.6
Preliminary yields	26.1	28.4	30.8	25.9
Mean	27.8			
Deviation	— 1.7	+ 0.6	+ 3.0	— 1.9
Adjusted yields	33.2	34.3	27.0	39.5
As % of Control	100	103.3	81.3	119.0

* Stimulex was not available. RRIC Mixture II was therefore substituted in January 1964 applications.

APPENDIX III

YIELD STIMULATION EXPERIMENT NO. 5 — KURUWITA

Tapped 2S/2, d/4 100%

Yield in grams per tree per tapping — Dec. 1963 to Nov. 1964

	Control	*RRIC Mixture I	Dilatex	RRIC Mixture I	RRIC Mixture II, groomed	RRIC Mixture II
Yield	64.4	68.4	69.6	63.2	70.8	69.7
Preliminary Yields	30.9	30.3	34.7	32.0	29.3	31.9
Mean	31.52					
Deviation	— 0.6	— 1.2	+ 3.1	+ 0.5	— 2.2	+ 0.4
Adjusted yields	65.0	69.6	66.5	62.7	73.0	69.3
As % of Control	100	107.1	102.3	96.5	112.3	106.6

* RRIC Mixture I was substituted as Stimulex was not available for January 1964 applications.

APPENDIX IV

TEST TAPPING RESULTS OF CLONES ESTABLISHED FROM HAND-POLLINATED SEEDLINGS

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	Origin of Material	Year of planting	Clone	No of trees tapped 1964	Yield in lb dry rubber per tree per year			No. of trees affected			Mean girth in inches at 60" 1964	Bark thickness in mm.	
					1962	1963	1964	Canker and Bark Rot	Branch break-age	Wind damage		Virgin	Renewed
Nivitigalakele	1939 H. P. Seedlings	1941	RRIC 9	3	31.9	32.7	34.0	—	1	—	49.0	14.0	12.0
			" 51	5	29.4	28.6	30.9	1	2	—	52.4	14.2	11.8
			" 14	2-3	14.3	20.0	29.3	2	1	1	48.8	13.5	9.7
			" 24	5	19.6	21.5	20.3	2	—	—	49.1	13.4	10.2
			Control Wagga 6278	—	—	10.6	10.0	—	—	—	—	—	—
Nivitigalakele	1940 H. P. Seedlings	1944	RRIC 39	1	46.3	35.2	47.6	1	—	1	48.8	15.0	13.0
			" 45	1	47.1	53.8	43.8	1	—	2	50.6	15.0	14.0
			" 60	3-2	34.0	38.3	36.5	—	1	1	49.2	13.5	12.5
			" 40	2	31.7	29.8	32.1	1	—	1	49.9	15.0	13.0
			" 41	2	41.0	39.0	31.6	—	2	—	42.7	12.0	10.5
			" 59	3-2	39.6	40.6	31.2	—	1	—	48.9	14.0	12.7
			Control Wagga 6278	—	19.3	20.5	20.0	—	—	—	—	—	—
Hedigalla	1941 H. P. Seedlings	1943	RRIC 75	2	32.3	36.5	36.3	—	—	—	43.7	12.8	—
			" 33	4-3	30.9	35.6	36.0	—	—	1	—	—	—
			" 76	4	28.4	34.5	35.5	—	—	—	40.4	14.7	—
			" 79	4	26.9	32.8	34.1	—	—	—	46.9	12.8	—
			" 37	4	26.0	28.6	34.1	—	—	—	38.0	12.5	—
			" 36	3	30.9	31.0	32.4	—	—	—	44.2	13.0	—
			" 50	4	40.1	37.7	32.2	—	—	—	44.6	14.3	—
			" 32	5	—	21.6	31.2	—	—	—	36.6	12.2	—
			" 74	4-3	26.8	27.9	28.8	—	1	—	41.8	13.5	—
			" 46	3	21.6	24.8	28.7	—	—	—	38.5	11.3	—
			" 35	4	30.6	32.2	27.6	—	—	1	44.2	12.9	—
			" 38	4	—	25.6	23.3	—	—	—	41.3	13.4	—
			" 47	3	21.0	21.9	22.1	—	1	—	41.1	12.8	—

APPENDIX IV (Contd.)

	Origin of Material	Year of planting	Clone	No. of trees tapped 1964	Yield in lb dry rubber per tree per year			No. of trees affected			Mean girth in inches at 60"	Bark thickness in mm.	
					1962	1963	1964	Canker and Bark Rot	Branch break-age	Wind damage		Virgin	Renewed
Nivitigalakele	1941 H. P. Seedlings	1943	PB 86 × PR 107	4	—	22.0	21.4	—	—	—	—	—	—
			RRIC 49	1	—	20.8	19.9	—	—	—	35.7	11.8	—
			„ 48	4	—	17.4	19.5	—	—	—	30.0	9.8	—
			„ 34	4	—	13.5	16.7	—	—	—	35.5	11.2	—
			Wagga 6278	4	—	21.5	21.1	—	—	—	—	—	—
Hedigalla	1943 H. P. Seedlings	1946	RRIC 62	1	—	25.0	34.3	—	—	—	30.8	10.7	—
			„ 98	4	40.4	30.8	29.0	—	—	1	40.3	12.5	—
			„ 97	4	26.3	30.2	25.3	—	—	1	47.5	12.4	—
			„ 96	5	32.4	26.2	23.6	—	—	—	43.9	12.5	—
			„ 55	3—2	35.6	25.3	23.2	—	1	2	33.2	11.8	—
			„ 57	5—4	—	24.0	23.2	—	1	—	33.7	11.3	—
			RR 241	5	25.0	20.2	23.0	—	—	—	33.9	10.3	—
			RRIC 61	4	23.6	19.5	23.0	—	—	1	35.9	10.3	—
			„ 77	4	25.7	28.4	22.7	—	1	—	38.3	12.5	—
			RR 233	5	—	24.8	22.4	—	—	—	—	—	—
			RRIC 54	4	—	20.6	18.4	—	—	1	38.1	11.8	—
			Control Tjir 1	4	20.9	16.8	16.7	—	1	—	—	—	—
Hedigalla	1944 H. P. Seedlings	1947	No. 134	1	—	34.3	47.7	—	—	—	—	—	—
			RRIC 64	5	34.7	25.6	30.7	—	—	—	35.7	9.7	—
			„ 65	5	26.1	20.2	28.4	—	—	—	35.7	10.1	—
			„ 78	3	24.2	19.3	23.6	—	—	1	31.7	11.2	—
			„ 66	4	22.2	17.9	19.9	—	—	1	33.2	8.5	—
			„ 63	4	—	13.4	16.4	—	—	1	26.2	8.9	—

REVIEW OF THE PLANT PATHOLOGY DIVISION

BY

O. S. PERIES

SUMMARY

All members of the staff of the Plant Pathology Division, except Mrs. V. Satchuthananthavale, Assistant Plant Pathologist, who continued her post-graduate studies overseas, were on duty throughout the year.

The writer continued to serve as the co-ordinator of research on leaf and panel diseases of *Hevea*, carried out in all the rubber-growing countries associated with the International Rubber Research and Development Board.

Laboratory studies on the biology and host-parasite relationships of *Oidium heveae* and *Phytophthora* spp. were continued. Studies on the epidemiology of the diseases caused by these fungi are in progress. Based on these studies tentative methods of forecasting epidemics of *Oidium* and *Phytophthora* leaf diseases have been proposed.

Studies on the biology of spore germination in *Gloeosporium alborubrum* have been completed, and the results of these studies are being prepared for publication.

None of the new fungicides tested in the laboratory for bark disease control came up to the standards required for further testing under field conditions. The studies on waterproof fungicides for Bark Rot control were continued.

Pure culture experiments with *Fomes lignosus* have revealed that at least ten pieces of wood ($10 \times 1 \times 1$ cms.) are necessary to cause infection of a rubber root by the method used.

The pot experiments for the assessment of the value of sulphur and copper sulphate for the biological control of *Fomes*, by altering the pattern of soil microflora, have been concluded and the results of this experiment are discussed.

Studies on soil fungi are being continued, and the types of fungi associated with the root systems of healthy and *Fomes*-infected plants are being defined.

Wintering commenced early this year and was even throughout most of the rubber-growing areas of Ceylon. This and the hot sunny weather during the refoliation season militated against the development of *Oidium heveae*, with the result that the foliage after refoliation in 1964 was the best seen for a number of years in this country.

Six field experiments were carried out on *Oidium* control during the 1964 refoliation season. None of the experiments gave significant results due to the very low incidence of the disease in all experimental areas.

The incidence of *Phytophthora* leaf disease was comparatively heavy this year; because of the heavy pod set in most areas, following a mild *Oidium* season, and the favourable weather conditions for the propagation of the fungus during July.

Six *Phytophthora* control field experiments were carried out during the year to compare the various methods of control and to establish the economic importance of *Phytophthora* leaf disease in Ceylon. The results of these experiments have confirmed the results obtained in previous years that copper dusting at weekly intervals can reduce leaf fall significantly and is comparable to, if not better than, spraying at monthly intervals or once pre-monsoonally. All experimental areas have been regularly test-tapped, but there have been no significant differences in yields between treated and untreated areas.

Studies were carried out on the incidence of the disease in the various rubber-growing districts in the Island with the co-operation of planters, who participated in a *Phytophthora* survey. The results of this survey have been summarized.

At the end of the *Phytophthora* season a special questionnaire was circulated amongst planters to establish the extent of defoliation caused by this disease in various districts. The writer visited all estates reporting severe leaf-fall, and it was found that only small areas in a few estates suffered more than 50 per cent leaf-fall, and a high proportion of such areas consisted of old seedling and pre-war planted rubber. From the available yield data on these areas it would appear that even severe defoliation rarely affects yields in the same year. The deleterious effects on the tree, however, cannot be assessed at present.

Detailed studies have been carried out on the following aspects of *Gloeosporium* leaf disease : (a) clonal susceptibility (b) distribution of the disease, (c) periods of the year when fungal infection is most virulent, (d) foliar flush in *Hevea*, and the susceptibility of each flush to *Gloeosporium* (e) field trials to select a suitable fungicide for the control of the disease.

The incidence of Bark Rot was above normal during the year. Field trials for the selection of the most effective fungicide for bark disease control have shown that "Fylomac 90" is significantly better than all other fungicides tested for this purpose.

The field experiments on *Fomes* detection and treatment were continued, and preliminary results have indicated that the disease is best identified by leaf symptoms. Based on the results of pot experiments referred to above, a field experiment was laid down to assess the role of sulphur in the biological control of White Root disease. The first examination of these areas has shown that the field incidence of *Fomes* can be considerably reduced by the addition of small quantities of sulphur to the planting hole.

The rhizobial cultures, for the inoculation of *Pueraria* seeds, have been maintained by the Division and issued free to estates on request.

In addition to the field experiments on *Oidium* and *Phytophthora* leaf disease control, the Agricultural Engineering Section carried out further studies on the rainfastness and application characteristics of spray and dust formulations of copper fungicides and assessed the application performance of two new spraying and dusting machines.

A considerable amount of time of various members of the staff has been spent on the preparation of exhibits for the Industrial Exhibition to be held early in 1965.

The Head of the Division and the Assistant Plant Pathologist have prepared papers to be read at the 1965 Rubber Conference.

DETAILED REVIEW

GENERAL

Staff

The Head of the Department, Dr. O. S. Peries, the Assistant Plant Pathologist, Mr. D. L. S. Wimalajeewa, the Senior Technical Assistant, Mr. H. I. Munasinghe, and the Technical Assistants Messrs. E. G. Mendis, T. M. Fernando, S. K. Samara-weera, D. M. Dantanarayana, W. C. Dayaratne, T. Shanmuganathan and Z. E. Irugalbandara were on duty throughout the year.

Mrs. V. Satchuthananthavale, Assistant Plant Pathologist, continued her post-graduate studies at the University of Nottingham.

Mr. P. Seresinhe was appointed Technical Assistant and took up duties on 1 June, 1964, but on his request he was transferred to the Botany Division with effect from 1 November 1964. Mr. D. A. Jayasekera was appointed Technical Assistant, to fill this vacancy, and the latter assumed duties on 16 December, 1964.

Correspondence

	<i>Inward</i>	<i>Outward</i>
General	77	83
Technical	715	530

Visits

	<i>Advisory</i>	<i>Experimental</i>	<i>Others</i>	<i>Total</i>
Head of Division	40	100	20	= 160
Assistant Plant Pathologist	10	51	4	= 65
Senior Technical Assistant	13	5	4	= 22
Technical Assistants	22	549	11	= 582
Total ...	85	705	39	= 829

The staff of the Division now pays an unprecedented number of visits annually to outside estates for advisory and experimental work. During the course of these visits the results of our experimental studies are discussed with planters, who are often persuaded to carry out small-scale experiments to assess the efficacy of new methods of controlling pests and diseases. Thus a considerable amount of extensor work is being carried out by this Division.

Meetings

The writer attended the following meetings :--

1. The Tea Research Institute Conference, 23 and 24 January 1964.
2. The Sabaragamuwa District Planters' Association Meeting held on 2 June 1964, at which he addressed those present on "Some interesting aspects of disease control in *Hevea*."
3. Kalutara District Planters' Association Meeting, held on 11 June 1964, at which the incidence and control of *Phytophthora* leaf disease was discussed.
4. Ceylon Association for the Advancement of Science, sessions 22-25 September 1964.
5. Committee Meeting of Section B of the Ceylon Association for the Advancement of Science, held at the Coconut Research Institute on 7 November 1964.

Publications

The following papers were prepared for publication by the Staff of the Plant Pathology Division during 1964 :—

- (1) Annual Review of the Plant Pathology Division for 1963.
- (2) A virus as the causal agent of bark cracking in *Hevea brasiliensis*. *Nature (London)* **205**, pp. 624-625.
- (3) Sexual Compatibility and variation in *Phytophthora* cultures isolated from *Hevea brasiliensis* in Ceylon. For presentation to the *Trans. Brit. mycol. Soc.*
- (4) Control of White Root Disease (*Fomes lignosus*) of *Hevea brasiliensis*. *Rubb. Res. Inst. Quart J.* **41** (In the Press).
- (5) Recent developments in the control of the diseases of *Hevea* rubber tree. (To be read at the Rubber Conference on 22 February 1965).
- (6) The significance of the factors affecting spore germination in the spread of *Gloeosporium* leaf disease of *Hevea*. (To be read at the Rubber Conference on 22 February 1965).
- (7) Packing plant specimens for despatch to the Rubber Research Institute. *Rubb. Res. Inst. Ceylon Quart. J.* **40**, p. 78.
- (8) Half-yearly review of the Plant Pathology Division.

Co-ordination of research

Dr. O. S. Peries continued his duties as co-ordinator of research work carried out on leaf and bark diseases at all the Rubber Research Institutes affiliated to the International Rubber Research and Development Board. Summaries of the work that is being carried out on leaf and bark diseases at all the allied Institutes have been received and circulated amongst the members. It is now essential for the research officers in the various Institutes to meet and discuss their work so as to produce a joint programme of research of benefit to all countries.

LABORATORY WORK

Diseased specimens

The following diseases and pests were identified on specimens sent to the Institute in connexion with advisory work during the period under review :—

Identity of diseases, pests and other causes of damage	No. of cases
(a) Fungi and Bacteria	
<i>Botryodiplodia theobromae</i>	1
<i>Gloeosporium alborubrum</i>	7
<i>Oidium heveae</i>	4
<i>Phytophthora leaf-fall</i>	4
<i>Phytophthora Bark Rot</i>	3
<i>Fomes lignosus</i>	5
(b) Pests and other causes	
Insect damage	4
Marginal scorch	1
Physiological yellowing of leaves	8

BIOLOGY OF THE FUNGAL PARASITES OF HEVEA

These studies were continued.

Biology of Oidium heveae.—(O. S. Peries & S. K. Samaraweera). The effect of sunlight and ultra-violet light on the germination of *Oidium* spores was studied. It was found that both direct sunlight and ultra-violet light were injurious to the conidia, comparatively short periods (< 1 hour) of exposure to either being lethal to them. Detached spores were particularly susceptible, while spores attached to mycelium on leaves were also killed by 3 — 4 hours exposure to sunlight.

The sensitivity of conidia to exposure to direct sunlight helps to explain certain aspects of the epidemiology of *Oidium* leaf disease, e.g. the slow spread of the disease during periods of very hot dry weather, such as the early months of 1964. The poor development of the disease during these periods being due to a combination of high temperature, low humidity and bright sunshine, all of which militate against its rapid propagation.

Further studies on the host range of *O. heveae* showed that the mildew on *Euphorbia hirta* can cause a non-sporulating infection on certain varieties of beans.

Biology of Phytophthora spp. growth.—(O. S. Peries & T. M. Fernando). Studies are being carried out on the growth of *Phytophthora spp.* on defined media.

It has been established that *Phytophthora spp.* can grow well in basic culture media composed of inorganic salts as long as Thiamin is supplied, growth being good in Glucose-Asparagine, Glucose-peptone and Fries III media.

Seventeen sugars were compared with one another to establish the best carbon source for *Phytophthora meadii* and *P. palmivora*. It was found that Glucose, Fructose and Maltose were better than the other sugars for both species.

Studies are now being conducted to establish the best nitrogen source for the growth of this fungus.

Oospore production by Phytophthora spp.—(O. S. Peries & D. M. Dantanarayana). These studies were continued, and it has been confirmed that certain isolates of the fungus are homothallic. All the homothallic isolates have been identified as *P. meadii*, except one, which was originally isolated from coconut. The identity of the latter has not been clearly established as yet.

A paper has been written on this subject for publication in an International Journal, setting down the views of this Institute on the identification and nomenclature of this fungus in accordance with Waterhouse's new key to the genus *Phytophthora* (Waterhouse, 1963).

Physiologic specialization.—(O. S. Peries & D. M. Dantanarayana). Studies on the physiologic specialization of *Phytophthora spp.* are being continued. It has been found that there are a number of different types of this fungus, which are pathogenic to the *Hevea* rubber tree. Some of these may be regarded as physiologic races of *P. meadii*, whereas others may be separate and authentic species. This study is being continued with the help of the Commonwealth Mycological Institute, England, to whom we are grateful for all the help given to us in this regard.

Budded stumps of seven clones have been planted out in close proximity to the laboratory in order to study the pattern of infection caused by the different isolates of the fungus, which show wide variation in morphological characteristics. The first series of inoculations carried out in this area, in December 1964, was not successful as the weather conditions were not conducive to the propagation of *Phytophthora* spp.

Persistence of P. palmivora.—(O. S. Peries & S. K. Samarawera). It has been established that the fungus can survive for approximately six weeks in detached dry twigs stored in the laboratory, and for about three months on infected twigs in the field.

The fungus can also survive for long periods in the soil.

Oospores of the fungus have been observed on infected pods in the field, every year since 1962. These organs are known to be resistant to the vagaries of weather and would help the fungus to tide over periods unsuitable for its growth.

Epidemiology of Phytophthora leaf disease.—(O. S. Peries, S. K. Samarawera & P. Seresinghe). Detailed studies in the field have shown that rubber pods on trees are readily infected by a suspension of *Phytophthora* zoospores. The minimum time taken for the appearance of lesions following inoculation of pods was six hours, the period of incubation being increased by high temperature. The humidity of the atmosphere does not appear to have a direct bearing on the infection of pods except in so far as low humidities may help the inoculum drops to dry up before the fungus has gained entry into host tissue. The inoculum drop must remain on the pod for at least one hour for infection to occur.

The petiole of the leaf, which is the site of infection of primary economic importance, is very much more resistant to infection than the pod. The minimum time recorded up to date for the appearance of lesions following artificial inoculation with a zoospore suspension on leaf petioles is 28 hours. In comparison to the pod, which is infected by a single inoculation, the petiole has to be repeatedly inoculated over a number of hours, or the leaf surface wetness must be maintained for long periods for infection to occur.

These studies are being continued, but the results already obtained have confirmed the earlier surmise that infected pods provide the inoculum for petiole infection. Field observations on the spread of the disease from primary infections have shown that pod infection invariably precedes petiole infection. Evidence is also available to show that in *Phytophthora* leaf disease the inoculum is disseminated almost entirely by splash dispersal, wind dispersal playing only a very minor role.

The above data prove that the pods are the vital organs to concentrate on for the control of the disease. The most economical method of control would be by the prevention or restriction of pod set, failing which the aim should be to minimize the sporulation of the fungus on the pods, as far as possible, by the use of fungicides. A tentative method of forecasting *Phytophthora* leaf disease epidemics has been developed on the basis of the laboratory studies on the biology of the causal fungus and field observations on the epidemiology of the disease (Peries, 1965). It has been found that severe leaf-fall generally occurs when the following weather conditions prevail for four consecutive days in the presence of infected pods:—

1. Temperature less than 84° F during the day.
2. Relative humidity above 80 per cent throughout.
3. At least 0·1 ins. of rain per day.
4. Less than 3 hours of sunshine each day.

Such periods ('Peries Periods') are most likely to occur during the mid monsoon months of June and July in the rubber-growing districts of Ceylon. To obtain the best results, control measures should be carried out, in susceptible areas, as soon as possible after a 'Peries Period' has been recorded.

Biology of Gloeosporium alborubrum.—(D. L. S. Wimalajeewa). The studies on the biology of spore germination in *G. alborubrum* have been concluded.

It has been found (Table I) that the concentration of spores, in the suspension used for germination studies, has an overall effect on spore germination.

TABLE I
EFFECT OF SPORE CONCENTRATION ON GERMINATION IN
GLOEOSPORIUM ALBORUBRUM

Spore concentration	Percentage germination
2×10^7 /ml.	0·0
1×10^7 /ml.	0·0
7×10^7 /ml.	2·5
5×10^6 /ml.	26·3
2×10^6 /ml.	70·0
2×10^6 /ml.	97·8

Period of incubation — 7 hours.

Maximum germination was recorded at a concentration of 2×10^5 spores/ml. of the suspension. Therefore this concentration was used in all subsequent studies on spore germination.

The effect of temperature on the germination of spores is summarized in Table II.

TABLE II

INFLUENCE OF TEMPERATURE ON GERMINATION (DURING THE PERIOD OF INCUBATION)
 PERCENTAGE GERMINATION OF SPORES AT VARIOUS TEMPERATURES AFTER DIFFERENT
 PERIODS OF EXPOSURE

Temperature of incubation †	Period of incubation and percentage germination				
	4 hours	6 hours	9 hours	11 hours	24 hours
15°C	0·0	0·4	35·0	59·0	93·2
20°C	10·6	45·4	94·0	93·4	98·4
25°C	24·8	55·4	96·4	96·6	*
28°C	37·2	86·6	99·0	99·2	*
33°C	30·2	59·6	81·4	90·6	96·6
35°C	01·0	20·4	25·6	35·8	36·5
40°C	0·0	0·0	0·0	0·0	0·0

* As sporulation had occurred no counts were taken.

† Degree of germination at 0°C remained 0·0% throughout the experiment.

This table shows that the optimum temperature for spore germination is between 28° and 33°C, the minimum is well below 15°C and the maximum between 35° and 40°C. Temperatures below 20°C and above 35°C are generally not recorded in the rubber-growing districts of Ceylon.

Table II also shows that germination takes place most rapidly at optimum temperatures, both lower and higher temperatures having a retarding effect. At temperatures above the optimum, germination takes place rapidly, but, ultimately, such temperatures appear to be detrimental to the fungus as the final percentage germination recorded is lower than that at temperatures below the optimum.

The effect of light on spore germination is summarized in Table III, which shows that visible light has no effect on spore germination, whereas ultra-violet light has a lethal effect.

TABLE III

EFFECT OF VISIBLE AND ULTRA-VIOLET LIGHT ON GERMINATION

(Period of incubation — 7 hours)

Nature of light	Percentage germination
Visible light (358 f.c.)	94·8
Darkness	94·2
Ultra-violet light (2537 A.U.)	0·0

Spore concentration — 2×10^5 /ml.

Gloeosporium spores can germinate on a dry slide as long as the humidity in the germination chamber is maintained at a high level. No germination occurs at relative humidities below 85%. The results obtained in these studies are tabulated below:—

TABLE IV
EFFECT OF RELATIVE HUMIDITY
ON GERMINATION (PERIOD OF INCUBATION — 8 HOURS)

Percentage relative humidity	Percentage germination
52%	0·0
75%	0·0
85%	0·0
96%	91·6
100% (approx.)	90·6
Free water	92·4

Spore concentration — 2×10^5 /ml.

Studies were then carried out to establish the effect of storage of spores at different relative humidities on germination. The results of these studies, summarized in Table V, show that the spores of this fungus can be stored for long periods at relatively low humidities without losing their viability completely. The anomalous results obtained at a relative humidity of 43% are difficult to explain, and further investigations are being carried out on this subject to elucidate it.

TABLE V
EFFECT OF LOW HUMIDITY
PRE-TREATMENT ON GERMINATION (PERIOD OF INCUBATION — 8 HOURS)

Relative humidity	Percentage germination				
	5-hour Exposure	24-hour Exposure	72-hour Exposure	168-hour Exposure	240-hour Exposure
0%	89·8	63·2	41·0	36·8	28·2
7%	96·2	78·2	57·4	39·2	53·6
22%	94·4	88·6	61·4	57·8	57·8
43%	97·0	60·6	29·2	14·0	0·0

Spore concentration — 2×10^5 /ml.

In studies on the effect of the pH on the germination of spores it was found that the optimum pH for germination is between 5·9 and 6·8. Both highly alkaline and acidic media restricted germination significantly, and no germination was recorded below pH 3·0. Table VI gives a summary of the results obtained in these studies.

TABLE VI
EFFECT OF pH ON GERMINATION (TEMP. 28·5°C)
PERIOD OF INCUBATION — 8 HOURS

pH (before starting experiment)	Percentage germination	pH (after experiment was concluded)
3·0	0·0	2·9
4·0	36·3	4·0
5·0	67·0	5·1
5·9	96·7	5·9
7·1	37·4	7·3
8·0	13·2	8·2
Control—distilled water (initial pH 6·8—on agar)	96·7	6·7

McIlvaines buffer solutions were used throughout.

The results of the studies on the biology of the fungus have helped to explain the success of this fungus as a pathogen on *Hevea* in this country, as it is well adapted to survive the extremes of weather that are likely to occur in the rubber-growing districts of Ceylon, and grow out quickly when the weather conditions become suitable for its propagation.

HOST-PARASITE RELATIONSHIPS

Phytophthora spp.

Phytophthora infection of bark, petioles and pods.—(O. S. Peries & Z. E. Irugalbandara) The studies on the histology of infected bark, petioles and pods are being continued.

Gloeosporium alborubrum

Clonal susceptibility to Gloeosporium leaf disease.—(D. I. S. Wimalajeewa). The results of laboratory studies on the susceptibility of different clones to *Gloeosporium* leaf disease are summarized in Table VII.

TABLE VII

LABORATORY ASSESSMENT OF SUSCEPTIBILITY OF SELECTED CLONES TO
GLOEOSPORIUM LEAF DISEASE

Clone		Rating		
PB	86	++++	++++	Highly susceptible
IRCI	7	++++	+++	Above average susceptibility
AVROS	255	+++	++	Average susceptibility
PB	28/59	+++	+	Below average susceptibility
RRIC	52	++		
Wagga	6278	++		
RRIM	513	++		
PR	107	++		
RRIC	7	+		
RRIC	45	+		
Mil	3/2	+		

Clonal susceptibility to Gloeosporium leaf disease.—a field survey.—(D. L. S. Wimalajeewa, O. S. Peries & T. Shanmuganathan). The results of a field survey carried out in all the rubber-growing districts of Ceylon are given below in Table VIII.

TABLE VIII

CLONAL SUSCEPTIBILITY TO GLOEOSPORIUM
LEAF DISEASE IN THE FIELD

Clone		Rating
PB	86	++++
IRCI	7	++++
AVROS	255	+++
RRIC	7	++
RRIC	52	++
RRIM	513	++
RRIC	45	+
Wagga	6278	+
Mil	3/2	+
PR	107	+
RRIM	605	+
AVROS	385	+
PBIG Seedlings		+

Ratings as in Table VII.

It has been observed that clone PB 86, although it is generally highly susceptible to the disease, is often not affected by *Gloeosporium* during the 1st and 2nd years of growth.

Bark cracking in young trees.—(O. S. Peries & T. Shanmuganathan). Serological studies have indicated that bark cracking in young plants of certain clones is caused by a virus infection. A paper has been accepted for publication in an International Journal on this subject (ref. Publications).

The writer is deeply grateful to Dr. (Miss) Yvette E. M. Brohier of the Medical Research Institute, and Dr. Nissanka Seneviratne of the Faculty of Medicine, University of Ceylon, for all the help they gave this Institute in completing these studies.

The sap expressed from infected twigs and leaves has been despatched to the Rothamsted Experiment Station, England, for study with the aid of the electron microscope. We are indebted to Mr. F. C. Bawden, F.R.S., Director, Dr. P. H. Gregory, F.R.S., Head, Plant Pathology Department and Mr. H. I. Nixon, all of Rothamsted for kindly consenting to help us with these studies.

Fungicides for Bark Rot control.—(O. S. Peries & D. M. Dantanarayana). The Rubber Research Board decided to charge a nominal fee of Rs. 300/- for testing new fungicides for bark disease control. One locally prepared fungicide, "Barko", was tested for this purpose, but it was found to be non-toxic at 100% strength to the causal fungus of Bark Rot. This shows that planters should not use any of the different concoctions now available in the market for Bark Rot control, unless they have been tested and proved to be satisfactory for the purpose by this Institute. The results of all tests carried out on this subject are summarized below :—

Fungicide	Active Ingredient (A.I.)	Fungitoxic limits of A.I.		Phytotoxic limit of A.I.
		Contact	Diffusion	
Barko	Phenols	Not toxic	Not toxic	Not tested
Elicide 73	Sodium ethyl mercuric thiosalicylate 12%	0.001%	0.1%	Not tested

Fungicides for root disease control.—(O. S. Peries & T. Shanmuganathan). Studies on the loss of activity of Tillex against *Fomes lignosus* on agar on prolonged incubation were continued. The help given by the Rubber Chemistry Division for these studies is gratefully acknowledged.

Fungicides for Gloeosporium leaf disease control.—(O. S. Peries, D. L. S. Wimalajeewa & T. Shanmuganathan). Detailed studies were carried out to establish the effect of organo-mercurial fungicides on rubber plants. It has been found that mercury is very rapidly absorbed and readily translocated from mature to immature leaves of *Hevea*.

The help given by Dr. J. T. Martin and Mr. J. A. Pickard of the Long Ashton Research Station, Bristol, England, in the analysis of leaves for mercury content is gratefully acknowledged in this connexion.

Studies have also been carried out to establish the limits of phytotoxicity of organo-mercurial fungicides to rubber leaves, both mature and immature, and the results of these are given in Table IX.

TABLE IX

PHYTOTOXICITY OF ORGANO-MERCURIAL FUNGICIDES TO HEVEA

Concentration of Hg W/v in spray formulation	Dates of observations and % leaf area scorched					
	30-4-64		2-5-64		5-5-64	
	Immature	Mature	Immature	Mature	Immature	Mature
Spraying date 29-4-64						
0.01%	0	0	1	0	6	0
0.05%	2	0	5	0	50	0
0.10%	7	0	15	0	100	4
0.50%	10	0	50	5	100	20

The above results show that a spray formulation containing 0.01% Hg W/v would be the threshold phytotoxic limit to young *Hevea* leaves.

Soil micro-flora and root disease incidence.— (O. S. Peries, H. L. Munasinghe & S. K. Samaraweera). The pot experiment started in 1963, to test the effect of the addition of sulphur or copper sulphate to the soil on the incidence of *Fomes*, was completed early this year. In this experiment the following treatments were given to soil in empty tar barrels :—

1. Copper sulphate solution, 3 gallons per pot of a 2.5% solution.
2. Copper sulphate solution, 3 gallons per pot of a 1.25% solution.
3. Copper sulphate solution, 3 gallons per pot of a 0.5% solution.
4. Sulphur at the rate of $\frac{1}{4}$ lb per cu. ft. of soil + 3 gallons water.
5. Sulphur at the rate of $\frac{1}{8}$ lb per cu. ft. of soil + 3 gallons water.
6. Sulphur at the rate of 1/16 lb per cu. ft. of soil + 3 gallons water.
7. Control — 3 gallons water.

Each treatment was replicated six times so that 42 barrels were used for the experiment. A large piece of infected rubber wood was buried in each barrel, all inoculum pieces being of approximately the same size. Finally, a budded stump was planted in each barrel and the soil in them was watered at regular intervals. All the barrels were emptied six months after the budded stumps were planted and the root systems of the latter examined carefully. The results of this experiment are given in Table X.

TABLE X

EFFECT OF DIFFERENT SOIL TREATMENTS ON *FOMES* INFECTION IN POT CULTURE

	No. of pots treated	Infected		Uninfected		Healthy Unsprouted	Final pH
		Dead	Sprouted	Dead	Sprouted		
Control	6	6	0	0	0	0	5.1
CuSo ₄ 0.5%	6	5	0	0	1	0	4.8
CuSo ₄ 1.25%	6	2	0	0	4	0	4.8
CuSo ₄ 2.5%	6	1	2	0	3	0	4.5
Sulphur 1/16 lb	6	0	1	2	3	0	3.2
Sulphur 1/8 lb	6	0	0	3	2	1	3.3
Sulphur 1/4 lb	6	0	0	6	0	0	2.8

The wood blocks were examined at the end of the experiment and it was found that they were thickly covered by *Fomes* mycelium in all the control pots; in the copper sulphate-treated pots too there was a fair growth of *Fomes* on the inoculum pieces, whereas there were only traces of *Fomes* mycelium on the blocks in the sulphur-treated barrels. All the wood blocks were then wrapped in gunny bags and kept moist in a shady spot for six weeks and re-examined. It was found that all the control blocks and the copper sulphate-treated blocks showed a thick growth of *Fomes* mycelium but that the sulphur-treated blocks showed only slight traces of the fungus.

Scrapings were taken from the wood blocks at the end of the pot experiment and cultured to find out whether there were any significant differences in the growth of fungi on them. This study did not give any significant results.

It was concluded from this experiment that there was a possibility for the biological control of *Fomes* in newly replanted areas through soil amendment with sulphur. Therefore, an experiment was designed and set down to establish the effect of the addition of small quantities of sulphur to the soil on the incidence of *Fomes* under field conditions. The preliminary results of this field experiment, recorded six months after planting, have been encouraging and indicate that the incidence of *Fomes* in the field can be reduced by the application of small quantities of sulphur to the planting hole.

Soil micro-organisms.—(H. L. Munasinghe). The basic investigations on the quantitative evaluation of soil micro-organisms in various rubber-growing soils in Ceylon, were continued.

In a comparative study of different methods of assessing the type and distribution of fungi in the rubber-growing soils of Ceylon, it was found that the soil-plate method of Warcup yielded mainly the heavy sporing *Moniliales*. Warcup's hyphal isolation method gave very poor results, only about 2% of the hyphal tips plated developing into colonies. An adaptation of the micro-sieve technique (Parkinson & Williams, 1961) has given the best results in the isolation of soil fungi under *Hevea*, and as much as 25–30% of the fungi isolated by this method remain sterile in culture. Most sterile mycelia isolated from soils have been found to be *Basidiomycetes* (Warcup, 1962), a group swamped out in other methods of isolation which generally favour the heavily sporing type of fungus. The adaptation of the micro-sieve method has therefore been used almost exclusively in these studies.

The soil selected for study is that of a replanted field with a history of heavy infestation by the White Root disease fungus *Fomes lignosus*. The soil around two adjacent trees, one infected by *Fomes* and the other uninfected, is being studied with a view to defining the soil micro-flora around the plants and their rhizosphere fungi.

Specific and quantitative differences in soil and rhizosphere fungal flora have been associated with different environmental conditions such as (a) the drought during the early months of 1964, following the heavy rains in 1963, and (b) the beginning of the South West monsoon rains this year. Soil moisture apparently plays a significant role in determining the type and distribution of soil fungi at any time.

A total of 135 species of fungi, representing 102 genera, has so far been isolated from the soils and rhizospheres studied.

This work will be continued to cover a full cycle of seasonal variations.

LEAF DISEASES

Oidium leaf disease

General.—The wintering of rubber in 1964 occurred early and was uniform. This was probably due to the drought conditions prevailing during the early months of the year, which was in sharp contrast to the weather conditions prevailing during the wintering season of 1963, when heavy and continuous rain interfered to prolong the wintering period as shown in Table XI.

TABLE XI
RAINFALL FIGURES FOR DARTONFIELD GROUP, JANUARY—FEBRUARY, 1963/1964

Month	Dartonfield		Nivitigalakele		Hedigalla	
	1963	1964	1963	1964	1963	1964
January	11.16	8.37	7.64	6.31	21.18	9.83
February	10.05	6.03	8.20	5.22	16.69	6.03

The extremely hot sunny weather that was prevalent during the period of refoliation was inimical to the causal fungus *Oidium heaveae*, with the result that the incidence of the disease was negligible throughout the rubber planting districts of Ceylon this year. Rain late in the season helped to reduce the temperature and increase relative humidity, but by then the leaves had developed beyond the susceptible stage and only the flowers were infected to any extent. The result was that, at the end of the wintering season in 1964, the foliage was the best seen for many years in Ceylon.

The suggestions made in the discussion on wintering of rubber in the Annual Review of this Division for 1963 (Peries, 1964) have been confirmed; the time of wintering is controlled by weather conditions and the incidence of *Oidium* is correlated with the period of wintering.

A tentative method, based on weather data, of forecasting periods when *Oidium* leaf disease is likely to be severe, has been proposed recently by the writer (Peries, 1965). *Oidium* leaf disease is likely to assume epidemic proportions during periods when cool, dull, humid weather prevails with little rain and sunshine. Continuous heavy rain, excessive sunlight and high temperatures (> 90°F) militate against the propagation of the fungus, and control measures are not likely to be necessary when such weather conditions prevail.

Phytophthora leaf disease

General.—The incidence of *Phytophthora* leaf disease was comparatively heavy during July 1964, accompanying the cool wet conditions prevalent during a major part of that month. *Phytophthora* leaf-fall was first recorded at Dartonfield on 11 June, but the warm sunny weather during the month was not conducive to the spread of the disease and there was little leaf-fall in June. The weather changed at the end of June with a number of 'Peries Periods' being recorded late in June and early July. Fairly heavy leaf-fall was recorded from the 7th July till the end of the month. Seed-fall commenced at the beginning of August and the infection petered out during the first week of August. The rainfall figures given in Table XII show the close relationship between rainfall and the incidence of the disease. The high rainfall recorded in September 1964 was of no consequence as the pods, on which the fungus sporulates, had fallen by then.

TABLE XII

RAINFALL RECORDED ON DARTONFIELD GROUP, MAY—SEPTEMBER, 1964
AS COMPARED WITH THE AVERAGE FOR THESE MONTHS

Month	Dartonfield			Hedigalla			Nivitigalakele		
	5 yr. av.	1959*	1964	5 yr. av.	1959*	1964	5 yr. av.	1959*	1964
May	18.66	16.08	29.37	20.22	18.22	35.41	19.10	18.53	29.68
June	15.94	28.30	15.65	19.11	34.40	16.97	16.80	32.71	13.40
July	12.61	12.79	28.35	12.13	14.90	28.48	11.72	15.52	24.15
August	9.98	14.59	8.37	13.66	16.75	8.43	10.16	16.93	9.92
September	12.07	19.16	19.15	13.22	22.07	21.48	12.22	18.10	15.24

* Figures for 1959 have been given as heavy leaf-fall occurred in that year.

Gloeosporium leaf disease

General.—The incidence of *Gloeosporium* leaf disease was normal, and there was the usual number of requests calling for advice on the methods of controlling the disease.

BARK AND STEM DISEASES

Black stripe disease

General.—The incidence of Bark Rot was generally above normal during the period under review.

Field experiments.—(O. S. Peries, E. G. Mendis & T. M. Fernando). One more experiment on Bark Rot control was started in April, 1964. This is a split-plot experiment designed to compare the efficacy of four watermiscible fungicides and three waterproof materials for the control of Bark Rot.

Three other experiments started in 1962 were continued, and the results of one of these experiments, summarized in Table XIII, have shown that Fylomac (1%) is the most effective fungicide now available for the control of Bark Rot of *Hevea*. It now remains to establish the minimum effective concentration of Fylomac for field use.

TABLE XIII

NUMBER OF TREES AFFECTED BY BARK ROT IN TAPPING BLOCKS TREATED WITH FIVE DIFFERENT WATERMISCIBLE FUNGICIDES, CLONE PB 86, PLANTED 1953/54.

Blocks Treatments							Treat- ment Totals	Cost per gallon diluted Rs. cts.	Cost of colouring per gallon Rs. cts.	Total Cost Rs. cts.
	1	2	3	4	5	6				
A. Izal 5%	31	5	3	9	72	16	136	0.45	1.00	1.45
B. Brunolinum plantarium 15%	6	1	3	12	26	13	61	1.35	1.00	2.35
C. Verdasan 5.6%	11	3	2	16	16	25	73	1.80	1.00	2.80
D. Antimucin 0.83%	5	4	4	10	13	13	49	1.30	1.00	2.30
E. Fylomac 1%	7	3	1	5	6	7	29	1.30	Nil	1.30
Block totals	60	16	13	52	133	74	348	—	—	—

Treatments B,C & D are significantly better than A and Treatment E is significantly better than B,C & D.

The second experiment, carried out to assess the efficacy of waterproof panel dressings for the protection of the tapping panel, has also been concluded. In this experiment various combinations of watermiscible and waterproof fungicides were compared with one another using a randomized block design to test watermiscible fungicides with a split-plot arrangement for the assessment of waterproof panel dressings. Table XIV gives the results of this experiment, and shows that there were no significant differences between any of the treatment combinations tested.

TABLE XIV

NUMBER OF TREES AFFECTED WITH BARK ROT IN TAPPING BLOCKS TREATED WITH DIFFERENT COMBINATIONS OF FUNGICIDES AND PANEL DRESSINGS. CLONE PB 86, PLANTED 1947

Sub-plots	Main plots			Totals
	Antimucin	Brunolinum plantarium	Fylomac	
Kankerood	134	140	103	377
Shell TB 192	141	123	177	381
	275	263	220	—

Treatment effects, main-plot, sub-plot and interactions between the two, non-significant.

Preliminary results from other experiments have shown that waterproof dressings have no effect on the control of Bark Rot and it has already been pointed out (Peries, 1963 ; 1964) that none of the waterproof panel dressings, now available in the market, promote bark renewal. Based on this evidence it appears that a cheap panel dressing can be safely used instead of an expensive waterproof fungicide for this purpose. For the present, however, Shell TB 192 should be used on a trial scale, until further experiments now being carried out are completed, and the Institute is in a position to recommend the most economical combination of watermiscible fungicides and waterproof dressings for the prevention and control of Bark Rot.

Pink Disease (Corticium salmonicolor)

General.— There were no requests for advice regarding the control of this disease during the period under review.

ROOT DISEASES

White Root Disease (Fomes lignosus)

General.— The incidence of White Root disease, caused by the fungus *F. lignosus*, continues to be high in all the wetter rubber-growing districts of the Island.

Field experiments

Evaluation of the role of fungicides in the control of Fomes.— (O. S. Peries, T. M. Fernando & S. K. Samaraweera). The results of the experiments carried out in 1963 have clearly shown that Tillex does not play a significant role in the control of *Fomes* according to the methods now recommended.

Effect of treatment of soil with sulphur on the incidence of Fomes.— (O. S. Peries, E. G. Mendis & S. K. Samaraweera). An experiment was laid down at Galawatta Estate, Agalawatta, to assess the effect of adding sulphur to the soil at planting time on the incidence of *Fomes* in replanted areas. The same experiment is also designed to assess the most economical method of treating *Fomes*-infected trees by comparing the following treatments: (a) identify by leaf symptoms, uproot without any attempt at treatment, and replace with stumped budding after clearing area from all sources of infection, (b) identify by leaf symptoms and treat by the methods now recommended, (c) identify by periodical collar examinations, and follow as in (a) above, (d) identify by collar examination and follow as in (b) above.

Assessment of methods of identification and treatment of Fomes.— (O. S. Peries). The three long-term experiments started in 1962, to assess the relative merits of different methods of identifying and treating *Fomes*-infected trees in replanted areas, were continued during the period under review. One of the main problems for elucidation here is the effect of the method of disease identification on the incidence of the disease. Two main methods *viz.* foliar symptoms and periodical collar examination have been used for disease identification in this experiment, and Table XV gives the details regarding disease incidence during the first two years under each method.

TABLE XV

TOTAL NUMBER OF TREES FOUND TO BE INFECTED BY FOMES
BY TWO METHODS OF DISEASE IDENTIFICATION

Replanted Area	Collar Examination	Leaf Symptoms
A. 13½ Acres D'field	100	77
B. 9½ Acres D'field	239	147
C. 7½ Acres D'field	159	102

It can be seen that, apparently, the incidence of the disease is higher in the areas where collar examinations are carried out, but this should be considered to be a preliminary result. As leaf symptoms following root disease infection become visible only after a considerable period of time, infected plants may be identified in the areas where the disease is recognized entirely on above ground symptoms over a longer period of time, and the final counts may be comparable.

Another aspect of the problem for careful consideration here is that the chances of saving a tree infected by *Fomes* are always higher if the disease is recognized in the early stages, and this is more likely to be achieved by collar examination than by leaf symptoms. Therefore, even if collar examination leads to a slightly higher level of infection, economically it may be the more acceptable method as more infected trees can be saved by early detection of the disease. A complete analysis of this problem can be carried out in about the 5th year after replanting.

Effect of different manurial treatments on incidence of Fomes.—(O. S. Peries). This experiment, which is being carried out at Kuruwita Sub-station in close co-operation with the Soils Chemistry Division, was given routine attention by the latter Division.

Depth of penetration of Fomes mycelium on tap roots.—(O. S. Peries, E. G. Mendis & S. K. Samarawcera). The tap roots of a number of *Fomes*-infected trees were excavated and examined carefully to establish the depth to which the fungus can penetrate in soil. It was found that the fungus infects the full extent of the root irrespective of the depth to which the root had grown in the soil. The longest infected tap root examined was 8.5 ft. long and the fungus was observed throughout the length of that root. This is remarkable as root disease fungi are not normally found at such great depths. The significance of this in root disease control is obvious and means that all stumps should be eradicated before planting as they are potential sources of danger.

PESTS AND OTHER CAUSES

General

Damage caused by insects and other pests was of no economic importance on *Hevea* during the period under review.

“ Physiologic Yellows ”

The incidence of “ Physiologic Yellows ” was very low this year in spite of the heavy crowns carried by the majority of clones in all rubber planting districts of the Island, during the first six months of the year.

COVER CROPS

Rhizobial strains for nitrogen fixation in leguminous cover crops.— (O. S. Peries & H. L. Munasinghe). Cultures of selected strains of *Rhizobia* were issued to estates that applied for them. Some estates reported favourably on the effects of seed inoculation on the growth of covers under field conditions.

Laboratory studies, on the selection of new strains of *Rhizobia*, were continued.

FIELD EXPERIMENTS

Dartonsfield 1-acre, 1953 replanted area

This area is planted with mixed local and foreign clones for studies on resistance to leaf diseases and for small-scale field trials. Routine attention was paid to it during the year, and the branches of the trees were cut back to about 3 feet from ground level in order to facilitate studies on leaf and stem diseases.

AGRICULTURAL ENGINEERING SECTION

GENERAL

Staff

The three Technical Assistants attached to this Section, Messrs. E. G. Mendis, W. C. Dayaratne and T. Shanmuganathan were on duty throughout the year and worked directly under Dr. O. S. Peries, the Head of the Division, as there is no Agricultural Engineer at present at the Institute.

All field trials on leaf disease control were carried out by the Staff of this Section, with the help of Messrs. T. M. Fernando and S. K. Samaraweera, when necessary.

FIELD TRIALS

Leaf disease control

Oidium leaf disease control.— (O. S. Peries, E. G. Mendis, T. M. Fernando, S. K. Samaraweera & W. C. Dayaratne). Six randomized block experiments were carried out. Three of these were designed to establish the lowest weight of sulphur that can be used to control *Oidium* leaf disease on different clones grown in the wet low country districts of Ceylon. Two of the others were combined *Oidium* and *Phytophthora* control experiments, to assess the effect of each of these diseases on the production of latex. The last experiment was a swath width experiment to establish the optimum swath width for sulphur dusting.

None of these experiments gave significant results due to the very mild incidence of *Oidium* this year, and they will have to be repeated next year.

Phytophthora leaf disease control.— (O. S. Peries, E. G. Mendis, T. M. Fernando & W. C. Dayaratne). Six field experiments were laid down on commercial estates, the 1st and 2nd were mainly concerned with assessing copper fungicides and the comparison of dusting with spraying as a method of *Phytophthora* leaf disease control, the 3rd and 4th were the combined *Oidium* and *Phytophthora* control experiments described above, and the 5th was a swath width experiment to establish the optimum swath width for copper dusting. The 6th experiment was carried out to assess the overall effect of copper dusting on *Phytophthora* leaf disease control.

Details of field experiments.— The incidence of *Phytophthora* leaf disease was comparatively heavy in 1964 but some areas were affected very lightly, including some of the experimental areas used by the Institute on commercial estates. The details of all field experiments on *Phytophthora* leaf disease control, carried out during 1964, are summarized in Table XVI.

TABLE XVI
 DETAILS OF FIELD TRIALS UNDERTAKEN TO INVESTIGATE
 THE CONTROL OF PHYTOPHTHORA LEAF-FALL

Expt.	Estate	Clone & date of planting	Plot size (acres)	No. of treatments	No. of replicates	Result of Experiment	Av. % leaf-fall on untreated control plots
1	Ellakanda	PB 86 (1940)	2	4	4	Significant	—
2	Yatadola	PB 86 (1946-47)	2	7	4	Significant	—
3	Eladuwa	PB 86 (1951)	1½	4	4	Significant	—
4	Malaboda	PB 86 (1951-57)	2	2	4	Non-significant	—
5	Ellakanda	AVROS 352 (1946)	1	2	3	Non-significant	—
6	Culloden	Tjir 1	2	4	4	Non-significant	—

The results of the experiments carried out on *Phytophthora* control are summarized below :—

Experiment 1. This experiment which was designed to compare weekly dusting with one pre-monsoonal spray and monthly spraying was carried out on clone PB 86 at Ellakanda Estate, Horana, on a 35-acre area planted in 1940. This was a randomized block experiment consisting of 4 replications of 4 treatments, the plot size being 2 acres. This is identically the same experiment as carried out in 1963 on this area, the main purpose of the experiment being to assess the economic importance of *Phytophthora* leaf disease on *Hevea* in Ceylon. Therefore the yield of the trees under various treatments have been recorded continuously for two years, to ascertain whether *Phytophthora* leaf disease will cause a reduction in yield in the year of infection or after a period of years in areas left untreated over a number of years. Monthly spraying gave the best results in the control of the disease, but there were no significant differences between yields in areas under different treatments in the second year of these trials.

TABLE XVII
 EFFECT OF DUSTING AND SPRAYING WITH COPPER FUNGICIDES ON CONTROL
 OF PHYTOPHTHORA LEAF DISEASE ON PB 86 AT ELLAKANDA ESTATE

Treatments	Mean	L.S.D.
A. Control	61.24	—
B. Monthly spraying (Lovo Copper)	17.41***	+ 16.38 (5%)
C. One pre-monsoon spray (Lovo Copper)	34.86**	+ 23.54 (1%)
D. Weekly dusting (Copper)	42.86*	+ 34.63 (0.1%)

Treatment B better than A at 0.1%, better D at 1% and better than C at 5% levels.
 Treatment C better than A at 1% level.
 Treatment D better than A at 5% level.

Experiment 2. This was again a repeat of the experiment carried out on Yatadola Estate in 1963 (Peries, 1964). The incidence of the disease was relatively light in this area during the 1964 South West monsoon season, and the results obtained were similar to those recorded in 1963, as shown in Table XVIII.

TABLE XVIII
THE EFFICACY OF VARIOUS COPPER BASED DUSTING AND
SPRAYING MATERIALS IN THE CONTROL OF PHYTOPHTHORA
LEAF DISEASE

Treatments	Mean leaf-fall	L.S.D.
A. Lovo one pre-monsoon spray	11.12**	17.78 at 5% 24.35 at 1% 33.19 at 0.1%
B. Fycol monthly	10.01***	
C. Fycol one pre-monsoon spray	10.58**	
D. Oxycar dust weekly	11.55**	
E. Control	43.48	
F. Blendox dust weekly	6.18***	
G. Copper Sandoz dust weekly	9.06***	

In view of the mild incidence of the disease, the results of this experiment are of little practical value.

Experiment 3. This experiment was carried out at Eladuwa Estate to assess the economic importance of *Oidium* and *Phytophthora* leaf diseases on rubber. This is a 4×4 randomized block experiment where the following treatments are compared against a control which is not treated for the control of both diseases:—

- A. *Oidium* control with no control of *Phytophthora*
- B. *Oidium* control together with the control of *Phytophthora*
- C. *Phytophthora* control without *Oidium* control
- D. Control — no treatment

The yield records of the individual areas are maintained carefully to assess the effect of each disease separately on the yield of the rubber tree. The results of this experiment are tabulated below and show that although the treatment effects were significant there were no differences between the yields of the different areas.

TABLE XIX

ECONOMIC SIGNIFICANCE OF OIDIUM AND PHYTOPHTHORA LEAF DISEASES ON RUBBER
EXPERIMENT CARRIED OUT ON CLONE PB 86

Treatments	Mean leaf-fall	L.S.D.
A. <i>Oidium</i> control without <i>Phytophthora</i> control	56.36	
B. <i>Oidium</i> & <i>Phytophthora</i> control	15.47	
C. <i>Phytophthora</i> control without control of <i>Oidium</i>	15.43	54.11 at 0.1% 36.78 at 1%
D. Control—untreated	70.37	

Treatments B and C better than A and D at 5% level.

The leaf-fall due to *Phytophthora* infection was very low in this experimental area too, the total leaf-fall being less than 1%, and there was no significant difference between the yields. These results show that even during years when *Phytophthora* leaf disease is fairly severe in certain areas, in general the disease may not warrant the use of control measures as the overall effect on yields is not likely to be serious. Furthermore those years in which *Phytophthora* leaf disease assumes epidemic proportions, occur once in every five or six years, in Ceylon (Lloyd, 1964), so that there appears to be no justification for large-scale *Phytophthora* control in Ceylon, on the data available at present.

The incidence of leaf-fall was so mild in the other three experimental areas that the results are not of any practical importance, and will not be recorded here.

Gloeosporium leaf disease control.—(O. S. Peries, D. L. S. Wimalajeewa & T. Shanmuganathan). Two field experiments for the assessment of fungicides for *Gloeosporium* control were in progress during the period under review.

The first experiment was a formulation trial carried out on one-year old PB 86 at Pantiya Estate, to compare various copper preparations (wetable copper, copper in oil and dust formulations) with organo-mercurials for *Gloeosporium* leaf disease control. Unfortunately, this experiment had to be abandoned after about three months as the area selected for the trials was subject to strong wind action and the rubber leaves were damaged by wind so that it was difficult to assess the incidence of the disease in the area concerned.

The second experiment is a long-term experiment to establish the effect of *Gloeosporium* leaf disease on the growth of rubber, as there is an opinion amongst planters that this disease can retard the growth of rubber by as much as 2 years. This experiment has now been carried out for 1½ years, but the incidence of the disease was negligible on all plots, and it appears that the low incidence of the disease in 1 to 3-year old clearings (Wimalajeewa 1963) is due to some inherent characteristic of the plant and its relationship with the environment and not due to the more effective use of fungicides on young clearings.

Other field trials

Experiment to assess the effect of various levels of defoliation on the yield of latex.— (O. S. Peries & T. Shanmuganathan). This experiment was carried out on a four-year old clearing planted with clone HC 26 at Hedigalla Division of Dartonfield Group. The effect of four levels of mechanical defoliation was compared with a control where no leaf plucking was carried out. The experiment was conducted on one-tree plots, there being 20 replicates per treatment. The trees were tapped once a week after defoliation, and Table XX gives a summary of the analysis of variance on yields based on twenty tappings carried out in the area.

TABLE XX
THE EFFECT OF DIFFERENT LEVELS OF
DEFOLIATION ON YIELD OF TREES

Treatments % defoliation	Mean Yields	L.S.D.
A. 0 (Control)	6.27	+ 1.15 at 5% level
B. 25	6.30	
C. 50	6.82	
D. 75	6.71	
E. 100	5.12	

Treatment effects significant at 5% level.

100% defoliation causes a significant reduction of yield ($P < 0.05$). These preliminary results have indicated that rubber trees can be defoliated to a considerable extent before the effect of this treatment is reflected in the yield of latex from them. However, the cumulative effect of repeated defoliation in consecutive years has still to be assessed, and it is only when these data are available that the devitalizing action of leaf diseases on *Hevea* can be ascertained.

Effect of organo-mercurials on yields.— (O. S. Peries, S. K. Samaraweera, T. Shanmuganathan & Z. E. Irugalbandara). The effect of organo-mercurial fungicides applied on the tapping panel, on the yield of the rubber tree, has been a controversial subject for a number of years. Mercury not only promotes coagulation of latex but also can inhibit its synthesis by reacting with the enzymes responsible for its production. Therefore, three experiments were laid down during October/November 1964 to assess the effect of organo-mercurials and other fungicides applied on the panel, before and after tapping, on the yield of latex. The results of these experiments will be available for analysis shortly.

Assessment of sulphur dusting.— (E. G. Mendis). Studies were carried out during the refoliation season to ascertain in the vertical and lateral spread of sulphur dusted from a standard dusting machine under field conditions, and to define the pattern of sulphur dust particles deposited on leaves under these conditions. An unexpected complication arose with these studies, as the method of analysis used, the Plaster of Paris cast method, was found to be unsuitable for work with very young leaves; because the polyphenols that exude from injured leaves discolour the plaster cast so that the colour reaction produced by sulphur cannot be identified. A modified method for carrying out these analysis has been devised and will be tested out next year.

Hirst spore trap.— (O. S. Peries, H. L. Munasinghe & T. M. Fernando). The studies on the fungal spore distribution, in the atmosphere in rubber growing areas, were continued.

FORMULATION ASSESSMENTS

Assessment of the toxicity of copper fungicides to Phytophthora spp.—(O. S. Peries & W. C. Dayaratne). Leaves were sprayed with a solution of copper sulphate or Lovo copper suspension. Then drops of inoculum containing zoospores of *Phytophthora meadii* were placed on various spots on the sprayed leaves and they were incubated overnight (18—22 hours) at room temperature $29^{\circ}\text{C} \pm 1^{\circ}$. At the end of the incubation period Sellotape strips were made from the sprayed and inoculated leaves (Peries, 1961) and the percentage germination of zoospores on them calculated. The concentration of copper on the leaves was assayed by a colorimetric method and graphs were drawn of percentage germination against the concentration of copper deposited on the leaf surface.

It was found that copper sulphate gave extremely consistent results with this method, and that the lethal dosage of copper to *Phytophthora spp.* was $1.25 \mu\text{g Cu. per cm}^2$ of leaf surface. However, Lovo copper gave very variable results, there being a significant percentage germination of zoospores even at the highest concentration of copper used viz. $15 \mu\text{g per cm}^2$ of leaf surface. These results indicate that Lovo copper is very resistant to solution in water so that it is not redistributed over the leaf after it has dried, and the toxicity of the material is confined to restricted areas around the points of deposition. This may explain its poor performance in field trials during 1963 (Peries, 1964).

These studies are being continued.

Assessment of mercury deposits on Hevea leaves.—(O. S. Peries & T. Shanmuganathan). Studies are being carried out to devise a method of assessing the mercury content of *Hevea* leaves. The help given in this connexion by Dr. J. T. Martin of the Long Ashton Research Station, Bristol, England, is gratefully acknowledged.

MACHINERY AND APPLICATION

Assessment of spray machinery.—(O. S. Peries, E. G. Mendis & W. C. Dayaratne). One new type of spraying machine was tested during the first half of the year, but it had to be returned to the manufacturers due to certain mechanical defects before a complete analysis could be made of its performance. This machine, after it was repaired, together with a new machine imported from the U.K., were tested during the latter half of the year. The details regarding these two machines are given in Table XXI.

TABLE XXI
DETAILS OF NEW SPRAYING MACHINES TESTED DURING THE YEAR

Name of Machine Characteristics	Mistral IV AV	Minimicron 77
Type of application	Spray	Spray
Manufacturer	Birchmeier & Co. Ltd., Switzerland.	Micon Sprayers Ltd., England.
Engine	Villiers, 4-stroke, 150 c.c. developing 3 h.p. at 3,300 rpm.	JLO 77, 2-stroke, 73 c.c. developing 3.0 B.H.P. at 5,000 rpm.
Unladen weight of machine (lb)	90	?
Spray tank capacity (gals.)	4	2
Maximum output spray (pints/min.) or c.c.	1.9 pints	300 to 1,000 c.c. accor- ding to nozzle
Air outlet shape and di- mensions (inches)	Round 3.6 (diameter)	Rectangular
Air velocity at outlet (m.p.h.)	150	125
Air volume (cu.ft./Min.)	580	1,200
Mode of agitation of spray liquid	None	None
Tank pressure	?	10 lb/sq. inch. (0.7 atm.)

The Mistral IV AV is essentially the same machine that was tested last year, but the manufacturers have made some minor adjustments to it, to improve its performance. The results of the tests carried out on these machines are given in Table XXII.

TABLE XXII

DROP SPECTRUM ANALYSES OF THE TWO SPRAYING MACHINES TESTED DURING THE YEAR. THE NUMBER OF DROPS PER CM² AND THE SPRAY VOLUMES RECOVERED HAVE BOTH BEEN EXPRESSED PER GALLON OF SPRAY EMITTED PER ACRE.

Height above ground level (feet)	Mistral IV AV			Minimicron 77		
	Mass Median* diameter (microns)	Number of drops per cm ²	Recovery (Imp.gal./acre)	Mass Median* diameter (microns)	Number of drops per cm ²	Recovery (Imp.gal./acre)
0	146	213.8	0.829	126	24.5	0.043
5	81	206.9	0.143	93	44.8	0.057
10	161	160.5	0.700	89	45.0	0.050
15	141	240.1	0.905	88	61.7	0.072
20	132	312.1	0.835	80	87.0	0.060
25	132	426.9	1.000	76	109.7	0.074
30	123	456.7	1.090	165	164.9	0.258
35	197	517.2	2.560	63	305.0	0.105
40	67	350.9	0.300	65	148.2	0.045
45	131	260.8	0.700	66	166.5	0.064
50	120	61.8	0.088	72	114.9	0.040
55	134	87.3	0.123	74	199.6	0.109
60	126	87.0	0.186	52	192.3	0.035
65	106	130.3	0.204	135	172.4	0.192
70	106	63.7	0.070	63	162.4	0.033
75	85	43.9	0.025	71	144.0	0.041
80	53	74.7	0.012	55	99.1	0.012

* Mass median diameters were approximate values calculated by multiplying the surface median diameters (S.M.D.) by 1.2.

Both machines can reach the desirable height of 85—90 ft. under canopy-free conditions, but the distribution of the spray material at various heights was better in the Minimicron 77. In the Mistral IV AV a great deal of spray material is deposited at very low levels, which is wasteful of expensive fungicide formulations. The manufacturers have been informed of this and attempts are being made to correct this defect. Both these machines will be tested out in the field during the 1965 South West monsoon season.

FIELD SURVEYS

Survey of Gloeosporium leaf disease incidence.— (O. S. Peries & T. Shanmuganathan). A survey is being carried out in all the rubber planting districts of the Island to assess : (a) the periods when rubber plants produce new flushes of growth ; (b) the periods during which those new flushes are most susceptible to *Gloeosporium* leaf disease ; (c) clonal susceptibility of *Hevea* to *Gloeosporium* leaf disease. The results of this survey should be useful for defining the periods of the year when control measures against this leaf disease should be adopted and for general advice on the type of planting material suitable for various planting districts of Ceylon.

The preliminary results of these studies indicate that although the young rubber tree produces new flushes of leaves periodically throughout the year, such leaves are liable to infection only during the wettest months of the year *viz.* May to July and November, and control measures may be confined to these months only.

Oidium and Phytophthora leaf diseases survey.—(O. S. Peries & E. G. Mendis). These surveys are being carried out with the co-operation of the Superintendents of different selected estates in all rubber planting districts of Ceylon. The results of these surveys should help this Institute to recognize the commencement and trace the development of these diseases in all planting districts and should be useful for advisory work.

Oidium

This survey confirmed that the incidence of *Oidium* leaf disease was negligible in all districts in 1964; the disease occurring late in the season, generally after the new leaves had matured.

Phytophthora

It was the general opinion amongst planters that *Phytophthora* leaf disease was more severe this year than it has been since 1959; therefore, a circular letter was sent to all Agency Houses requesting the estates in their agencies to inform the Institute if heavy leaf-fall, > 50% of the canopy, occurred in any of their clearings. Fifty-five estates responded to this request, and ten of them reported heavy leaf-fall. The writer visited every estate, which reported over > 50% leaf-fall in any clearing, inspected the areas concerned and obtained the yield records of those areas at the end of the year. There was no clear indication that yields were affected by leaf-fall due to *Phytophthora* in any estate, and the occasional drop in yield on some estates may be explained on the basis of the normal variations in yield from year to year, when the number of tapping days and the stand per acre over the years is taken into consideration.

The *Phytophthora* questionnaire for 1964 showed that leaf-fall commenced in all rubber-growing districts in about mid-June and that the heaviest leaf-falls were recorded during the month of July. There was little leaf-fall in August and none in September. These observations are in accordance with the critical records maintained at Dartonfield.

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REVIEW OF THE SOILS CHEMISTRY DIVISION

By

A. J. JEEVARATNAM

SUMMARY

General.—The death of Mr. A. K. Gunadasa, a Technical Assistant in the Division is recorded with regret.

The Head of the Division represented the Institute on the Formulary Committee on Agrochemicals which was convened by the Ministry of Agriculture, Food and Fisheries.

The Soils Chemist attended the International Training course in Soil Biology held at the Indian Agricultural Research Institute, New Delhi, for a period of four weeks commencing from 20th December 1964.

Facilities were afforded to two Probationary Assistant Superintendents of Surveys to be trained in soil survey and soil classification by the Soils Chemist for a period of two months.

Advisory.—An advisory service has been established to make fertilizer recommendations to individual fields on the basis of field and laboratory examinations of soil conditions and tree nutrient status. This service was availed of by producers who sought the advice of the Institute in determining the fertilizer mixture that should be applied to individual fields in their holdings.

The subject on which the specialised advice of the Division was sought mostly concerns the role of nutrition on the incidence of wind damage. In general, changes in manuring policies, from the point of view of reducing wind damage losses were not encouraged. Reasons in support of this and the measures producers may adopt in order to reduce losses in future plantations were contained in an article entitled, "Tree damage caused by wind in rubber plantations" which was published in the Institute's Quarterly Journal.

An advisory problem of interest was the appearance of unusual foliar symptoms in the form of severe necrosis which was diagnosed as being due to the effects of Boron toxicity.

Research.—The Division participated in the inter-Institute parallel tests on leaf analysis which was organised under the aegis of the International Rubber Research and Development Board. The assay values obtained at the Institute's Laboratories compared very favourably with the values received from the co-ordinating body subsequently.

Laboratory investigations carried out during this year were mainly directed at improving the technique of determining fertilizer requirements on the basis of soil and leaf analysis. A method for estimating the potassium status of different soils has been worked out which, it is hoped, will prove very useful in determining the level at which potash should be applied in different areas.

A total of nineteen field experiments were in progress to study the different fertilizer effects on the growth and on yield of rubber trees.

The results from the long-term experiments in progress seem to indicate that from the point of view of yield much caution has to be exercised in determining the level at which potash should be applied to rubber plants during the immature as well as mature phase. In one of the experiments with four clones the plots that received applications of nitrogen and phosphate only during the immature phase and nitrogen, phosphate and potash from the time of commencement of tapping gave a mean yield of 33.1 grammes per tree per tapping, compared with a yield of 28.4 grammes from plots that received the complete NPK mixture during the immature as well as mature phase.

There are indications that locally available dolomite will prove just as good as the imported magnesium sulphate in preventing the incidence of magnesium deficiency on susceptible clones, when applied systematically at rates recommended by the Institute.

Occurrence of gaps in plantations and poor anchorage of trees in the soil being two primary factors responsible for a high percentage of wind damage losses, it is believed that the adoption of a planting procedure that permits equal growing space for every plant whilst carrying out the planting operations strictly on the contour will prove to be of great advantage. There is reason to believe that this method of planting would result in minimising the occurrence of gaps in a plantation by virtue of the more even distribution of plants in the field and greater uniformity in growth that could be obtained thereby. When it is realised that this could be achieved without having to sacrifice the main advantage of contour planting namely conservation of soil, which in turn is of significance in providing better anchorage of plants, the manifold advantages of this method of planting become apparent.

In view of the inadequacy of the soil conservation measures that are adopted in most rubber plantations, it is also believed that the opportunity of introducing any changes in the method of planting should also be availed of to emphasise the advantages of adopting soil conservation measures at the time of replanting on a scale that will be adequate to last the full cycle of the rubber plantation.

Considerable progress has been made in surveying the soils of the rubber-growing areas. Semi-detail reconnaissance survey maps of the soils and land forms of the areas covered by the Alutgama and Panadura one-inch sheets have been completed. Work is in progress on the areas covered by the Ambalangoda one-inch map.

DETAILED REVIEW

GENERAL

Staff

The Head of the Division, Mr. A. J. Jeevaratnam; the Soils Chemist, Mr. C. G. Silva; and the Assistant Soils Chemist, Mr. R. S. John; the Senior Technical Assistant, Mr. T. Kanthasamy assisted by seven technical and field assistants and four technical and field attendants were on duty throughout the year.

Mr. R. S. John, Assistant Soils Chemist was confirmed in his appointment with effect from 1-3-64, on satisfactory completion of the probationary period of two years.

The sudden death on 27-11-64 of Mr. A. K. Gunadasa, Technical Assistant in the Division is regretfully recorded.

Correspondence

	<i>Inward</i>	<i>Outward</i>
Technical	401	280
General	44	49

Visits

	<i>Advisory</i>	<i>Experimental</i>	<i>Others</i>
Head of Division	23	17	12
Soils Chemist	3	3 + Soil Survey	10
Asst. Soils Chemist	3	3	6
Technical and Field Assts.	Nil	130	39

Meetings

The Head of the Division attended the following meetings :—

1. The Tea Research Institute Conference—23rd & 24th Jan., 1964
2. The Kalutara District Planters' Association—11th Jan., 1964.
3. The Kurunegala District Planters' Association—17th Sept., 1964*
4. The Annual Sessions of the Ceylon Association for the Advancement of Science—22—25th Sept., 1964.
5. Carson Cumberbatch Visiting Agents' Conference—9th Oct. 1964.
6. The Soil Conservation Society Symposium—17th Oct., 1964.
7. Meeting of the Institute of Rubber Industry—23rd Oct, 1964.
8. Field Day—Smallholdings Department of the R.R.I.C—28th Nov., 1964*
9. Meetings of the Formulary Committee in Agrochemicals—11th Sept., and 28th Sept., 12th Oct., and 6th Nov., 1964.

* Meetings addressed by the Head of the Division.

The Soils Chemist attended the International Training Course in Soil Biology held at the Indian Agricultural Research Institute, New Delhi, from 20th December 1964 to 16th January 1965 at which he read a paper entitled "Advances made in the Classification of Ceylon Soils." He also availed of the opportunity to study the all India Soils Survey Programme in general, and the progress made in the classification of the rubber lands in India in particular.

Publications

1. Annual Review of the Soil Chemistry Division 1963.
2. "Tree damage caused by wind in rubber plantations". *Rubb. Res. Inst. Ceylon Quart. J.* 40, Parts 3 & 4 (1964), p. 64.

Training

Two probationary Assistant Superintendents of Surveys from the Survey General's Department were trained in soil survey and classification by the Soils Chemist for a period of two months.

Exhibitions

Preliminary work in the preparation of models for the Industrial Exhibition was undertaken towards the end of the year.

Administration

A responsible function of the Chief Administration Officer devolved on the Head of the Division during periods when the Chief Administrative Officer was away on leave during the latter part of the year, prior to his retirement.

ADVISORY WORK

A significant change has been instituted in respect of the advisory work of the Division by the establishment of an advisory service that is for the present confined to fertilizer recommendations to individual estates based on the field and laboratory examination of soil conditions, tree nutrient status, and the responses obtained to fertilizer applications in field experiments in other areas under similar conditions. Since the area that can be covered by this service had perforce to be restricted at the start, it has been confined to the estates that sought the services of the Institute in determining their manuring programme and who expressed their willingness to evaluate the advantages of adopting the recommendations made by such a service on a limited scale. It was believed that the adoption of such a course would not only provide the opportunity for some of the producers to assess the usefulness of adopting such recommendations for themselves but would also enable the Division to cope with the work involved during the initial stages of establishing such a service.

In the main, however, the procedure followed in the execution of the advisory function of the Division has continued to remain the same as in previous years which may be described as follows:—

1. Making general recommendations on subjects that come within the purview of the Division and improving on same from time to time, in the light of information that accrues from experiments in progress.
2. Specialised advice on nutritional and cultivation problems as and when they are brought to the notice of the Institute.

While there have been no changes in the general fertilizer recommendations issued by the Institute during the period under review, there is reason to believe that there is an undesirable trend in fertilizer usage in commercial practice in that certain practices which have not so far qualified for inclusion or deletion as the case may be in the general recommendations of the Institute are being adopted on a fairly wide scale.

An analysis of the subjects on which the specialised advice of the Division has been sought indicated that the subject that has been of particular interest to producer, during the period under review, was the role of nutrition on the undesirable effects of wind in both mature and immature plantations. The number of calls on the Division for specialised advice on this subject have been such that it was felt that there was a need for careful study of the problem of wind damage in general, not only in order that the correct advice may be given on the subject but also in order to ascertain the emphasis that should be placed on the objective of increased resistance to wind damage in the investigations on nutrition carried out by the Division in the future. Since the subject of wind damage does not come within the purview of any of the other Divisions of the Institute, all advisory work connected with the problem of wind damage devolved on the Soils Division.

A considerable proportion of the time of the Head of the Soil Division was devoted to a study of this problem and a paper entitled, "Tree Damage Caused by Wind in Rubber Plantations" was prepared and submitted for publication in the Quarterly Journal.

Rest of the advisory work on nutrition was concerned with instances of backward growth in immature areas and poor yields in mature areas. A detailed investigation of the causes of backward growth in the clone trial areas sited in the new plantings carried out in 1956 and 1957 at the Institute's experimental station at Hedigalla was undertaken at the request of the Rubber Research Board.

Another advisory problem of interest was the appearance of unusual foliar symptoms on one-year old plants of clone Wagga 6278 in an estate in Kalutara District. These symptoms have been tentatively diagnosed as being due to the effects of Boron toxicity. The cause for this toxicity has not been ascertained yet. But this should serve as a warning of the inadvisability of indiscriminate use of borated fertilizer mixtures which is one of the undesirable trends in fertilizer usage in commercial practice referred to earlier.

Most of the requests for advice on other aspects of rubber cultivation that come within the purview of the Division were concerned with the subject of ground covers and weed control.

Instances of deficiency symptoms exhibited by cover crops, competition between cover crops and the rubber plants during the early stages of growth of the rubber plants, and difficulty experienced in re-establishing cover crops after the original stand had been heavily attacked by snails are some of the problems brought to the notice of the Institute.

Requests for advice on the use of herbicides for weed control have been unusually high.

The subjects of cultivation practices, ground covers and weed control are so closely interwoven that it is invariably difficult to give advice on one subject independent of the others, particularly when the advice has to be given in the absence of accurate information of prevailing conditions.

RESEARCH INVESTIGATIONS

These are reported under three subject headings — Nutrition, Cultivation practices, Ground Covers, Weed Control and Soil Survey.

Investigations on the subject of nutrition are reported under the headings Laboratory Investigations and Field Experiments. Laboratory investigations have been mainly concerned with improving techniques of soil analysis and foliar diagnosis in determining fertilizer requirements.

Several field experiments are in progress to determine the response of different clonal materials during the immature phase to nutrient applications at different levels, from different fertilizer sources, and under different cultural practices.

Considerable difficulty has been experienced in finding suitable areas for laying down experiments in mature areas. On one estate where preliminary work had been carried out to lay down an experiment in a mature area, it has not been possible to continue the experimental work, due to the fact that the management found it necessary to reblock the area into different tapping tasks and to reallocate the tappers. The commencement of the experiments to investigate the response to manuring at different levels at increased rates of exploitation either by application of stimulants and/or by increasing the intensities of tapping has been delayed due to certain practical and financial difficulties in implementing the programme on the scale envisaged on outside estates.

Subject to the reconsideration of this programme, satisfactory progress has been made in the field experimental work envisaged in the programme of work for 1964.

The results from experiments that are of topical interest only are included in this progress report.

The response in terms of height of some of the more vigorous clones, that are being planted on a fairly wide scale in commercial practice now, to fertilizer application at different levels is of particular interest.

LABORATORY INVESTIGATIONS

The laboratory work connected with the analysis of leaf, soil, and fertilizer samples in advisory work, and analysis of soil samples collected in the soil survey programme has tended to restrict the amount of laboratory work that was undertaken in research investigations. However satisfactory progress has been made in the projects described below :—

Co-ordination of Research

Six samples of *Hevea* leaf powder received from the I.R.C.V., as part of the programme for the inter-Institute parallel tests on leaf-analysis were analysed for N, P, K, Ca, Mg, Mn and Cu in duplicate and the results were forwarded to the Co-ordinator of Research on mineral nutrition.

The results obtained in our laboratories compare favourably with the values received from the co-ordinating body subsequently.

Investigations on the Potassium Status of Different Soils (R. S. John)

The determination of different fractions of potassium in soils has indicated that the determination of the fraction approximating to the "total" potassium status of the soils would give a more reliable indication of the potassium supplying power of different soils. Soil samples from experimental areas that have shown a range of response to applications of potassium fertilizers have now been collected and analysed to study the correlation between the different fractions of soil potassium and response to added potassium.

Variations in Mineral Content of Leaves of Clone PB 86 as Influenced by Applications of Major Nutrients alone and in Combinations

Leaf samples collected from plants in the experimental plots receiving different fertilizer applications in the 2nd NPK trial with applications of Mg as commercial Epsom Salts and as dolomite on split-plots during the third year of growth have been analysed for their N,P,K, Ca, Mg, Mn and Cu contents.

Analysis of Fertilizer Samples.—Samples of fertilizer mixture R. 4 : 6 : 2 with and without Mg, R. 4 : 6 : 3 with and without magnesium, dolomite and saphos phosphate submitted by three firms who tendered for the supply of fertilizer to the Institute and another sample of R. 4 : 6 : 3 + Mg received from the Rubber Control Department were analysed for their N,P,K, Ca and Mg contents.

Field Experiments

(a) Seedling Nursery Phase—Comparative Vigour of Seedlings raised from seeds of four clones

Seeds from clones RRIC 45, RRIC 52 and Glen 1 were collected during the seedling season in 1963, germinated and planted in nursery beds in September 1963. At the end of four months' growth the seedlings were carefully uprooted along with seedlings raised from clone Tjir 1, and the following observations were recorded :

1. Length of shoot — base of stem to terminal bud.
2. Length of root — base of stem to apex of tap root.
3. Number of leaf whorls.
4. Distribution of lateral roots *i.e.*, — sparse or profuse (S or P); evenly distributed or confined to base of stem (E or C) respectively.
5. Dry weight of root.

The results obtained are reported in the Table below :—

	Tjir 1	RRIC 45	RRIC 52	Glen 1
Shoot length in inches	14	22	21	15
Root length in inches	15	19	21	13
Dry wt. of aerial parts in grms.	2.4	6.4	5.0	1.9
Dry wt. of roots in grms.	1.0	2.8	2.2	1.4
Av. number of leaf whorls	2.5	3.0	3.0	2.0
Root distribution				
sparse or profuse (S or P)	S	P	S	P
Even or confined to base of stem (E or C)	E	E	E	C

It would appear that seedlings raised from seeds of clones **RRIC 45** and **RRIC 52** may prove to be better than seedlings raised from other clones from the point of view of vigour of growth and root distribution.

These preliminary studies were undertaken with a view to explore which seedling materials could be used as substitutes for seedlings from clone Tjir 1 for seedling stocks in determining the optimum nutrient application for seedling nurseries for the future. Further work on these lines was not undertaken in 1964 as it was realised that this work was included in the programme of work of the Botany Division.

The necessity to find alternative seedling materials that will be readily available in the coming years is important, not only in view of the fact that budded plantations of clone Tjir 1 approved as seed gardens are fast dwindling, but also from the point of view of finding material that is better than Tjir 1 seedlings for the purpose. The use of seedlings that are intrinsically more vigorous as seedling stocks will make a substantial contribution in reducing the cost of producing budded stumps, which accounts for about 10 per cent of the cost of replanting an area and bringing it into production.

Enquiries are already being received from estates for advice on accelerating the growth of plants in seedling nurseries, so that as high a percentage of plants as possible may be ready for use as budded stumps for planting within a period of eight months from the time of planting the seedlings in nurseries. This should, perhaps, be the target in the determination of optimum fertilizer dosages for seedling nurseries in the future.

In the absence of any experimental data on which recommendations could be based, foliar spraying with urea or a complete liquid fertilizer like "Fertil-Rei" was recommended. Superintendents of estates who have used "Fertil-Rei" have been most enthusiastic about the effectiveness of this liquid fertilizer for the purpose.

Another preliminary experiment of interest brought to the notice of the Soils Division by the Plant Breeder is the enhanced growth of hand-pollinated seedlings planted in July 1962 on beds which had subsequently been covered with black polythene in November 1962 in spite of the fact that no manuring was done after covering with the polythene, compared with the growth of seedlings in adjoining beds which had been treated in the usual manner. It is proposed to investigate this matter more fully in seedling nurseries that will be planted in the future.

(b) *Immature Phase—Manurial Trials*

- (i) *Growth response of Tjir 1 clonal seedlings to two levels each of N, P and K/Mg.—1958 Replanting Moneragala District*

Girth measurements recorded at the end of 1964 indicate that the response in growth to higher levels of applications of N, P or K was not significant. The fertilizer applications for 1964 were given, as it was decided to continue to give additional applications up to the time of commencement of tapping.

- (ii) *Growth response of clone PB 86 to application of major nutrients N, P, and K singly and in combination. Magnesium applied as commercial Epsom Salts and as dolomite in split-plot treatments.*

1961 Replanting—RRIC Sub-station, Kuruwita

Girth measurements have been recorded at the end of three years from the time of planting.

There was no significant difference in the growth of plants receiving magnesium in the form of dolomite compared with the growth of plants receiving magnesium in the form of magnesium sulphate.

Clone/Manurial Trials

- (i) *Effect of four levels of potassium on growth of six clones—1958 Replanting—Eladuwa Estate.*

Girth measurements recorded at the end of six years from the time of planting were as follows:—

MEAN GIRTH IN INCHES OF PLANTS RECEIVING DIFFERENT TREATMENTS

Treatment	Mean girth in inches	Difference over R. 4 : 6 : 2	L. S. D.
R. 4 : 6 : 2	19.03		± 0.42
R. 4 : 6 : 3	19.14	+ 0.11	
R. 4 : 6 : 5	19.40	+ 0.37	
R. 4 : 6 : 8	19.09	— 0.06	

Since the above experiment has been laid down in an area planted with different clones, the mean girth in inches of the different clones are reported below.

MEAN GIRTH IN INCHES OF DIFFERENT CLONES

Clone	Mean girth in inches	Difference over PB 86
PB 86	17.52	—
GT 1	20.02	+ 2.50
RRIC 28	19.39	+ 1.87
RRIC 45	19.56	+ 2.04
IRCI 2	19.50	+ 1.98
RRIM 605	19.00	+ 1.48

The mean girth of an adjacent PB 86 block that had been manured according to commercial practice, interplanted with *Guatemala* and periodically thatched with loppings of *Guatemala* was 18.85" which is 1 inch more than the best mean girth recorded for a PB 86 plot receiving only the NPK mixtures.

(ii) *Effect of eight levels of R. 4 : 6 : 3 + Mg fertilizer mixture on the growth of four clones viz. — PB 86 ; RRIC 7 ; RRIC 45 ; and RRIC 52*

1963 Replanting—RRIC Sub-station, Kuruwita

This experiment has been in progress only for a period of one year. In view of the topical interest on the fertilizer requirements of some of the more vigorous modern clones, height measurements recorded at the end of one year's growth are reported below. Since earlier experience has shown that height measurements do not provide a good indication of subsequent girths, a statistical interpretation of the data has not been carried out. The fertilizer dosage for the year was given in four applications.

MEAN HEIGHT IN INCHES (MEAN OF 40 PLANTS)

Amount of R. 4 : 6 : 3 + Mg. applied in oz.	Clone				
	PB 86	RRIC 7	RRIC 45	RRIC 52	Average
0	59	49	73	69	62
4	79	70	88	81	80
8	77	71	90	70	77
12	76	69	99	90	83
16	75	67	92	85	80
20	81	74	98	79	83
24	79	81	98	86	86
28	80	75	90	87	83
Average	75	69	91	81	

It would appear that while the differences in the average height of plants between clones due to different rates of manuring may be significant the growth in height of the plants within any one of the clones did not differ materially due to different rates of fertilizer application.

Manurial/Cultivation Treatment Trials

There are four $3 \times 3 \times 3$ experiments in this series, two of which have been in progress for five years and the other two for three years. The girth measurements at the end of five and three years from the time of planting have been recorded.

(c) *Mature phase*

Manurial/Clone Trial—O,P,NP,PK and NPK Trial 1952 clearing 13½ acres, Hedigalla

Yields recorded in 1964, which was the fifth year of tapping are reported below

YIELD IN GRAMMES PER TREE PER TAPPING
(AVERAGE OF FOUR CLONES)

Post-tapping treatments	Pre-tapping treatments					Mean yields
	O	P	NP	PK	NPK	
O	19.7	19.5	23.6	21.5	21.5	21.6
P	21.1	21.7	24.1	23.2	22.9	22.6
NP	18.4	26.3	28.2	23.2	23.0	24.0
PK	20.6	21.1	24.5	22.3	22.5	22.2
NPK	18.7	21.5	33.1	21.2	28.4	24.6
Mean yields	19.7	22.0	26.7	22.3	24.1	23.0

It would be seen that the yields recorded in the experimental plots continue to reflect the treatments they received during the immature phase compared to the treatments they received after commencement of tapping. Nevertheless at the same time they do illustrate the presence of a positive response to manuring after the commencement of tapping operations. They also serve to focus attention on the relative importance of nitrogen and phosphate compared to potash in the nutrition of *Hevea*.

The yield trends that have been observed in this experiment from the time of commencement of tapping seem to indicate that from the point of view of yield, the best fertilizer treatment on the laterite soil type which is most typical of the rubber-growing areas in Ceylon, would be to apply only N and P during the immature phase and to include K only from the time of commencement of tapping.

The average yield of 33.1 grammes per tree per tapping for four clones obtained with this treatment in 1964 compared to the average yield of 28.4 grammes obtained from plots that continued to receive NPK right through would seem to merit further attention. It is therefore proposed to carry out a comprehensive analysis of the growth and yield data recorded in this experiment from the time of commencement of the experiment.

In view of the fact that the subject of wind damage has been much in the lime light during the period under review, and that the analysis of the causes of wind damage had revealed that barring wind velocity, the presence of gaps in a plantation and poor anchorage were the two most important primary causes for such damage, investigations under this heading were mainly directed at exploring possibilities of improving planting practices which would lead to a reduction of gaps and better anchorage of plants in rubber plantings.

Cultivation Practices

A careful study of the different methods of planting in vogue revealed that there is much to be gained by adopting the planting procedure which permits the provision of equal growing space for every plant without having to compromise on the necessity to plant on dead level contours, as described by two workers in Malaya. This is achieved by adjusting the planting distance along the contour row to make allowance for variations in distances between contour rows.

There is reason to believe that this method of planting would result in minimising the occurrence of gaps in a plantation by virtue of the more even distribution of plants in the field and the greater uniformity in growth that could be obtained thereby. When it is realised that this could be achieved without having to sacrifice the main advantage of contour planting, namely conservation of soil, which in turn is important for providing better anchorage of plants in the soil, the manifold advantages of this method of planting become apparent.

Some headway was made in introducing this system of planting to producers by preparing models illustrating the different systems of planting.

Efforts to recommend this method of planting to producers, seemed opportune to focus attention on the advantages of and ways and means of providing soil conservation measures at the time of replanting, on a scale that will prove adequate to last the full life cycle of a rubber plantation. Towards this end, it was decided to emphasise the advantages of carrying out planting operations along narrow reverse slope contour platforms and the construction of lateral silt-pitted drains between every planting row, which would ultimately result in the conversion of the land surface into a series of contour terraces or contour platforms.

Ground Covers and Weed Control

No fresh investigations were carried out under this heading during the period under review. This was partly due to the lack of resources necessary to carry out the long-term comprehensive investigations on a scale that seemed necessary, as the subject of ground covers and weed control are so interwoven, and are also dependent on economic considerations.

To carry out short-term investigations on one subject independent of the other did not appear to be appropriate in determining the best procedure that should be adopted, in respect of either, from the point of view of growth and yield of rubber plants which is the main objective.

Whereas, studies on the comparative merits of different cover crops in the past proved that *Pueraria phaseoloides* is by far the best ground cover one could possibly grow, more harm than good may be done to the rubber plants by having a very good stand of *Pueraria* established before the rubber plants are planted in the field. Such a procedure results in the *Pueraria phaseoloides* becoming more competitive to the rubber plants than the natural vegetation which it has replaced. The replacement of the natural vegetation with a more beneficial ground cover, is best effected gradually without having to resort to clean weeding.

Soil Survey — (C. G. Silva)

The soil survey programme initiated in early 1968 was continued. Generalised reconnaissance survey maps of the Alutgama and Ratnapura one-inch maps were compiled and these were found to be too generalised to be of much use. Hence a programme of detail nature was initiated during the latter half of the year and a semi-detail reconnaissance survey of the soils and land forms of the Alutgama Panadura and Horana one-inch maps was completed. Soils and land form maps of the Avissawella and Gampaha one-inch maps are also available. With completion of the Kandy and Kurunegala one-inch maps the major rubber-growing areas would have been covered at the semi-detail reconnaissance level for soils and land forms. This would then lead to a survey of the same areas at the detail reconnaissance level.

REVIEW OF THE RUBBER CHEMISTRY DIVISION

By

M. NADARAJAH

SUMMARY

The advisory activities and the routine analyses connected with them have increased due to an increasing acreage of replanted areas coming into tapping.

It has been found that increased tapping intensities lower the d.r.c. values and this is a frequent cause of difficulties experienced by estates in weighing and determining the d.r.c. of latex with a standard metrolac for payment to tappers especially if double tapping is done to bring up crop figures.

Investigations on the oil-extension of natural rubber at the latex stage have been continued. Sun Rubber Process Oil 596 or Sundex 1585 may be used with equally good results when extending natural rubber up to 25%. Dutrex 130 looks very acceptable for use as extender oil in natural rubber.

Advice was given to Vincit Estate, Waharaka, to improve the quality of concentrated latex and to manufacture low ammonia concentrate.

There appears to be a relationship between calcium content and yield. In the case of latex from clones such as RRIM 501, Mil 3/2 and from slaughter-tapped trees, the latex flow occurs for a long time and the calcium content does not build up to a high level towards the end of the latex flow. But in the case of clone IRCI 7, the calcium content was found to build up to a high level towards the end of the latex flow.

Soaking of panel scrap in fresh serum for 1 or 2 days reduces the copper content below the specification (8 p.p.m.) but not that of manganese (10 p.p.m.). Samples of latex solids film from clones RRIC 86, RRIM 501, RRIC 41 and Nab 15 were sent to the L.F.C. and to the R.R.I.M. for copper and manganese determinations in the round robin test organised by the I.R.R.D.B.

The use of the fungicide, Antimucin WB, on the tapping panel gives a beneficial yield response for clone Nab 12 and an adverse yield response for clone RRIM 501. Further, high-yielding trees, slaughter-tapped trees and trees of certain clones e.g. RRIM 501 where Antimucin was applied before tapping were found to give adverse yields.

DETAILED REVIEW

GENERAL

Staff

The Department consists of the Head of the Rubber Chemistry Division, Mr. M. Nadarajah, the Assistant Rubber Chemist, Mr. S. W. Karunaratne, the Senior Technical Assistant, Mr. D. S. Muthukuda, three Technical Assistants, Messrs. M. T. Veerabangsa, G. G. Gnanasegaram and O. M. R. Sirisena and 13 Minor Staff officers.

Mr. S. Karunaratne, Asst. Rubber Chemist, was awarded a Colombo Plan Scholarship to follow a course in Rubber Technology, leading up to the A.I.R.I., at the National College of Rubber Technology, London, from September, 1964.

Mr. O. M. R. Sirisena was on no-pay study leave to follow a course leading to the L.I.R.I. at the National College of Rubber Technology, England and reported for duty on 1-8-64. He was successful at the L.I.R.I. and at the L.N.C.R.T. examinations.

Advisory Services, Correspondence, Visits

	<u>1964</u>
Inward correspondence	598
Outward correspondence	566
Visits by the staff of the Division (details below)	354

	<i>R.R.I.C. Estates</i>	<i>Commercial Estates</i>	<i>Other Visits</i>	<i>Total</i>
Head of the Rubber Chemistry Division ...	2	41	27	70
Asst. Rubber Chemist ...	4	4	13	21
Senior Technical Assistant ...	4	96	25	125
Technical Assistants ...	14	20	32	66
Lab. & Factory Attendants	15	36	21	72
Total ...	<u>39</u>	<u>197</u>	<u>118</u>	<u>354</u>

Publications

The publications during 1964 to which members of the Division have contributed include the following:—

- (1) Review of the Rubber Chemistry Division for 1963. *Ann. Rev. Rubb. Res. Inst. Ceylon*, (1964).
- (2) Some observations on the non-rubber constituents of *Hevea* Latex. Part II. *Rubb. Res. Inst. Ceylon Quart. J.* **40**, (1964), 1-13.
- (3) Mineral content of unprocessed panel scraps. *Rubb. Res. Inst. Ceylon Quart. J.* **40**, (1964), 13-21.
- (4) Polyphenol oxidase in *Hevea* latex. *Rubb. Res. Inst. Ceylon Quart. J.* **40**, (1964), 74-77.

(5) Short notes on the following subjects for inclusion in the "Question Corner" of the Institute's Quarterly Journal.

(a) Use of detergent 40E in serum for soaking scrap.

(b) Economics of the manufacture of blanket crepe with and without taking a fraction.

(c) Comminuted rubber.

Meetings, Lectures, Visits

1. Refresher courses for Rubber-Makers were held at the Ratnapura Club on 28-4-64 and 29-4-64 and at the Tebuwana Club on 5-6-64 under the auspices of the Sabaragamuwa Planters' Association and the Kalutara District Planters' Association, respectively. A course in rubber-making for Estate Superintendents was held under the auspices of the Kalutara District Planters' Association at Tebuwana Club on 2-6-64, and of the Kelani Valley Planters' Association at Talduwa Club on 28-10-64. The Head of the Rubber Chemistry Division and the Senior Technical Assistant addressed the trainees.
2. The Head of the Rubber Chemistry Division gave a talk on 16-3-64 on "The Preparation and Properties of Plantation Rubber" to the Tyre Corporation trainees.
3. The Head of the Rubber Chemistry Division and Mr. O. M. R. Sirisena are assisting the I.R.I. (Ceylon Section) in conducting part-time lectures for 28 students drawn from the rubber industry. The lectures are held every Saturday morning and it is intended to cover the L.I.R.I. syllabus in 18 months.

Despatch of Latex.—(S. W. Karunaratne). Samples of latex of clones PB 186, RRIM 501 and Nab 12 collected in vessels surrounded by ice have been sent monthly in polythene containers packed in ice in a thermos flask, to the laboratories of the Natural Rubber Producers' Research Association at Welwyn Garden City, England, for research purposes.

Samples of latex from trees of clone PB 186 which were regularly treated with Antinucin after tapping at a concentration of 1 in 120 were sent to the N.R.P.R.A. for testing for biosynthetic activity. They have found that the latex of the treated trees loses its activity more quickly than that of latex of untreated trees in the conversion of Isopentenyl Pyrophosphate into rubber.

Clonal Analyses.—(M. T. Veerabangsa). The average values of nitrogen for samples of latex and rubber collected monthly during 1962 from 23 clones are given in Table I.

TABLE I
ANALYSES FOR NITROGEN OF CLONAL LATEX

Clones	Mean values for 1962	
	Nitrogen %	
PB 186	0.63	
PB 86 (old)	0.59	
PB 86 (young)	0.72	
PR 107	0.62	
Nab 12	0.70	
Nab 15	0.62	
Nab 20	0.68	
RRIM 500	0.62	
RRIM 501	0.70	
RRIC 5	0.67	
RRIC 7	0.70	
RRIC 41	0.70	
RRIC 45	0.76	
RRIC 52	0.68	
RRIC 86	0.67	
Tjir 1	0.65	
Mil 3/2	0.61	
AVROS 255	0.64	
AVROS 352	0.61	
LCB 1320	0.63	
Wagga 6278	0.71	
Glen 1	0.70	
<i>H. benthamiana</i> (F 4537)	0.64	
Mean	0.67	

Determination of d.r.c. of Latex.—(D. S. Muthukuda). Latex from intensively tapped trees e.g., from slaughter-tapped trees and from trees double tapped to keep up with the estimates, has a greater amount of non-rubber constituents than latex from normally tapped trees. This factor can affect the determination of the d.r.c. of latex by the metrolac. In such cases the calibration of the metrolac by trial coagulation is necessary to obtain an accurate weight of the tappers' latex. Assistance was given to the Chief Advisory Officer Smallholdings for checking actual yield by trial coagulation compared to yield by the metrolac in connexion with his yield survey of replanted smallholdings. 73 determinations were taken in the Ratnapura, Matugama, Colombo, Avissawella, Kegalla and Galle Divisions. It was found that the average d.r.c. of 73 determinations was 33.0 by trial coagulation and 28.8 by metrolac and that the metrolac in this survey underreads by about 13%.

Control of Coagulation

Bromo Cresol Green indicator papers prepared at the Institute are regularly supplied to estates for the control of latex coagulation.

Latex Dripping.—(M. T. Veerabangsa). It is known that slaughter tapping and yield stimulation of trees result in a greater amount of late dripping of the latex. The results obtained on the relation between calcium content and yield of a yield-stimulated and intensively tapped tree is given in Table II. The relation between the calcium content and yield of a tree of clone RRIM 501 and Mil 3/2 which are late drippers are also given in Table II. It will be seen that the calcium content does not rise to a marked extent with latex flow and hence the late dripping.

TABLE II
 VARIATION OF CALCIUM CONTENT (IN P.P.M. ON T.S.) AND OF YIELD (IN GRAMS)
 IN LATEX COLLECTED AT 15 AND 30-MINUTE INTERVALS AFTER TAPPING

Sample	Yield Stimulated and intensively tapped trees				Normally tapped trees				Clone Mil 3/2	
	Tree No. 1		Tree No. 2		Tree No. 3		Tree No. 4		Tree No. 5	
	Yield (grms.)	Ca (p.p.m.)	Yield (grms.)	Ca (p.p.m.)	Yield (grms.)	Ca (p.p.m.)	Yield (grms.)	Ca (p.p.m.)	Yield (grms.)	Ca (p.p.m.)
After 15 mins.	51.2	52	47.6	114	13.6	78	13.7	110	13.1	50
From 15-30 mins.	31.1	34	34.9	72	11.2	84	9.8	50	8.5	60
" 30-60 mins.	45.7	32	43.1	102	17.2	28	13.0	62	13.2	78
" 60-90 mins.	45.1	40	32.6	222	15.4	78	10.7	74	11.0	88
" 90-120 mins.	26.8	19	24.5	48	15.1	42	10.1	92	8.2	80
" 120-150 mins.	19.6	34	22.3	52	7.4	24	5.5	74	5.0	22
" 150-180 mins.	16.2	29	19.3	50	5.9	100	4.6	72	5.0	81
" 180-210 mins.	10.5	36	19.0	68	—	—	—	—	4.7	43
" 210-240 mins.	9.9	46	14.2	52	—	—	—	—	—	—
" 240-270 mins.	10.0	20	13.4	48	—	—	—	—	—	—
" 270-300 mins.	—	—	14.6	52	—	—	—	—	—	—
" 300-330 mins.	—	—	8.3	76	—	—	—	—	—	—
Panel scrap 24 hrs. after tapping	6.9	400	5.5	2640	0.9	1082	2.0	710	0.8	691
Shell scrap 24 hrs. after tapping	38.5	24	2.3	97	2.4	103	1.3	192	0.6	34

In the case of clone IRCI 7 the latex flow stops after about 75 minutes (Table III) and it was suspected that the increase in concentration of the calcium ions towards the end of this period causes the latex particles to coagulate and to cover the end of the latex vessels.

TABLE III
 VARIATION OF CALCIUM CONTENT (IN P.P.M. ON T.S.) AND OF YIELD
 (IN GRAMS) OF CLONE IRCI 7 IN LATEX

Sample	Tree No. 1		Tree No. 2	
	Yield (grams)	Ca (p.p.m.)	Yield (grams)	Ca (p.p.m.)
After 10 mins.	10.2	40	11.4	60
From 15-30 mins.	6.4	100	5.3	170
From 30-45 mins.	4.5	120	2.9	70
From 75-105 mins.	4.4	110	1.5	100
From 105-135 mins.	1.1	220	0.8	181
Panel Scrap after tapping	0.5	153	—	—
Cup lump after tapping	2.0	1010	1.7	810

It may be mentioned that the Chemara Research Station, Malaya, in their 1963/64 Annual Report states that higher yield groups are associated with progressively lower calcium values in leaf samples.

Concentrated Latex.—(M. T. Veerabangsa). Advice has been given to Vincit Estate, Waharaka to reorganize their concentrated latex manufacture. Samples of their concentrated latex are regularly tested for mechanical stability, ammonia content, dry rubber content and magnesium content. Advice is also given on the amount of diammonium hydrogen phosphate that has to be added to field latex to keep the magnesium content in the concentrate within the specified limits (50 p.p.m.). In appreciation of the services being rendered to them, Messrs. Richard Pieris & Co., have gifted one of their second hand centrifuges to the R.R.I. and this is now being installed at Dartonfield. Advice was also given to Vincit Estate to produce low ammonia SPP concentrate.

Defects in Smoked Sheets.—(D. S. Muthukuda). Frequent enquiries regarding various defects in smoked sheet have been received and several estates have been visited for detailed investigations of the cause.

The latex from slaughter-tapped and intensively tapped trees, tends to give a spongy coagulum due to fermentation effects. It is recommended that such latex is coagulated separately without bulking with the rest of the latex. The addition of formalin with the coagulant at the rate of two fl. oz. per tank containing latex equivalent to about 200 lb of dry rubber, improves the quality of the sheet.

Oil-Extended Sheets.—(S. W. Karunaratne & D. S. Muthukuda). Samples of oil-extended Ribbed Smoked Sheet containing 25% naphthenic (Sun Rubber Process Oil 596) and 25% high aromatic (Sundex 1585) oils were sent to Sun Oil Company U.S.A. for testing. They have found that either Sun Rubber Process Oil 596 or Sundex 1585 may be used with equally good results when extending natural rubber up to 25 per cent. The results obtained by them are given in Table IV and in Table V.

TABLE IV
CEYLON OIL-EXTENDED NATURAL RUBBER EVALUATION
FORMULATIONS (PHR)

Code No.	1	2	3	4	5
100 Smoked Sheets	100	—	—	—	—
75% Ceylon Rubber — 25% 1585	—	100	—	—	—
75% " " — 25% 1585 *	—	—	100	—	—
75% " " — 25% 596	—	—	—	100	—
S.B.R 1708 (27.3% oil)	—	—	—	—	100
HAF	50	55	55	55	50
Zinc Oxide	5	5	5	5	3
Stearic Acid	2	2	2	2	1.5
PBNA	1	1	1	1	—
BLE	—	—	—	—	1
Santocure	1	1	1	1	0.8
Sulphur	2	2	2	2	2
596 Process Oil	4	—	—	—	—
	(3.8% oil based on rubber)				

* Contains Santo White Antioxidant.

TABLE V
OIL-EXTENDED NATURAL RUBBER EVALUATION
PHYSICAL PROPERTIES

Compound Code No.		1	2	3	4	5
Mooney Viscosity (ML 4—212) Raw		65	42	40	44	68
Mooney Viscosity (ML 4—212) Comp.		64	44	44	47	73
Vulcanisate Properties @ °F		288	288	288	288	307
	Time Minutes					
Tensile, psi	20	3475	2450	2700	2625	3150
	40	3260	2710	2650	2650	3025
	60	3300	2525	2500	2425	2925
Modulus, 300	20	2100	1875	1875	1850	1700
	40	2500	1950	2050	2000	2425
	60	2200	1875	1850	1750	2575
Elongation, %	20	465	390	425	405	495
	40	400	405	400	400	370
	60	415	400	395	390	325
Rebound, %	55	61.5	48.7	48.2	52.5	53.9
Heat Build Up, °F	55	47	63	62	66	52
Fico Abrasion Rate	45	154	103	119	122	136
Hardness — Shore A	20	68	69	68	66	60
	40	69	69	68	66	62
	60	70	69	68	67	63

We have also found that Dutrex 130, which was obtained from Shell Co. of Ceylon Ltd., was very acceptable for the manufacture of oil-extended sheet containing 25%, 30%, 35% and 40% of this oil. The samples were evaluated by the Shell Co. Ltd., in the following formulation.

Polymer	100
HAF black	50
ZnO	5
Stearic acid	2
PBNA	1
Santocure	1
Sulphur	2

In the NR reference compound however, 4 phr of Dutrex 20P was used as processing oil.

The optimum cure times were determined by means of two types of curometers and found to be at 145° C : 12 minutes for the reference compound and 10 minutes for the OE compounds. Properties of polymer, compounds and vulcanisates (cured at 145° C optimum times) are given in Table VI in which A is reference natural rubber, B-E are the extended polymers containing 25, 30, 35 and 40 phr of Dutrex 130 respectively.

TABLE VI
OIL-EXTENDED NATURAL RUBBER
EVALUATION PHYSICAL PROPERTIES

Compound Code	A	B	C	D	E
Mooney Visc. at 100° C raw	76	48	46	44	38
Compound	49	49	48	46	34
Ts, Kg/cm ²	286	241	232	232	217
M 300, Kg/cm ²	153	121	118	118	108
EB, 0/0	530	520	520	520	520
Tear (Angle) Kg/cm	135	106	93	93	90
Hardness (Shore A)	64	65	61	63	62
Rebound at 23°C 0/0	61	48	49	46	44
Rebound at 70°C 0/0	75	66	67	65	63
Set (Const. Dfl) 0/0	22	29	28	28	32
H. B. U. °C (Over 37·8)	23	28	26	27	29
Abrasion resist. (Akron)	507	452	442	431	430

CHANGE OF PROPERTIES AFTER AGEING FOR 7 DAYS AT 70°C

Delta Ts, 0/0	— 14	— 10	— 5	— 14	— 11
Delta M 300, 0/0	+ 39	+ 15	+ 18	+ 14	+ 13
Delta EB, 0/0	— 21	— 8	— 4	— 10	— 6
Delta tear 0/0	— 30	+ 9	+ 4	+ 11	+ 2

The retention of properties after ageing is very promising and in general an improvement is observed with increasing amounts of extender oil.

As far as this limited evaluation allows, Dutrex 130 looks very acceptable for use as extender oil in natural rubber.

The rubber that is most suitable for oil extensions is that having a high molecular weight. Molecular weight determinations (viscosity average) are being carried out on unmilled crepe rubber made from clonal latices collected monthly. The solvent used was Toluene and determinations were carried out at 25°C. The preliminary results obtained show that the molecular weight (viscosity average) is about 10⁶ (Table VII).

TABLE VII
MOLECULAR WEIGHT (VISCOSITY AVERAGE) OF
CREPE MADE FROM CLONAL LATICES

Clone	Molecular weight
PB 86 (old)	$10^6 \times 1.2$
PB 86 (young)	$10^6 \times 0.8$
RRIC 5	$10^6 \times 1.7$
Nab 15	$10^6 \times 0.9$
RRIM 500	$10^6 \times 0.05$
RRIM 501	$10^6 \times 0.6$
PR 107	$10^6 \times 1.4$
Wagga 6278	$10^6 \times 1.4$
AVROS 255	$10^6 \times 1.2$
AVROS 352	$10^6 \times 1.1$
PB 186	$10^6 \times 1.0$
Mil 3/2	$10^6 \times 2.0$
LCB 1320	$10^6 \times 1.7$
RRIC 45	$10^6 \times 1.0$
RRIC 7	$10^6 \times 1.7$
RRIC 86	$10^6 \times 0.9$
Glen 1	$10^6 \times 0.9$
Nab 12	$10^6 \times 0.7$
RRIC 41	$10^6 \times 1.1$
Nab 20	$10^6 \times 0.8$
Tjir 1	$10^6 \times 1.1$

CREPE RUBBER

Untreated Panel Scrap.—(M. T. Veerabangsa). The copper, manganese and iron contents of untreated panel scrap samples collected monthly in 1962 and in 1963 are given in Table VIII. Soaking of panel scrap in fresh serum for 1 or 2 days reduces the copper content below the specification (8 p.p.m.) but not that of manganese (10 p.p.m.).

Fraction Crepe

No. 3 Pale Crepe which is fractioned yellow crepe contains a higher mineral content than No. IX Pale Crepe which is fractioned white crepe. The mineral content of yellow latex and in the crepe after fractionation was determined. The results are given in Table IX.

TABLE VIII

COPPER, MANGANESE AND IRON CONTENTS (IN P.P.M.) OF CLONAL PANEL SCRAP (UNTREATED)

Clone	Copper						Manganese						Iron					
	1962			1963 (1.1.63-31.4.63)			1962			1963 (1.1.63-31.4.63)			1962			1963 (1.1.63-31.4.63)		
	Mean	High-est	Low-est	Mean	High-est	Low-est	Mean	High-est	Low-est	Mean	High-est	Low-est	Mean	High-est	Low-est	Mean	High-est	Low-est
PB 186	5.0	6.8	3.3	8.1	—	—	36	44	30	34	—	—	730	4060	90	260	260	260
PB 86 (old)	5.7	9.0	3.3	4.5	5.0	4.0	43	63	14	37	38	36	845	2060	215	300	320	280
PB 86 (young)	6.9	9.5	4.1	4.9	6.2	4.1	59	90	20	54	61	40	759	2780	200	437	690	310
PR 107	5.5	14.1	2.4	5.3	6.1	4.4	21	31	14	17	21	13	1171	3520	220	500	500	500
Nab 12	5.5	12.4	3.0	13.4	18.1	8.7	26	38	15	26	29	22	684	1840	120	2840	3880	1800
Nab 15	4.8	18.0	2.1	3.2	4.4	2.2	29	38	21	24	30	20	634	2200	90	1780	3760	270
Nab 20	5.1	7.0	3.1	3.6	4.8	2.4	25	39	17	25	28	23	911	3440	160	970	970	970
RRIM 500	6.5	14.6	2.4	5.4	—	—	18	28	11	16	—	—	729	3480	220	230	230	230
RRIM 501	7.0	16.0	2.0	—	—	—	21	35	16	—	—	—	496	1260	90	—	—	—
RRIC 5	5.6	12.7	2.6	3.3	4.7	2.3	37	67	27	27	33	22	1340	3860	105	290	290	290
RRIC 7	7.2	11.7	4.0	5.8	7.3	4.3	42	55	32	37	38	36	1620	4040	100	605	1010	200
RRIC 41	8.0	17.2	2.7	5.0	5.6	4.6	41	77	15	64	76	58	2109	3640	500	740	980	500
RRIC 45	7.2	17.5	2.7	5.2	8.9	1.5	30	51	21	25	26	24	1506	4180	280	2240	2240	2240
RRIC 52	5.3	11.9	2.5	5.8	—	—	32	48	21	44	—	—	1036	3120	100	1700	1700	1700
RRIC 86	7.0	13.0	3.3	5.8	7.6	3.9	30	31	15	27	35	20	1363	3960	140	2010	2010	2010
Tjir 1	6.6	17.4	3.0	7.8	10.2	5.3	24	32	16	33	33	33	778	2080	250	330	330	330
Mil 3/2	5.8	14.6	2.2	2.2	2.8	1.6	23	28	17	14	14	14	922	3860	230	310	310	310
AVROS 235	7.2	16.3	3.3	3.5	4.4	2.5	26	39	13	20	23	16	1671	8800	180	280	280	280
AVROS 352	8.9	18.1	2.7	3.6	—	—	25	36	13	16	23	9	1683	6100	295	320	320	320
LCB 1320	7.7	15.7	3.8	6.2	9.2	3.1	24	39	14	16	17	14	1497	6900	220	740	740	740
Wagga 6278	6.8	14.6	2.3	7.5	11.3	4.9	31	46	16	41	56	30	1401	2260	430	1050	1560	540
Glen 1	4.0	9.8	2.4	3.3	4.2	2.5	43	83	24	43	47	38	640	1520	90	320	340	300
<i>H. benthamiana</i> (F 4537)	6.5	8.5	3.4	5.0	5.5	—	29	42	17	32	38	25	1022	2060	520	235	310	160
Mean	6.3	13.3	2.9	5.4	7.0	3.7	31	47	18	31	35	25	1111	3523	211	840	1047	661

TABLE IX

CALCIUM, MAGNESIUM, COPPER AND MANGANESE CONTENTS (IN P.P.M.) OF
YELLOW LATEX AND IN THE CREPES AFTER FRACTIONATION
(MEAN OF 3 DETERMINATIONS)

Sample	Calcium	Magnesium	Copper	Manganese
Yellow latex (T.S.)	50	1046	5.6	0.9
White latex (T.S.) after fractionation	55	935	5.5	1.4
Yellow crepe	37	286	1.6	1.8
White crepe	27	38	0.2	0.9

COMPOUNDING AND TESTING

Physical Testing of Crepe.—(G. G. Gnanasegaram). The average results of the physical testing of crepe made from 21 different clones for the years 1961 and 1962 are given in Table X and in Table XI. The crepe samples were collected monthly and were made from undiluted latex and with an excess of formic acid, to complete the coagulation within half an hour. It will be seen that crepe from clone AVROS 352 gives fast curing crepe, (Blue circle) and most of the rest give medium curing crepe (Yellow circle).

TABLE X

CLONAL LATEX SAMPLES, MEAN VALUES, JULY—DECEMBER 1961
A.C.S.I PURE GUM MIX CURED FOR 40 MINUTES @ 140°C

Clone	600% Modulus Kg/Cm ²	Tensile Strength Kg/Cm ²	Elongation %	Mooney	Strain @ 5 Kg/Cm ²	Strain Corrected for V/c @ 5 Kg/Cm ²
PB 86	20.9	93.4	880.0	35.5	95.8	94.7
PB 86 (old)	18.0	117.4	896.3	43.6	86.8	88.9
PB 86 (young)	24.9	103.0	865.1	44.3	81.5	84.1
PR 107	29.7	119.9	850.0	43.7	74.4	74.7
Nab 12	26.6	92.4	842.2	40.1	83.4	84.2
Nab 15	23.1	95.8	878.8	46.3	88.8	95.0
Nab 20	26.2	93.2	854.2	39.4	83.8	82.7
RRIM 500	25.3	96.7	856.5	37.0	81.8	77.8
RRIM 501	34.9	106.4	810.9	29.0	69.6	65.3
RRIC 5	27.9	103.8	851.1	45.1	75.3	75.5
RRIC 7	26.4	112.3	873.1	46.4	74.1	75.8
RRIC 52	24.4	93.9	863.2	37.0	85.1	83.0
RRIC 86	21.3	93.0	886.5	39.3	90.5	87.9
Tjir 1	29.0	106.9	845.1	42.2	77.6	77.8
Mil 3/2	23.0	101.6	878.3	44.2	83.3	86.5
AVROS 255	25.2	108.3	873.9	42.2	85.9	86.9
AVROS 352	31.2	113.7	834.4	38.6	70.4	69.3
LCB 1320	23.0	104.8	874.9	45.5	85.2	88.3
Wagga 6278	26.6	103.9	850.8	42.8	74.4	75.4
Glen 1	25.4	102.1	857.0	40.3	83.2	83.3
H. benthamiana (F. 4537)	25.3	87.0	842.5	37.9	89.6	87.4

TABLE XI

CLONAL LATEX SAMPLES, MEAN VALUES : JANUARY—DECEMBER 1962
A.C.S. 1 PURE GUM MIX CURED FOR 40 MINUTES @ 140° C

Clones	600% Modulus Kg/Cm ²	Tensile Strength Kg/Cm ²	Elongation %	Strain Corrected for V/c @ 5 Kg/Cm ²
PB 186	22.7	93.4	867.9	88.2
PB 86 (old)	20.7	94.7	896.4	92.8
RRIM 500	23.7	92.7	859.0	91.1
Nab 12	24.7	89.6	835.7	84.8
Nab 15	22.9	98.2	869.0	92.8
RRIM 501	29.2	92.8	828.2	82.5
PB 86 (young)	31.7	98.6	864.3	87.1
Nab 20	25.3	99.1	862.5	85.6
Tjir 1	21.8	92.3	872.9	91.2
Mil 3/2	23.8	98.8	870.8	88.4
AVROS 255	24.4	100.4	787.6	80.4
AVROS 352	29.7	122.0	839.9	73.0
LCB 1320	22.8	105.8	880.0	87.3
PR 107	24.1	96.9	861.9	83.8
RRIC 5	24.1	96.8	859.9	85.1
RRIC 7	23.4	107.2	885.5	84.5
RRIC 52	26.4	94.8	865.6	86.4
RRIC 86	24.1	86.6	860.6	86.3
Wagga 6278	24.3	102.4	863.3	80.6
Glen 1	23.9	91.1	855.9	91.6
<i>H. benthamiana</i> (F 4537)	24.9	95.4	853.8	84.8
RRIC 45	24.2	86.3	846.3	90.0
RRIC 41	27.2	92.0	827.4	85.9

MISCELLANEOUS

Phenols in Latex.—(S. W. Karunaratne). The phenol content of latex from high upward cuts is about double that of latex from normal cuts. This high phenol content may be an important factor in causing the discolouration of latex from high cuts and consequently the rubber manufactured from such latex.

Round Robin Test.—(M. T. Veerabangsa). About hundred grams each of latex solids film from the clones BRIC 86, RRIM 501, RRIC 41 and Nab 15 were sent to the I.F.C. and to the R.R.I.M. for copper and manganese determinations, in the round robin test organised by the I.R.R.D.B.

Effect of the Mercury Fungicide Antimucin WB on Rubber Yield

Antimucin WB is used as a panel fungicide to prevent Bark Rot. The bactericidal action of Antimucin WB on acid producing bacteria present in the tapping cut should give increased yields. But as it is a latex coagulant, it could have an adverse effect on yield if applied before tapping. Further the interaction of the organo-mercury compound present in Antimucin *i.e.* phenyl mercuric acetate with the thiol group containing enzymes, present in the latex vessels which are essential for rubber biosynthesis could also adversely affect yield. Our investigation has shown that clone Nab 12 gave increased yields when treated with Antimucin WB. However, high-yielding trees, slaughter-tapped trees and trees of certain clones *e.g.* RRIM 501 where Antimucin is applied before tapping gave depressed yields.

These studies on the possible effects of the application of fungicides containing mercury compounds will be continued in balanced experiments in the field with control plots or tapping tasks treated with fungicides without mercury compounds as the active ingredient by the Plant Pathology Division.

REVIEW OF THE SMALLHOLDINGS DEPARTMENT

By

A. B. DISSANAYAKE

SUMMARY

The work of the Smallholdings Department both in the field and in office increased during the year. The Chief Advisory Officer Smallholdings was on duty throughout the year except for a period of 2 months end-of-contract leave. The Senior Assistant Advisory Officer acted for C.A.O.S. during this period. The S.A.A.O. and the 2 Assistant Advisory Officers were on duty throughout the year.

The death of Messrs. W. P. H. Dias, J.P., the Smallholders' Representative on the Rubber Research Board and of J. D. W. Jayawardene, Rubber Instructor, are regretfully recorded.

The newly appointed temporary Clerk reported for duty on 10-4-64. A Replanting Attendant was appointed temporary Rubber Instructor while a temporary Clerk was absorbed to the permanent cadre. A Rubber Instructor tendered his resignation.

The Smallholdings Headquarters was shifted to No. 2, Rheinland Place, Colombo 3, as from 1-10-64.

The C.A.O.S. attended a Staff Meeting and the acting C.A.O.S. attended an Administrative Committee Meeting at the Institute Headquarters, Agalawatta.

4 Conferences of Supervisory Officers were held during the year to discuss sulphur dusting, yield survey and transfers.

2 Advisory Officers of the R.R.I.M. were sent here to see rubber smallholdings and study methods adopted here. They visited smallholdings all over the rubber-growing areas of the Island, the Research Institute Headquarters at Agalawatta and other places of interest. A United Nation Technical Assistant, Dr. McCarthy and Dr. Constable of the F.A.O. visited Smallholdings Headquarters and had discussions with the C.A.O.S.

This Department participated in 6 exhibitions during the year. An attractive stall was put up at the Agricultural and Industrial Exhibition at the Independence Commemoration Day at Galle. To all the other exhibitions too the heavy and valuable departmental exhibits were sent from the Headquarters of the Smallholdings Department. In some of the school exhibitions cine films on interesting topics allied to agriculture were screened.

4 Loans have been given to 4 Instructors to purchase motor cycles and a loan of Rs. 250/- was given to the watcher to buy a push cycle.

The leaflet on "Manufacture and Smoking Rubber Sheet" has been prepared and is with the printer. The Annual Review of the Smallholdings Department published in Sinhala was distributed among smallholders in order to acquaint them with the work done by this Department.

Lining for soil conservation works and planting points was carried out by the field staff. They also advised smallholders on all aspects of rubber work. 1,588 aluminium pans were sold at a concession rate and 4 tons of rubber manure were bought by a smallholder through the Department at a discount of 5%.

The Field Day of the Department was held at Kosgama. The Chairman, Rubber Research Board, the Director, Rubber Research Institute of Ceylon, the Head of Soils Chemistry Division (Guest Speaker) and a social worker of the area were present. The S.H. Representative on the Board could not attend as he was sick. The field work for the day comprised a lecture demonstration by Divisional Advisory Officer, Avissawella.

37,906 visits were made during the year to replanting and replanted smallholdings inclusive of 31,316 visits to permit areas of previous years. 1,617 subsidy holdings of the year 1964 totalling 2,125 acres 2 roods 03 perches were lined for soil conservation works and 2,000 subsidy holdings of 2,765 acres 2 roods 30 perches for planting holes by Rubber Instructors. In addition to the above in 652 subsidy holdings of previous year's issue Instructors lined an extent of 1,029 acres 3 roods 04 perches for soil conservation works and in 676 similar holdings they have lined 1,059 acres 3 roods 03 perches for planting holes. In 558 subsidy holdings Instructors have marked for tapping 32,978 tappable trees by way of demonstration.

Field staff of this Department carried out random checks on planting material issued by the Rubber Controller at commodity purchase depots for subsidy replanters and a total of 14,982 plants were examined at 129 visits to various depots. 287 visits were also made by the field staff to commodity purchase depots for inspection of smallholders' sheet rubber and advising them how to avoid defects seen in their sheet.

Each rubber smallholding for which new planting rights were desired was visited by an Instructor before a permit was issued and 1,249 such preliminary inspections were made and reports submitted to the Rubber Controller. 3,157 visits were made by the field staff to new planting and new planted permit areas of 1964 and 1963, for advice and lining. Further, a total of 7,885 subsequent visits were made by the field staff to new-planted permit areas of previous years. A new record sheet was entered up for each of the years' new planted areas visited. 1,329 Final Inspection Reports and 1,433 Special Reports were made by Rubber Instructors during the year. Instructors lined 192 permit areas of 275 acres 0 roods 07 perches for soil conservation works and 167 areas of 261 acres 0 rood 31 perches for planting holes in this year's permit areas. In addition to this 134 permit areas of 192 acres 2 roods 37 perches were lined by Instructors for soil conservation works and 145 holdings of 221 acres 2 roods 36 perches for planting holes in last year's new planted permit areas. Rubber Instructors marked 6,963 tappable trees in 112 smallholdings. Rs. 3,973.75 were paid as soil conservation grants to 92 peasant class permit holders. Special inspections were undertaken at the request of the Rubber Controller in addition to normal advisory visits.

The State-aided Sulphur Dusting Scheme organised by this Department was only partly carried out owing to the non-arrival of the 2nd consignment of sulphur in time in Ceylon. 100 co-operative groups comprising 10,922 acres were organised. The total extent of 10,922 acres accepted for dusting in 1964 constitutes the largest extent of smallholdings accepted for dusting in a single season though due to circumstances beyond our control an acreage of only 5,687½ acres (1,771 holdings) was dusted. Dusting operations commenced on 4-2-64 in the

Pinnawala sulphur dusting group and were concluded on 21-3-64, when Baduraliya, Morapitiya, Narandeniya and Wilakoladeniya sulphur dusting groups were given the 5th round of dusting. This year the dusted and undusted holdings which refoliated early generally showed no signs of infection by *Oidium* due to the dry climate prevailing during refoliation. It has been observed that the undusted holdings which were late winterers were infected with *Oidium*.

A total of 100 co-operative groups comprising 10,922 acres (same acreage as that organised for last season) are expected to be organised for the forthcoming 1965 sulphur dusting season. No increase in acreage can be made as funds are limited. Due to the rise in cost of sulphur it was decided to dust at the rate of 50 lb of sulphur per acre in 4 or 5 rounds.

The Publicity Unit held 121 publicity meetings and exhibitions during the year. The Publicity Unit too participated at 4 school exhibitions and was also sent to 4 Government Agricultural Farms on request for publicity meetings-cum-exhibitions.

Divisional Advisory Officers conducted a series of lectures in Sinhala on rubber planting, sheet making and allied subjects to Farm School students.

Rubber instructors have conducted 2,963 demonstrations on various aspects of rubber production and manufacture. 52 demonstration smoke-houses and 67 ordinary smoke-houses were started and 40 demonstration and 43 ordinary smoke-houses were completed and a grant of Rs. 75/- was paid to each demonstration smoke-house completed.

A scheme for training smallholders in rubber tapping, manufacture of sheet and other allied subjects was started. 51 training classes were started with 1,402 applicants. However 47 classes functioned with 1,102 trainees of which 697 were successful. The successful trainees of the Avissawella Division, and of the Ratnapura and Horana ranges were awarded their certificates at the Annual Field Day by the Chairman of the Rubber Research Board. The other ranges had small functions of their own to distribute the certificates to successful trainees.

The Rainfall Survey is being continued.

A total of 47 smallholdings scattered all over the rubber-growing areas were under observation from the moment they were planted for a period of one year. However information was available for only 44 plantations. The average cost incurred in maintaining a smallholding for the 2nd year of planting is Rs. 243.05 per acre and the maximum would be Rs. 330.74 per acre while the average cost incurred in maintaining a smallholding for the 3rd year of planting is Rs. 203.60 and the maximum cost would be Rs. 293.39 per acre.

Yield measurements of 8 holdings in each of the 48 ranges in 4 villages were taken at weekly intervals for a period of 15 weeks. Thus the survey covered 384 smallholdings. An average yield of 6.2 lb of sheet rubber and 0.72 lb of scrap per acre per tapping was obtained by using the metrolac reading while an average yield of 7.6 lb of sheet rubber and 0.74 lb of scrap per acre per tapping was obtained by measuring the weight of smoked sheet. It has been observed that the metrolac under-reads by about 13.5%. It can safely be assumed from this survey that the average yield of replanted rubber smallholdings per acre per year is about 1,000 lb or at any rate over 880 lb.

DETAILED REVIEW

INTRODUCTION

The work of the Smallholdings Department both in the field and in office increased during the year under review. Fairly large numbers of Subsidy Re-planting and New Planting permits were again issued and the consolidation of the old sulphur dusting groups and the organisation of new groups and supervision of all the groups were again undertaken. The Publicity Unit functioned in the field throughout the year. Assistance to smallholders was given in the form of advisory visits, lining for planting holes and soil conversation works and the usual advisory services continued to be given to rubber smallholders in general.

GENERAL

Staff

The Chief Advisory Officer Smallholdings was on duty throughout the year except for a period of two months' end-of-contract leave from 16th August to 15th October, 1964.

The Senior Assistant Advisory Officer acted for the Chief Advisory Officer Smallholdings during this two-month period.

The Senior Assistant Advisory Officer at Smallholdings Headquarters and the two Assistant Advisory Officers in the field were on duty throughout the year.

The death under tragic circumstances of Mr. J. D. W. Jayawardane, Rubber Instructor, Matugama, in January, 1964, is recorded with deep regret. He was an able and hard working officer who counted over 6 years of service in this Department.

The death of Mr. W. P. H. Dias, J.P., on 15th April, 1964, is also recorded with deep regret. Mr. Dias had been a former Chairman of the Rubber Research Board and the Smallholders' Representative on the Rubber Research Board up to December 1963, for a period of over 25 years.

The newly appointed temporary Clerk, Mr. M. Jayasuriya assumed duties with effect from 10th April, 1964.

Mr. D. Hettiarachchi, Replanting Attendant, was appointed to a vacant post of temporary Rubber Instructor with effect from 1st September, 1964.

Mr. R. E. Perera, temporary Clerk was absorbed to the permanent cadre with effect from 23rd July, 1964.

Mr. H. D. N. G. Seneviratne, Rubber Instructor, Dehiowita, tendered his resignation to take effect from 26th December, 1964.

The Headquarters of the Smallholdings Department was shifted to No. 2, Rheinland Place, Colombo 3, with effect from 1st October, 1964.

The Chief Advisory Officer Smallholdings attended a Staff Meeting at Director's office at Dartonfield, Agalawatta, to discuss details regarding participation in the Industrial Exhibition.

The Acting Chief Advisory Officer Smallholdings attended an Administrative Committee Meeting at the Institute headquarters at Dartonfield on 2-10-64 where the departmental estimates and programme of work for the year 1965 were considered.

Four conferences of the Supervisory Officers were held at the Smallholdings Department Headquarters during the year :—

- (i) On 31st January, 1964 ... to discuss the situation of sulphur dusting of smallholdings which was greatly affected due to the strike at the Colombo Port.
- (ii) On 29th June, 1964 ... to discuss the yield survey of smallholdings, sulphur dusting in 1965 and transfers.
- (iii) On 29th August, 1964 ... to discuss several items in connection with the yield survey of smallholdings.
- (iv) On 28th September, 1964 ... to discuss several items in connection with the yield survey.

Visitors

A United Nations Technical Assistant called at the Smallholdings Headquarters on 14-2-64 for discussions with the Chief Advisory Officer Smallholdings. Dr. McCarthy and Dr. Constable of the F.A.O. visited C.A.O.S. on 8-7-64 in order to obtain information about the peasants' use of fertilizers and their general attitude on manuring. Two Advisory Officers of the Smallholdings Department of the Rubber Research Institute of Malaya were sent here to see rubber smallholdings and study methods adopted here. From 21st to 31st October they visited smallholdings all over the rubber-growing areas of the Island, the Research Institute at Agalawatta and other places of interest.

Exhibitions

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

- (i) The Agricultural and Industrial Exhibition at the Independence Commemoration Day at Galle from 4th — 8th February.
- (ii) The Jubilee Echoes Exhibition and Fair at the Good Shepherd Convent, Kandy from 5th — 7th June.
- (iii) The Yakella School Exhibition in Undugoda range on the 12th June.
- (iv) The Ruwanwella Madhya Maha Vidyalaya Exhibition on the 13th and 14th June.
- (v) The Yatiyantota Exhibition on the 20th and 21st June.
- (vi) The Omatta Government School Exhibition on the 7th and 8th December, 1964.

An attractive stall was put up at the Agricultural and Industrial Exhibition in Galle with the help of funds provided by the Rubber Replanting Advisory Board; to all the other exhibitions too the heavy and valuable departmental exhibits were sent from the Head Office in Colombo. In some of the school exhibitions cine films on interesting topics, allied to agriculture were shown to audiences consisting of smallholders and other visitors.

For the Industrial Exhibition at the Colombo Race Course our Department was allotted a certain amount of space for which a working model showing rain falling on a rubber plantation where all types of soil conservation measures have been adopted is being prepared. Progress on the exhibit is good and this will be ready for the exhibition scheduled to open on 1st February, 1965.

Loans

Four loans totalling Rs. 9,360/- for purchase of motor cycles were given to four Rubber Instructors and the Watcher was given a loan of Rs. 250/- to buy a new push cycle.

Correspondence.—The following figures in regard to correspondence are an indication of the volume of work done during this period both in the field and at the Smallholdings Department Headquarters:—

General :

Inward 8,766

Outward 10,364

With the Rubber Controller :

Inward 1,426 (from the Rubber Controller with new planting applications etc.)

Outward 4,011 (including 1,249 Preliminary Reports, 1,329 Final Inspection Reports and 1,433 Special Reports)

From the Field Officers to Permit-holders :

3,825 (not included in the above figures)

Publications

The new leaflet on “Manufacture and Smoking Rubber Sheet” has been prepared and is with the printer. This leaflet too has been well illustrated with photographs taken from smallholdings.

The Annual Review of the Smallholdings Department published in Sinhala was distributed among smallholders in order to acquaint them with the work done by the Department.

ASSISTANCE TO SMALLHOLDERS

Lining for soil conservation works and for planting points was carried out by Rubber Instructors and Replanting Attendants. Rubber Instructors also advised smallholders on the correct tapping procedure, disease control methods, manuring, sheet making and smoking. 1,588 locally made aluminium coagulating pans were sold to smallholders at the usual concession rate of Rs. 3.50 per pan. The cost per pan to the Department is Rs. 4.50. Four tons of R. 4 : 6 : 5 rubber manure mixture were bought for a smallholder through this Department at a discount of 5%.

ANNUAL FIELD DAY

The Annual Field Day of the Department was held at the Kosgama Maha Vidyalaya on 28th November, 1964. The programme was as follows :—

- 8-00 — 9-45 a.m. ... Field work.
9-45 — 10-00 a.m. ... Tea break.
10-00 — 10-15 a.m. ... C.A.O.S. welcomes the Chairman, Director, S.H. Representative and the Guest Speaker.

A few words by : 1. The Chairman,
2. The Director,
3. The S.H. Representative.

- 10-15 — 11-00 a.m. ... Talk by Mr. A. J. Jeevaratnam, Head of Soils Chemistry Division on " Cultural Practices of Significance to Smallholdings ".
11-00 — 11-15 a.m. ... Question time.
11-15 — 11-30 a.m. ... Assembling smallholders.
11-30 — 11-45 a.m. ... Talk in Sinhala by the Chief Advisory Officer, Smallholdings on the scheme of training classes.
11-45 — 12-15 p.m. ... Presentation of certificates by the Chairman, Rubber Research Board.
12-15 — 12-20 p.m. ... Short talk by a smallholder.
12-20 — 12-30 p.m. ... Any other short talks by Chairman, Director, S.H. Representative, etc.

Conclusion of programme.

Mr. J. W. Craig, the Chairman, Rubber Research Board, Mr. C. A. de Silva, the Director, Rubber Research Institute of Ceylon, Mr. A. J. Jeevaratnam, the Head of the Soils Chemistry Division and Mr. S. E. Wijesundera, J.P., a social worker of the area, were present. Mr. N. Abeygoonewardene, J.P., the Smallholders' Representative on the Rubber Research Board could not attend as he was sick and in hospital.

The field work for the day consisted of a lecture-demonstration by Mr. D. R. Ranwala, the Divisional Advisory Officer, Avissawella, on compost making. After the welcome to guests by the Chief Advisory Officer Smallholdings, the Chairman and the Director spoke a few words.

The Chairman in his short address paid a tribute to the late Mr. W. P. H. Dias and in his memory a two-minute silence was observed by all present. The guest speaker, Mr. A. J. Jeevaratnam, the Head of the Soils Chemistry Division addressed the officers on " Cultural Practices of Significance to Smallholdings ", after which questions were asked and the subject discussed at length with Chairman, Rubber Research Board and the Director taking part.

After assembling the smallholders the Chief Advisory Officer explained in Sinhala the necessity for and the details of the Training Scheme in Tapping and allied subjects for smallholders and invited the Chairman to distribute the certificates to the successful trainees.

A short address of thanks and appreciation of the work of the Department and specially the scheme of Training Classes by a smallholder brought the day's proceedings to an end.

REPLANTING

Considerable attention was paid by the field staff in assisting smallholders as well as small estate owners (on request) in replanting their permit areas according to the requirements of the Rubber Replanting Subsidy Scheme.

The following Rubber Replanting Subsidy Scheme permits issued to smallholdings during the year were in force as at 31st December, 1964 :—

<i>Number of Permits</i>	<i>Acres</i>	<i>Roods</i>	<i>Perches</i>
4,437	6,040	0	27

Copies of the permits issued by the Rubber Controller to smallholders and received by this Department from time to time were forwarded to the Range Instructors.

Every one of the above 4,437 smallholdings was visited by a Rubber Instructor. 6,590 visits were made to 1964 replanting permit areas during the year. 37,906 visits were made during the year to replanting and replanted smallholdings inclusive of 31,316 visits to permit areas of previous years.

During the year Rubber Instructors lined 1,617 permit areas totalling 2,125 acres 2 roods 03 perches for soil conservation works and 2,000 permit areas of 2,765 acres 2 roods 30 perches for planting holes in 1964 permit areas.

Similarly, Rubber Instructors have lined a further 652 permit areas of 1,029 acres 3 roods 04 perches in extent for soil conservation works and 676 permit areas of 1,059 acres 3 roods 03 perches in extent for planting holes in permit areas of the previous year.

Special reports on subsidy replanting permit areas were submitted to the Rubber Controller.

A total of 32,978 tapping holes were marked for tapping by Rubber Instructors by way of demonstrations.

A total of 287 visits were made by field staff to Commodity Purchase Depots for inspection of smallholders' sheet rubber and advising them on sheet making and smoking and how to avoid defects seen in their sheet. 129 visits were made to the depots by the field staff for the purpose of random checking of planting material issued to subsidy replanting smallholders. In all 14,982 plants were examined at these visits.

NEW PLANTING

Apart from replanting work Rubber Instructors devoted part of their time in visiting, advising and assisting rubber new-planting smallholders. Each new smallholding for which rubber new-planting rights were desired was visited and reported on by a Rubber Instructor before a permit was issued by the Rubber Controller. 1,249 such preliminary inspections were made and reports sent to the Rubber Controller during the year. 876 new planting permits covering approximately 1,399 acres 0 roods 03 perches in extent were issued during the year.

3,157 visits were made by the field staff to new-planting and new-planted permit areas of the years 1964 and 1963 for advice and lining assistance. A new record sheet (yellow form) was entered up for each of the years' new-planting permit areas visited. The condition in which the previous year's new-planted areas were found and the work recommended to be done were recorded in the relevant form of each such permit area visited in 1964.

1,329 Final Inspection Reports and 1,433 Special Reports were made by Rubber Instructors during the year. Further, a total of 7,885 subsequent visits were made by the field staff to new-planted permit areas of previous years.

Rubber Instructors lined 192 permit areas of 275 acres 0 rood 07 perches in extent for soil conservation works and 167 permit areas of 261 acres 0 rood 31 perches in extent for planting holes in this years' permit areas.

Similarly, 134 permit areas of 192 acres 2 roods 37 perches in extent were lined by Rubber Instructors for soil conservation works and also 145 permit areas of 221 acres 2 roods 36 perches in extent for planting holes in last year's (1963) new-planting permit areas. Divisional Advisory Officers have checked such lining in the field in 83 new-planting permit areas. Rubber Instructors marked 6,963 tappable trees in 112 new-planted smallholdings.

Soil conservation

Rs. 3,973.75 were paid as soil conservation grants to 92 peasant class permit-holders during the year. 63 holdings were measured by Rubber Instructors, vouchers prepared and submitted during the year. Divisional Advisory Officers checked the measurement reports submitted in 56 cases in all.

SPECIAL INSPECTIONS FOR THE RUBBER CONTROL DEPARTMENT

The following inspections were undertaken at the request of the Rubber Controller in addition to the normal advisory visits mentioned in this report:—

Visits for Preliminary Reports	...	...	1,249
Visits for Final Inspection Reports	...	...	1,329
Visits for Special Reports (new planting)	...	...	1,433
Visits for Special Reports (subsidy replanting)	...	...	149
Visits for random checking of planting material	...	...	129

SULPHUR DUSTING

The State-aided Sulphur Dusting Scheme organised by the Department was only partly carried out during the wintering season in January to March, 1964, because of the non-arrival of the second consignment of sulphur in time in Ceylon.

In all 100 co-operative groups comprising 10,922 acres were organised this year. This showed an increase of 694 acres over the 1963 season's acreage of 10,228 acres. (Annexure I).

Before the commencement of dusting the correct procedure of dusting and other requisite instructions such as proper maintenance of dusting machines, supervision of dusting, submitting daily, weekly and monthly reports on the progress and results of dusting and the checking of accounts of incidental expenses of different co-operative dusting groups were given to the staff. The necessary forms for these purposes were distributed among the staff well in time.

Collection of money for incidental expenses in the co-operative dusting scheme was one of the greatest difficulties which had to be overcome. As was done earlier only Rs. 5/- per acre was collected from the group members for incidental expenses. In many cases the Rubber Instructors and the supervisory staff had to personally see to the collection of money.

The departmental mechanic and the agents of the sulphur dusting machines did the servicing of dusting machines in five of the divisions excluding the Colombo Division, where the servicing was attended to by a locally engaged mechanic, prior to the commencement of dusting. Minor repairs at dusting were attended to either by the departmental mechanic or by reliable local mechanics. However, the major repairs were done by the agents. Each accepted co-operative dusting group was issued a sulphur dusting machine on loan. Spare machines were made available at central spots in order to avoid interruptions at dusting. Discussions at the monthly conferences held in the six divisions from July to September and a conference of supervisory officers held in September helped to solve the difficulties faced during the period of group formation.

A special conference of the supervisory officers was convened during the month of January, 1964, to discuss the situation which arose as a result of the delay in unloading the consignment of sulphur due to the strike at the Colombo Port.

The sulphur dust was scheduled to be distributed in early December but due to unsettled conditions in the Colombo Port extending from December 1963 to January 1964, only half the sulphur dust was available by the end of January when refoiliation had already started in many areas. Thus sulphur dusting could not be carried out in about half the number of sulphur dusting groups due to non-availability of sulphur in time. Defoliation was observed to be fairly even.

Each group had its machine operator and two labourers to carry the machine. The machine operators of the newly formed groups, who have had no previous experience in sulphur dusting, were given demonstrations and training.

The Rubber Instructors were instructed to personally supervise the first two rounds of dusting in all groups. Subsequent rounds of dusting were to be supervised as duties permitted. Almost all the dusted groups had their five rounds of dusting.

Dusting operations commenced on 4-2-64 in the Pinnawala sulphur dusting group in the Padukka Range. The Elpitiya sulphur dusting group was the first to complete dusting having completed the final round on 27-2-64. The dusting operations for the season were concluded on 21-3-64 when the Baduraliya, Morapitiya, Narandeniya and Wilakoladeniya sulphur dusting groups (Kalutara, Matara and Ratnapura Districts) were given their fifth round of dusting (Chart I)

It has been reported that a number of groups had to start sulphur dusting as early as 2 a.m. in order to complete the day's dusting programme by 7-30 a.m.

Results

This year the dusted and undusted holdings which refoiliated early, generally showed no signs of infection by *Oidium* due to the dry climate prevailing during refoiliation. But it has been observed that the undusted holdings which were late winterers infected with *Oidium*.

Summary

Number of holdings dusted	...	...	1,771
Acreage dusted	...	...	5,687½
Number of groups which functioned	...	...	54
Average size of a holding	...	...	3·2 acres
Size of the smallest holding	...	...	¼ acre
Size of the largest holding	...	...	27 acres
Average number of holdings in a group	...	...	33
Average cost of dusting an acre including sulphur	...	...	Rs. 12·42

The total extent of 10,922 acres accepted for dusting in 1964 constitutes the largest extent of smallholdings accepted for dusting against *Oidium* in a single season ; though due to circumstances beyond our control an acreage of only 5,687½ acres was dusted. The distribution of co-operative sulphur dusting groups according to districts is given in Annexure II.

TABLE I
Total Acreage Accepted and Dusted in 1964

District	No. of groups accepted	acreage accepted	No. of groups dusted	Acreage dusted
Kalutara	26	2962	13	1523½
Colombo	22	2550	12	1332½
Kegalla	24	2365½	10	896
Ratnapura	15	1710	10	1079½
Galle	10	1063½	7	661
Matara	2	197	2	194
Kandy	1	74	—	—
Total	100	10922	54	5687½

The smallest holding to be dusted was ¼ acre in extent. The total acreage dusted consisted of 4,613½ acres of budded rubber, 953½ acres of clonal seedling rubber and 120½ acres of ordinary unselected seedling rubber (Annexure III). Of the total acreage, 4,646½ acres, (i.e. 82%) were provided with subsidised sulphur at the rate of Rs. 6/05 per acre and 1,041 acres were supplied with sulphur dust at the non-subsidised rate of Rs. 12/10 per acre.

A follow-up questionnaire was distributed a month after dusting to ascertain the results of sulphur dusting. The results are tabulated in Chart II.

The answers to the questionnaire reveal that :—

1. Almost all the dusted holdings were free of *Oidium*.
2. In general the incidence of the disease in undusted holdings has been less heavy than the previous year.
3. In dusted holdings, especially in the partial and later winterers infection by *Oidium* appeared on a very small scale.
4. Almost all the smallholders who took part in this scheme this year have expressed their willingness to participate in the scheme in the coming year as well.

Sulphur dusting for 1965

For the forthcoming 1965 sulphur dusting season a total of 100 co-operative groups are expected to be organised as funds are limited and, therefore, no increase in acreage could be made. The acreage, therefore, is expected to be the same as that organised for the 1964 season (10,922 acres). Approximately 240 metric tons of approved sulphur dust will be used during the 1965 dusting season. Due to the rise in cost of sulphur it was decided to dust at the rate of 50 lb of sulphur per acre in 4 or 5 rounds rather than increase the money that the smallholder should pay.

PUBLICITY UNIT

During the year a total of 121 Publicity Meetings and Exhibitions were conducted in the ranges by the Range Instructors assisted by the Rubber Instructor, Publicity Unit. During the last few months of the first half of the year these publicity meetings and exhibitions were held at points where tapping training classes were organised by the Range Instructors. This proved very useful to the trainees and other smallholders. The usual set of slides on the following subjects *viz.* *Oidium*, *Fomes*, soil conservation, tapping and tapping posters were projected and simultaneously supported by tape-recorded commentaries on each subject.

The Publicity Unit too participated at four School Exhibitions where the Range Instructors for Undugoda, Ruwanwella, Yatiyantota and Agalawatta ranges had arranged Smallholdings Department Stalls at Yakella Senior School, Ruwanwella Central College, Yatiyantota Senior School and Omatta Maha Vidyalyaya.

The Publicity Unit was also sent to the following Government Agricultural Farms on request for publicity meetings-cum-exhibitions and the usual slide shows were held. These were specially held for the benefit of the Farm School students at :—

Ambepussa Farm

Batangala Farm

Mapalana Farm

Horana Farm

At these shows neighbouring smallholders too were allowed to be present.

LECTURES, DEMONSTRATIONS AND TRAINING CLASSES

Lectures

The Divisional Advisory Officers visited, on request, the Government Farm Schools at Batangala, Ambepussa, Karapincha and Horana and conducted a series of lectures in Sinhala on rubber planting, sheet manufacture and allied subjects to the students taking courses in practical agriculture.

Demonstrations

Rubber Instructors conducted 1,008 sheet making demonstrations, 1,007 tapping, 493 disease control and 455 miscellaneous demonstrations on other planting topics during the year.

For the purpose of improving smoking of smallholders' sheet rubber, Rubber Instructors have paid 993 and 1,770 visits to demonstration and ordinary smokehouses and persuaded smallholders to commence building 52 demonstration smokehouses and 67 ordinary smokehouses of which 40 demonstration and 43 ordinary smokehouses were satisfactorily completed. A grant of Rs. 75/- was paid to each demonstration smokehouse completed.

Training classes

A scheme for training smallholders in rubber tapping and manufacture of sheet and other allied subjects on rubber was started on similar lines as in the previous year. Instructors were not given a special training this year as they had a good training last year. All applications for the training classes were received by the end of May and 51 training classes were started with 1,402 applicants. Later however 47 classes functioned with a total of 1,102 trainees of which 697 were successful. (Table II).

The first class was started on the first week of June and two classes were held weekly at each place for a duration of eight weeks, making 16 classes in all at each place of training.

The successful trainees of Avissawella Division, Ratnapura and Horana ranges were awarded certificates at the Annual Field Day which was held this year at the Kosgama Maha Vidyalaya. The certificates were given away by the Chairman of the Rubber Research Board. The other ranges had small functions of their own to distribute the certificates to the successful trainees.

TABLE II

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

Division	No. of trainees accepted	No. of trainees participated	No. successful
Kegalla	232	210	132
Avissawella	188	150	89
Colombo	195	155	96
Ratnapura	238	201	132
Matugama	305	223	152
Galle	244	163	96
Total	1402	1102	697

SURVEYS

Rainfall survey

The Rubber Instructors continued to send the daily rainfall returns. The survey is being continued.

Cost of maintaining a smallholding for the 2nd year of planting

A total of 47 smallholdings scattered all over the rubber-growing areas were under observation from the moment they were planted for a period of one year. As some smallholders either stopped work or abandoned the plantation, information was available for only 44 plantations. The average cost incurred in maintaining a smallholding for the 2nd year of planting is Rs. 243·05 cts. (Table III).

TABLE III
AVERAGE COST OF MAINTAINING A SMALLHOLDING
IN THE 2ND YEAR OF PLANTING

Items	No. of smallholders who carried out	Total cost Rs. Cts.	Average cost per acre Rs. Cts.
Weeding	44	3,798·54	86·33
Cover crops	41	530·57	12·94
Manuring	40	2,536·61	63·41
Repairs to S.C. works	30	881·81	29·39
Repairs to fence	29	323·49	11·15
Filling vacancies	27	344·30	12·75
Watchman	22	1,351·72	61·44
Inspection and attention	20	637·99	31·90
Others, watch-huts, roads etc.	14	151·11	10·79
Pest & disease control	13	138·32	10·64
Total	—	10,694·46	330·74
Average per acre	—	243·05	330·74

It can be seen from the above that some of the items are carried out only if they become necessary. Vacancies are filled only if a sufficiently large number of vacancies occur. Pest and disease control are necessary only in cases where there is an outbreak of diseases or damage by pests. The total cost of maintaining during the 2nd year of planting is Rs. 10,694·46. This works out to Rs. 243·05 per acre. If however, the averages for the different items are added the cost is Rs. 330·74. This can be regarded as the maximum cost per acre that a smallholder will be called upon to spend if he has to carry out all the items mentioned. The total expenses incurred in the different divisions are given in Annexure IV. The figures in brackets represent the number of smallholders who carried out those particular items.

Cost of maintaining a smallholding in the 3rd year of planting

In this too observations were made for a period of one year on 47 smallholdings scattered all over the rubber-growing areas of the Island. Data were however available in the end for only 46 holdings. The average cost incurred in maintaining a smallholding for the third year of planting is Rs. 203·60 cts. (Table IV).

TABLE IV
AVERAGE COST OF MAINTAINING A SMALLHOLDING
IN THE 3RD YEAR OF PLANTING

Items	No. of smallholders who carried out	Total cost Rs. Cts.	Average cost per acre Rs. Cts.
Weeding	46	3,534·75	76·84
Manuring	44	3,697·87	84·04
Repairs to S.C. works	36	819·74	22·77
Repairs to fence	35	379·11	10·83
Cover crops	35	393·38	11·24
Pest and disease control	17	158·02	9·29
Watchman	15	596·37	39·75
Inspection and attention	14	328·14	23·43
Other charges, watch-hut, roads etc.	11	119·71	10·88
Thinning out	—	25·92	4·32
Total	—	10,053·01	293·39
Average per acre	—	203·60	293·39

The total expenses incurred for the different divisions are given in Annexure V. Here too the figures in brackets represent the number of smallholders who carried out those items. The total cost of maintaining 46 smallholdings in the 3rd year of planting is Rs. 10,053·01. Therefore the average cost per acre of maintaining a smallholding for the 3rd year of planting is Rs. 203·60. However, if we add the averages for the different items we would get the maximum cost per acre a smallholder will be called upon to incur if he has to carry out all items in maintaining a smallholding in the 3rd year of planting. This amount is Rs. 293·39.

Yield survey of replanted smallholdings

Yield measurements of eight holdings in each of 48 ranges in 4 villages were taken at weekly intervals for a period of 15 weeks. Thus the survey covered 384 smallholdings from July to mid-October 1964. The number of readings taken were however far below than expected due to heavy rain during this period. The yield of dry rubber was measured by using the metrolac reading. As the metrolac was observed to under-read, metrolac readings were supplemented towards the latter half of the survey by measurement of the weight of smoked sheet produced.

A total of 609 acres 3 roods 7 perches gave a yield of 3,767 lb 11.5 oz of sheet rubber and 441 lb 12.5 oz of scrap. Thus the average yield per acre per tapping is 6.2 lb of sheet rubber and 0.72 lb of scrap (Table V).

TABLE V
YIELD OF REPLANTED RUBBER SMALLHOLDINGS AS OBTAINED
BY USING THE METROLAC READING

Division	Acreage			Yield of smoked sheet		Yield of scrap	
	A.	R.	P.	Lb	Oz.	Lb	Oz.
Galle	91	2	07	529	05	36	10
Ratnapura	105	2	02	665	07.5	80	15.5
Matugama	111	0	39	765	12	105	06
Kegalla	98	2	38	506	05	68	06.5
Avissawella	107	2	35	626	13.5	73	02.5
Colombo	95	0	06	674	00.5	77	04
Total	609	3	07	3767	11.5	441	12.5
Average yield per acre per tapping in pounds	—			6	2	0	72

Assuming an average of 140 tapping days per year on the S/2, d/2, 100% system the yield per acre per year to the nearest pound would be 868. As the metrolac under-reads by about 13.5% the corrected yield per acre per year to the nearest pound is $868 \times 100 = 1,003$ lb.

86.5

Towards the end of the survey, as mentioned earlier, the actual weight of the smoked rubber sheet was measured. Here 599 acres 0 rood 3 perches gave a total yield of 4,208 lb 2½ oz of sheet rubber and 444 lb 2 oz of scrap. This works out to 7.0 lb of sheet rubber and 0.74 lb of scarp per acre per tapping. (Table VI).

TABLE VI
YIELD OF REPLANTED RUBBER SMALLHOLDINGS AS OBTAINED
BY MEASURING THE WEIGHT OF SMOKED SHEET

Division	Acreage			Yield of smoked sheet		Yield of scrap	
	A.	R.	P.	Lb	Oz.	Lb	Oz.
Galle	91	2	17	563	01	47	00
Ratnapura	105	2	02	772	10	85	12
Matugama	112	2	25	877	10	104	14
Kegalla	96	1	38	585	03.5	65	11
Avissawella	97	2	35	669	10	69	12.5
Colombo	95	0	06	740	00	71	00.5
Total	599	0	03	4208	02.5	444	02
Average yield per acre per tapping in pounds	—			7	0	0	74

On this basis the yield of a replanted smallholding per acre per year is $7.0 \times 140 = 980$ lb of sheet rubber and 104 lb of scrap.

Of the total area surveyed 436½ acres consisted of budded rubber of PB 86 which gave a total yield of 3,182 lb 9 oz of sheet and 327 lb 13 oz of scrap. (Table VII).

TABLE VII

YIELD OF REPLANTED SMALLHOLDINGS PLANTED WITH BUDDED RUBBER
(AS OBTAINED BY MEASURING THE WEIGHT OF SMOKED SHEET)

Division	Acreage			Yield of smoked sheet		Yield of scrap	
	A.	R.	P.	Lb	Oz.	Lb	Oz.
Galle	67	2	30	433	10	36	01·5
Ratnapura	74	1	17	573	08	58	14
Matugama	83	1	26	667	00	76	10·5
Kegalla	65	3	20	422	01·5	50	00·5
Avissawella	71	3	14	507	01·5	49	09
Colombo	73	1	13	579	04	56	09·5
Total	436	2	00	3182	09	327	13
Average yield per acre per tapping in pounds	—			7	3	0	75

The yield per acre per tapping is 7·3 lb of sheet and 0·75 lb of scrap which works out to 1,022 lb of sheet rubber and 105 lb of scrap per acre per year for replanted budded rubber smallholdings.

The balance 162½ acres consisted of clonal rubber of Tjir 1 which gave a total yield of 1,025 lb 9½ oz of sheet and 116 lb 5 oz of scrap. (Table VIII).

TABLE VIII

YIELD OF REPLANTED SMALLHOLDINGS PLANTED WITH CLONAL RUBBER
(AS OBTAINED BY MEASURING THE WEIGHT OF SMOKED RUBBER SHEET)

Division	Acreage			Yield of smoked sheet		Yield of scrap	
	A.	R.	P.	Lb	Oz.	Lb	Oz.
Galle	23	3	27	129	07	10	14·5
Ratnapura	31	0	25	199	02	26	14
Matugama	29	0	39	210	10	28	03·5
Kegalla	30	2	18	163	02	15	10·5
Avissawella	25	3	21	162	08·5	20	03·5
Colombo	21	2	33	160	12	14	07
Total	162	2	03	1025	09·5	116	05
Average yield per acre per tapping in pounds	—			6	31	0	71

The yield per acre per tapping is 6·31 lb of sheet and 0·71 lb of scrap which works out to an average yield of 882 lb of sheet rubber and 99 lb of scrap per acre per year for clonal replanted smallholdings.

From the above it can be assumed that the average yield of replanted rubber smallholdings per acre per year is about 1,000 lb or at any rate is over 880 lb.

DETAILS OF THE SULPHUR DUSTING PROGRAMME FOR 1964

CHART I

Name of District	Rubber Instructor's Range	No. of Dusting Groups	No. of Holdings	Kind of Rubber (Acres)				Holding (Acres)		Total cost of dusting per acre Rs. Cts.	Remarks
				Budded	Clonal Seedling	Ordinary Seedling	Total	Smallest	Largest		
Colombo	Dompe	3	131	296.75	19.50	—	316.25	0.50	12.00	10.88	Dusting was started as early as the first week of February, 1964 in most cases and spread till the last week of February. The operations were concluded in mid-March in most cases while in some others, they were continued till the end of March 1964.
	Gampaha	1	43	38.25	77.00	—	115.25	0.50	9.00	9.90	
	Homagama	6	237	449.75	147.50	25.00	622.25	0.50	10.75	12.10	
	Padukka	1	49	109.00	16.75	2.75	128.50	0.75	10.00	11.32	
	Weliweriya	1	57	130.00	11.50	9.00	150.50	0.50	8.00	11.37	
Kalutara	Bandaragama	1	67	129.75	9.75	—	139.50	0.50	8.00	11.24	
	Horana	3	163	294.50	65.00	7.00	366.50	0.50	12.00	11.44	
	Ingiriya	2	110	195.00	37.25	—	232.25	0.50	10.00	11.37	
	Baduraliya	3	63	260.00	102.00	—	362.00	1.00	9.50	11.05	
	Welipenne	2	68	116.25	120.75	—	237.00	0.50	9.00	11.35	
	Agalawatta	1	33	80.00	21.25	—	101.25	0.50	10.00	12.03	
Kegalla	Neboda	1	34	74.75	2.50	11.00	85.25	0.50	9.50	11.05	
	Rambukkana	2	43	122.50	21.00	13.50	157.00	0.50	13.00	11.78	
	Warakapola	2	33	173.25	—	—	173.25	1.00	14.50	13.12	
	Hettimulla	3	106	245.00	49.00	—	294.00	0.50	18.00	11.63	
	Aranayake	1	11	66.75	8.00	—	74.75	1.50	15.25	12.60	
Galle	Polgahawela	1	34	61.75	22.25	17.50	101.50	0.25	9.00	12.50	
	Yatiyantota	1	16	95.50	—	—	95.50	0.50	18.00	13.09	
	Pitigala	2	52	195.50	16.25	—	211.75	0.50	20.00	11.99	
Matara	Imaduwa	3	30	221.25	36.75	—	258.00	1.25	25.00	15.25	
	Elpitiya	2	65	154.75	22.75	13.75	191.25	0.50	10.00	10.71	
Ratnapura	Kamburupitiya	2	40	182.00	12.00	—	194.00	1.00	17.00	12.87	
	Ratnapura	1	17	118.00	25.75	7.00	150.75	0.50	27.00	18.61	
	Kuruwita	3	76	223.00	46.25	2.25	271.50	0.50	26.00	15.17	
	Kiriella	1	41	81.50	27.25	9.00	117.75	1.00	10.00	9.96	
	Pelmadulla	2	55	221.75	11.00	—	232.75	0.75	21.00	11.53	
	Nivitigala	2	65	205.50	12.50	2.00	220.00	0.50	15.00	12.24	
	Dodampe	1	32	74.75	11.75	0.50	87.00	0.50	10.00	12.58	

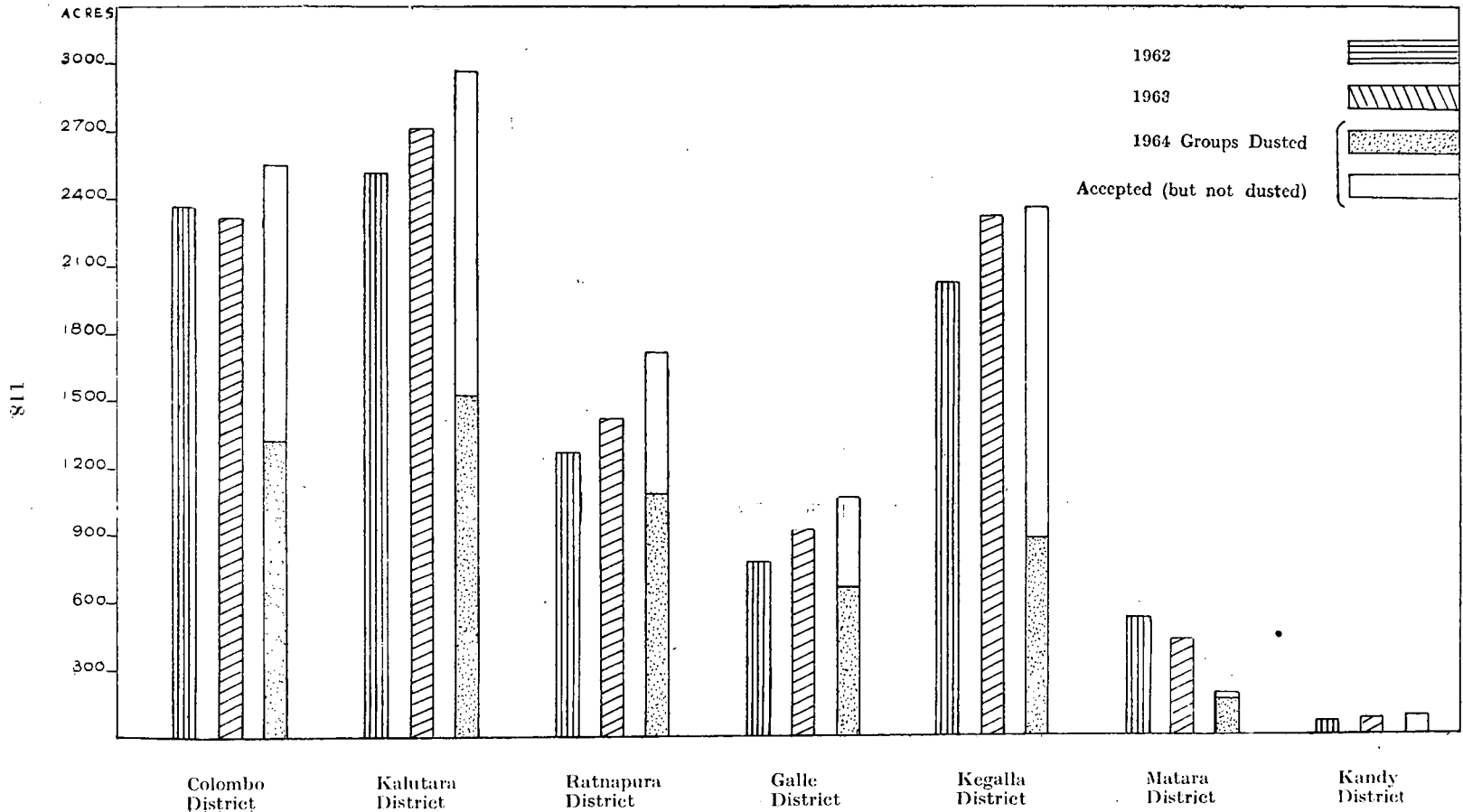
RESULTS OF A QUESTIONNAIRE ON DUSTED AND UNDUSTED HOLDINGS

CHART II

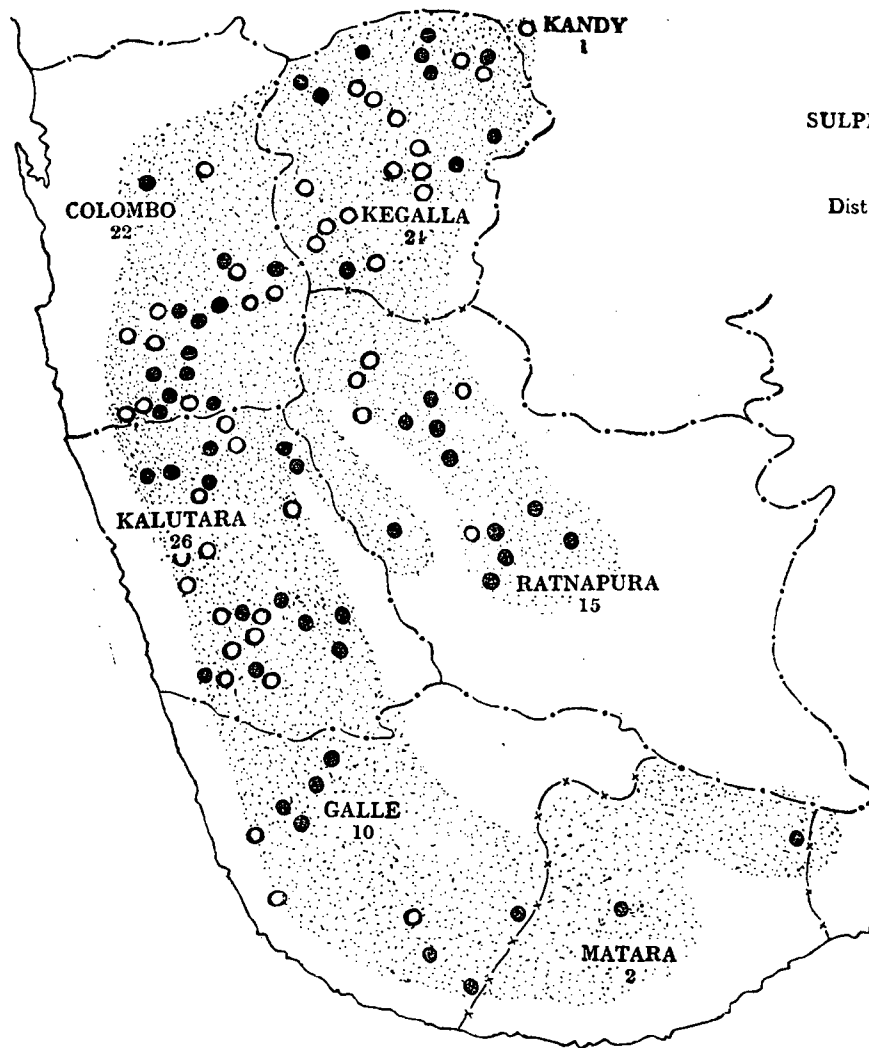
Questionnaire	Colombo		Kalutara		Kegalla		Galle		Matara		Ratnapura		Total No. of holdings	Per- centage	
	No. of holdings	Per- centage	No. of holdings	Per- centage	No. of holdings	Per- centage	No. of holdings	Per- centage	No. of holdings	Per- centage	No. of holdings	Per- centage			
	508		533		231		140		40		281		1733		
1. How far is the dusted foliage free of <i>Oidium</i> ?	(a) 95—100% free	507	99.8	422	79.2	202	87.4	59	42.1	34	85	263	93.6	1487	85.8
	(b) 90—95% free	1	.2	40	7.5	29	12.6	81	57.9	6	15	6	2.1	163	9.4
	(c) Below 90% free	—	—	71	13.3	—	—	—	—	—	—	12	4.3	83	4.8
2. What percentage of leaf-fall has been observed in dusted holdings ?	(a) Below 5%	507	99.8	518	97.2	231	100	123	87.9	34	85	263	93.6	1676	96.7
	(b) 5—10%	1	.2	15	2.8	—	—	17	12.1	6	15	17	6.0	56	3.2
	(c) Over 10%	—	—	—	—	—	—	—	—	—	—	1	.4	1	.1
3. Is the foliage in adjoining undusted areas badly infected? If so is it.....	(a) More than last year (1963)	—	—	—	—	—	—	—	—	—	—	13	4.6	13	.8
	(b) Same as last year (1963)	—	—	33	6.2	77	33.3	—	—	—	—	5	1.8	115	6.6
	(c) Less than last year (1963)	508	100	500	93.8	154	66.7	140	100	40	100	263	93.6	1605	92.6
4. Are there any dusted holdings which show ?	(a) More <i>Oidium</i> than the leaves of undusted holdings	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	(b) The same amount of <i>Oidium</i> as the leaves of undusted holdings	—	—	—	—	—	—	—	—	40	100	54	19.2	94	5.4
	(c) Less <i>Oidium</i> than the leaves of undusted holdings	508	100	533	100	231	100	140	100	—	—	227	80.8	1639	94.6
5. Will the small-holders like to join the dusting scheme next year as well ?	(a) Yes	508	100	533	100	231	100	99	70.7	40	100	229	81.5	1640	94.6
	(b) No	—	—	—	—	—	—	27	19.3	—	—	2	.7	29	1.7
	(c) Not yet decided	—	—	—	—	—	—	14	10	—	—	50	17.8	64	3.7

PROGRESS IN SULPHUR DUSTING OF SMALLHOLDINGS

1962.....1963.....1964






1962 Dusting Season — 9597 Acres
 1963 „ „ — 10228 Acres
 1964 „ „ — 10922 Acres (total accepted)



CEYLON
SULPHUR DUSTING SCHEME 1964

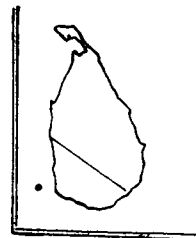
Showing
Distribution of dusting "Groups"

-  Rubber
 Groups Dusted
 Groups Accepted (but not dusted)

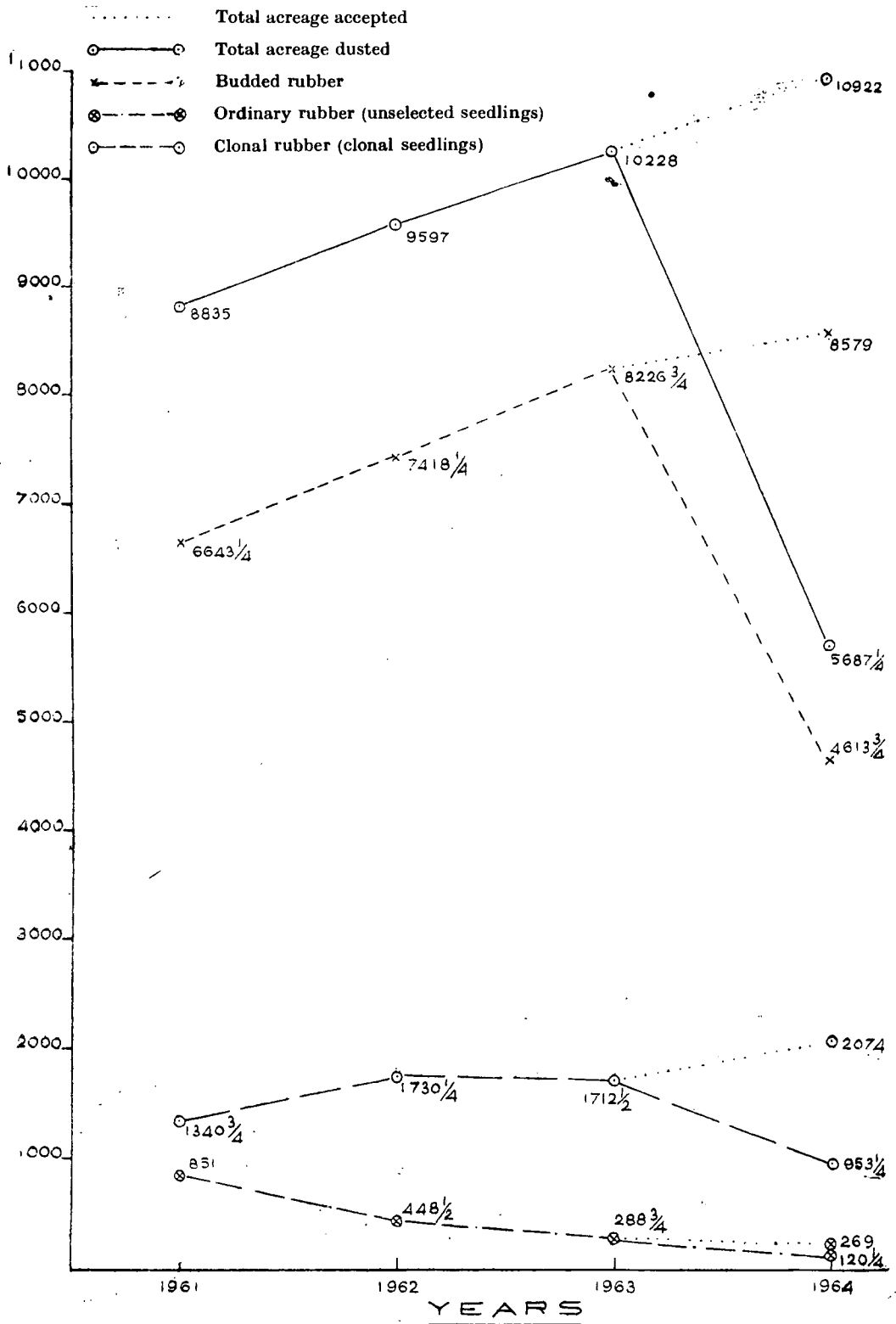
	No. of Groups Accepted
Colombo District	22
Kalutara ..	26
Kegalla ..	24
Galle ..	10
Matara ..	2
Ratnapura ..	15
Kandy ..	1

100

ANNEXURE 2



PROGRESS OF SULPHUR DUSTING OF SMALLHOLDINGS



ANNEXURE IV

COST PER ACRE OF MAINTAINING A SMALLHOLDING

IN THE 2ND YEAR OF PLANTING

Item	Galle Division		Matugama Division		Ratnapura Division		Colombo Division		Avisawella Division		Kegalla Division		Total	Average per item
	Total	Average	Total	Average	Total	Average	Total	Average	Total	Average	Total	Average		
Weeding	(7) 454.15	64.88	(8) 775.42	96.92	(7) 782.07	111.72	(8) 561.42	70.88	(7) 600.65	85.81	(7) 624.83	89.26	(44) 3798.54	86.33
Filling vacancies	(4) 40.24	10.06	(6) 81.80	13.63	(5) 78.99	15.80	(5) 60.22	12.04	(4) 36.04	9.01	(3) 47.01	15.67	(27) 344.30	12.75
Total cost of manuring	(6) 317.15	52.86	(8) 569.65	71.21	(7) 496.08	70.87	(7) 510.56	72.94	(7) 353.85	50.55	(5) 289.32	57.86	(40) 2536.61	63.41
Pest and disease control	(1) 8.61	8.61	(3) 73.50	24.50	(3) 34.85	11.62	(2) 5.50	2.75	(2) 4.73	2.36	(2) 11.13	5.56	(13) 138.32	10.64
Repairs to fence.	(5) 38.29	7.65	(5) 95.25	19.05	(7) 65.59	9.37	(4) 39.35	9.84	(3) 52.17	17.39	(5) 32.84	6.57	(29) 323.49	11.15
Inspection and attention	(4) 233.19	58.30	(6) 78.50	13.08	(2) 26.00	13.00	(2) 22.30	11.15	(4) 203.50	50.88	(2) 74.50	37.25	(20) 637.99	31.90
Cover crops	(6) 86.75	14.46	(8) 115.09	14.38	(6) 73.57	12.26	(8) 141.98	17.74	(6) 55.29	9.21	(7) 57.89	8.27	(41) 530.59	12.94
Repairs to soil conservation works	(6) 93.69	15.61	(7) 431.20	61.60	(5) 144.72	28.94	(3) 31.50	10.50	(5) 125.87	25.17	(4) 54.83	13.71	(30) 881.87	29.39
Watchman	(6) 110.12	18.35	(5) 227.25	45.45	(3) 320.68	106.89	(3) 310.00	103.33	(4) 311.67	77.92	(1) 72.00	72.00	(22) 1351.72	61.44
Other charges	(2) 23.08	11.54	(3) 23.08	7.69	—	—	(2) 38.00	19.00	(6) 54.15	9.02	(1) 12.80	12.80	(14) 151.11	10.79
Total	(7) 1405.27	—	(8) 2470.74	—	(7) 2022.55	—	(8) 1720.83	—	(7) 1797.92	—	(7) 1277.15	—	(44) 10694.46	—
Average per Division	200.75	—	308.84	—	288.93	—	215.10	—	256.85	—	182.45	—	243.05	—

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ANNEXURE V

COST PER ACRE OF MAINTAINING A SMALLHOLDING
IN THE 3RD YEAR OF PLANTING

Item	Galle Division		Matugama Division		Ratnapura Division		Colombo Division		Avisawella Division		Kegalla Division		Total	Average per item
	Total	Average	Total	Average	Total	Average	Total	Average	Total	Average	Total	Average		
Weeding	(8) 583.41	72.93	(8) 720.23	90.03	(8) 584.23	73.03	(8) 677.49	84.69	(7) 616.82	88.12	(7) 352.57	50.37	(46) 3534.75	76.84
Total cost of manuring	(8) 582.93	72.87	(7) 648.63	92.66	(8) 557.50	69.69	(8) 828.81	103.60	(7) 701.99	100.28	(6) 378.01	65.00	(44) 3697.87	84.04
Pest and disease control	(5) 36.40	7.28	(5) 59.37	11.87	(4) 49.67	12.42	(1) 1.08	1.08	(2) 11.50	5.75	—	—	(17) 158.02	9.29
Repairs to fence	(7) 61.86	8.84	(7) 53.43	7.63	(8) 92.54	11.57	(2) 53.33	26.66	(5) 43.37	8.67	(6) 74.58	12.43	(35) 379.11	10.83
Inspection and attention	(4) 153.82	38.45	(6) 86.65	14.44	(1) 3.00	3.00	(1) 4.67	4.67	(1) 20.00	20.00	(1) 60.00	60.00	(14) 328.14	23.48
Cover crops	(7) 93.21	13.31	(7) 48.91	6.99	(7) 141.58	20.23	(5) 62.00	12.40	(4) 28.62	7.15	(5) 19.06	3.81	(35) 393.38	11.24
Repairs to soil conservation works	(7) 180.29	25.76	(6) 166.62	27.77	(7) 146.32	20.90	(5) 52.36	10.47	(6) 173.23	28.87	(5) 100.92	20.18	(36) 819.74	22.77
Watchman	(3) 50.92	16.97	(5) 241.73	48.35	(2) 88.72	44.36	(2) 35.00	17.50	(3) 180.00	60.00	—	—	(15) 596.37	39.75
Other charges	(2) 16.24	8.12	(4) 36.07	9.02	(2) 49.40	24.70	(1) 10.00	10.00	(1) .50	.50	(1) 7.50	7.50	(11) 119.71	10.88
Thinning out	(2) 8.57	4.28	(1) 5.25	5.25	(1) 7.60	7.60	—	—	(1) 2.00	2.00	(1) 2.50	2.50	(6) 25.92	4.32
Total	(8) 1767.65	—	(8) 2066.89	—	(8) 1720.56	—	(8) 1724.74	—	(7) 1778.03	—	(7) 995.14	—	(46) 10053.01	—
Average per Division	220.96	—	258.36	—	201.71	—	215.59	—	254.00	—	142.16	—	203.60	—

REVIEW OF THE ESTATE DEPARTMENT

By

L. WIJAYEGUNAWARDENE

SUMMARY

The Institute's stations at Dartonfield, Nivitigalakele and Hedigalla in extent 1,491 acres, 0 roods and 30 perches carried a planted acreage of 996 acres of which 846 $\frac{3}{4}$ acres were tapped during the year. At Hedigalla fifty seven acres were under nursery for the Rubber Replanting Subsidy Scheme.

Weather conditions were more favourable for tapping and harvesting of crops than during the previous year. Rainfall was above average for the three Divisions. However the distribution of the rainfall at Hedigalla Division in the third quarter of the year interfered with tapping and harvesting of crop in that Division.

A crop of 540,073 lb was harvested representing an average yield of 637.8 lb per acre as against a very poor average of 481 lb per acre last year. There was no reduction in the immature rubber acreage.

The incidence of *Oidium heveae* was light in general, and presented no difficulty in the application of control measures. Sulphur dusting was carried out successfully resulting in an exceptionally fine foliage throughout the mature areas of the Group. Late wintering clones at Hedigalla Division were however adversely affected. It was very noticeable how unevenly the trees wintered due to the numerous clones planted in close proximity to each other. A satisfactory control of the disease was however achieved.

Leaf-fall due to *Phytophthora palmivora* was not pronounced this year. Susceptible clones particularly LCB 870 crown buddings and a few of the RRIC clones under test suffered heavy leaf-fall. The dusting technique employed throughout the Group using copper-based fungicidal dust proved adequate and efficient.

Budwood of the RRIC clones continued to be in demand and issues to all estates and smallholdings were attended to. Routine weeding, cultivation and other agricultural operations were carried out in all mature and immature areas of the Group.

The Rubber Replanting Subsidy Scheme nursery at Hedigalla under the Rubber Controller continued to be supervised throughout 1964. The nursery was in full production.

Estimates for 1965, dealing with the working of the Group, field and factory experiments etc., were prepared by the writer and approved by the Rubber Research Board. The Hedigalla nursery estimates for 1965 were also prepared and approved by the Rubber Replanting Advisory Board.

DETAILED REVIEW

GENERAL

Staff

The Superintendent, Mr. L. Wijeyegunawardene, and the Assistant Superintendent at Hedigalla Sub-station, Mr. M. R. T. Mendis, were on duty throughout the year.

Mr. J. B. Rodrigo was appointed as Estate Dispenser at Hedigalla on 8th December.

Senior Staff	...	1
Intermediate Staff	...	1
Assistant Staff	...	24
Minor Staff	...	22
		48
		48

Visiting Agent

Mr. W. B. Jonklaas paid two visits to the Institute's properties during the year. Reports on these visits were submitted to the Rubber Research Board.

<i>Correspondence</i>	Inward	...	928
	Outward	...	1,480

Weather (Estate Gauge)

Comparative rainfall figures (inches) for 1964 are given below :

Month	Dartonfield		Nivitigalakele		Hedigalla	
	1964	1963	1964	1963	1964	1963
January	8.37	11.16	6.31	7.64	9.83	21.18
February	6.93	10.05	5.22	8.20	6.06	16.69
March	14.71	13.35	12.43	12.09	15.80	6.56
April	10.75	19.50	9.40	16.35	16.23	17.63
May	29.37	37.65	29.68	32.90	35.41	26.73
June	15.65	15.82	13.40	14.33	16.97	14.31
July	28.35	27.33	24.15	24.06	28.48	19.79
August	8.37	16.81	9.92	14.83	8.43	18.67
September	19.15	35.00	15.24	32.30	21.48	32.08
October	25.45	25.81	19.88	27.75	27.22	20.03
November	10.97	39.70	11.96	33.69	16.07	34.78
December	9.50	17.10	11.44	12.64	10.81	16.82
	187.57	269.28	169.03	236.78	212.79	245.27

Average (5-year period)	182.63"	169.20"	193.32"
Total No. of wet days	235 279	240 271	279 305

The rainfall for the year at Dartonfield, Nivitigalakele and Hedigalla Divisions amounted to 187.57", 169.03" and 212.79" on 235, 240 and 279 days respectively and was in keeping with the five-year average for Dartonfield and Nivitigalakele but 9.48" above average at Hedigalla Division.

Acreage Summary — Dartonfield Group

Rubber	Dartonfield			Nivitigalakele			Hedigalla			Total		
	A.	R.	P.	A.	R.	P.	A.	R.	P.	A.	R.	P.
Mature	95	0	19	105	2	31	660	2	27	861	1	37
Immature	31	1	—	40	3	28	50	1	20	122	2	8
Nurseries	3	2	—	8	3	7	—	—	—	12	1	7
Total	129	3	19	155	1	26	711	0	7	996	1	12
Building sites etc.	41	2	36	15	1	33	8	1	18	65	2	7
Pinewood plantation	—	—	—	—	—	—	1	0	34	1	0	34
Roads	6	2	22	0	3	27	9	0	4	16	2	13
Swamp areas	—	—	—	0	2	8	0	2	20	1	0	28
Streams and reservations	—	—	29	—	—	—	13	0	29	13	1	18
Jungles etc.	—	—	—	1	3	38	395	0	0	396	3	38
Grand Total	178	1	26	174	1	12	1138	1	32	1491	0	30

Crop

Weather conditions were not unfavourable for tapping and harvesting of crop at Dartonfield and Nivitigalakele. The distribution of the rainfall at Hedigalla Division in the third quarter of the year hampered tapping severely entailing loss of crop. The crop harvested for the year was 90.1% of the season's estimate.

	1964	1963
Estimated	600,000 lb	520,000 lb
Harvested	540,073 „	408,681 „
Deficit	59,927 lb	Deficit 111,319 lb

Comparative Yield Records of Individual Fields

Dartonfield	Acreage in tapping	Total yield in lb		Yield in lb per acre	
		1964	1963	1964	1963
1938 Replanted Area	4½	6,445	4,485	1,432.2	996.6
1941 „ „	5	5,389	2,509	1,077.8	501.8
1947 „ „	4	6,120	2,899	1,530.0	724.7
1950/51 „ „	25¾	17,875	12,937	694.2	502.4
1952 „ „	27	26,104	17,194	966.8	636.8
1953 „ „	11½	4,880	4,127	424.4	358.9
1954 „ „	7¾	1,684	1,657	217.3	213.8
1955 „ „	5	2,197	777	439.4	155.4
1955/56 „ „	4¾	2,248	535	473.2	112.6
	95¼	72,942	47,120	765.8	494.7
<i>Nivitigalakele</i>					
1935 Replanted Area	18½	18,982	18,177	1,023.3	637.8
1939 „ „	10¾	9,200	6,286	897.6	613.3
1940 „ „	9¾	10,550	6,672	1,082.0	684.3
1940 Swamp Area	3¼	3,556	2,831	1,094.1	871.1
1941 Clearing	7	8,330	6,108	1,198.9	872.6
1942 „ „	4½	4,941	3,979	1,097.9	884.2
1943 „ „	7	4,956	3,927	707.8	561.0
1944 „ „	4½	4,730	3,797	1,051.0	843.8
1946 Replanted Area	21	27,631	20,714	1,315.7	986.4
1953 Clearing	10	9,464	7,591	946.4	759.1
1954 „ „	10	9,511	7,980	951.1	798.0
	105¾	111,801	88,062	1,057.2	760.8

Hedigalla

1943 Clearing	10½	11,254	7,073	1,098·0	690·1
1944 "	11½	11,629	7,255	989·6	617·5
1945 "	22½	14,470	13,226	650·3	594·4
1946 "	12½	5,865	7,322	460·0	574·3
1947 "	45	26,324	24,997	585·0	555·5
1949 "	34½	27,768	21,855	799·1	629·0
1950/51 "	18	13,758	14,421	764·3	721·1
1952 "	79½	45,194	37,351	568·5	469·8
1953 "	131	75,322	62,483	575·0	440·0
1954 "	192½	72,910	46,986	448·7	298·3
1955 "	78	35,400	26,556	453·9	340·5
1956 "	40	15,437	3,974	385·9	159·0
	<u>645½</u>	<u>355,330</u>	<u>273,499</u>	<u>550·3</u>	<u>428·2</u>
Total for the Group	<u>846¾</u>	<u>540,073</u>	<u>408,681</u>	<u>637·8</u>	<u>480·9</u>
Outside sources		245			
		<u>540,318</u>			

Tapping

Non-experimental areas were tapped throughout the wintering period. Tapping was resumed after winter rest during refoliation in the experimental areas on the 26th February at Dartonfield and on the 2nd and 3rd March at Nivitalakele and Hedigalla respectively. Tapping panels were marked with the appropriate bark consumption.

Analysis of tapping rounds on Dartonfield Group for 1964 (1963 figures in brackets)

<i>Dartonfield</i>	<i>No Tapping</i>				
	<i>Early Tapping</i>	<i>Late Tapping</i>	<i>Winter Rest</i>	<i>Rain</i>	<i>Holidays</i>
1st Quarter	70 (42)	19 (24)	— (18)	1 (2)	1 (4)
2nd "	49 (42)	16 (24)	— —	23 (21)	3 (4)
3rd "	37 (28)	20 (20)	— —	35 (44)	— —
4th "	57 (39)	19 (35)	— —	16 (18)	— —
	<u>213 (151)</u>	<u>74 (103)</u>	<u>— (18)</u>	<u>75 (85)</u>	<u>4 (8)</u>

<i>Nivitalakele</i>	<i>No Tapping</i>				
	<i>Early Tapping</i>	<i>Late Tapping</i>	<i>Winter Rest</i>	<i>Rain</i>	<i>Holidays</i>
1st Quarter	71 (45)	16 (22)	— (17)	3 (4)	1 (2)
2nd "	52 (38)	14 (29)	— —	20 (18)	5 (6)
3rd "	40 (26)	20 (27)	— —	32 (39)	— —
4th "	48 (35)	28 (35)	— —	15 (22)	1 —
	<u>211 (144)</u>	<u>78 (113)</u>	<u>— (17)</u>	<u>70 (83)</u>	<u>7 (8)</u>

<i>Hedigalla</i>	<i>No Tapping</i>				
	<i>Early Tapping</i>	<i>Late Tapping</i>	<i>Winter Rest</i>	<i>Rain</i>	<i>Holidays</i>
1st Quarter	64 (46)	5 (7)	— (21)	22 (14)	— (2)
2nd "	40 (47)	10 (6)	— —	37 (33)	4 (5)
3rd "	38 (30)	5 (4)	— —	49 (58)	— —
4th "	50 (30)	11 (31)	— —	31 (31)	— —
	<u>192 (153)</u>	<u>31 (48)</u>	<u>— (21)</u>	<u>139 (136)</u>	<u>4 (7)</u>

Manufacture

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

<i>Latex Grades</i>		<i>Total in lb</i>	<i>Percentage</i>
Pale Crepe No. 1	...	345,105	68.90
• Pale Crepe No. 2	...	46,844	8.67
Pale Crepe No. 3	...	74,517	13.80
		<hr/>	
		466,466	86.37
		<hr/>	
<i>Scrap Grades</i>			
Scrap Crepe No. 1	...	46,647	8.64
Scrap Crepe No. 2	...	19,456	3.60
Scrap Crepe No. 3	...	7,504	1.39
		<hr/>	
		73,607	13.63
		<hr/>	
Total	...	540,073	100.00
		<hr/>	
From outside sources	...	245	
		<hr/>	
Total	...	540,318	
		<hr/>	

The production of a high percentage of uniform crepe No. 1 is made increasingly difficult with acreages of experimental areas of various clones with different latices in production.

Miscellaneous

Field and Factory Experiments.—The Rubber Chemistry, Botany, Plant Pathology and Soils Divisions were given assistance in carrying out their field and factory experiments.

Estimates.—Estimates of Capital and Revenue Expenditure for 1965 in respect of Dartonfield Group, prepared and submitted by the writer to the Rubber Research Board, were approved.

Estate Roads.—All motorable roads and paths were maintained in good order throughout the year.

Manuring.—Mature areas of the Group received fertilizers in accordance with the Institute's recommendations.

PESTS AND DISEASES

Oidium heveae

Climatic conditions this year were more favourable than in the past few years for the inhibition of the growth and spread of the fungus *Oidium heveae*. Wintering was generally early at Dartonfield and Nivitigalakele, but due to the numerous clones at Hedigalla Division the wintering was protracted and late winterers suffered a mild attack. A protracted spell of 'spot' sulphur dusting was necessitated at Hedigalla and a good foliage canopy was obtained.

Gloeosporium alborubrum

The incidence of *Gloeosporium* was not much in evidence this year.

Phytophthora palmivora

Although some leaf-fall due to *Phytophthora* was evident the attack on the whole was not severe. Heavy leaf-fall was however observed confined to clones susceptible to *Phytophthora*, particularly the LCB 870 crown buddings at Dartonfield and at Hedigalla Division, clones RRIC 43, RRIC 46, RRIC 49 together with the LCB 870 crown buddings. The dusting technique employed throughout the Group proved adequate and sufficient. Satisfactory control was achieved by spot dusting with copper based fungicidal dust.

Bark Rot

The incidence of Bark Rot was negligible. The organo-mercurial fungicides, Antimucin and Kankerdood, proved effective.

Wind Damage

The loss of trees due to wind damage on Dartonfield, Nivitigalakele and Hedigalla were 44, 105 and 605 trees respectively.

CAPITAL ACCOUNT — AGRICULTURAL DEVELOPMENT

Dartonfield Division — Immature Areas

1960/61 Replanted Area ... 31½ acres

Nivitigalakele Division — Immature Areas

1962 Replanted Area ... 16¾ acres

1963 " " ... 14 "

1964 " " ... 10 "

40¾ acres

Hedigalla Division — Immature Areas

1956 Clearing ... 20 acres

1957 " " ... 17½ "

37½ 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.

Number of trees uprooted — Immature Areas

Dartonfield

1960/61 Replanted Area

Fomes lignosus ... 1

Nivitigalakele

1962 Replanted Area

1963 Replanted Area

Fomes lignosus ... 27 29

Hedigalla

1956 Clearing

Fomes lignosus ... 8

1961 Replanted Area (31½ acres) at Dartonfield.—This area carries two tapping tasks of each of the clones RRIC 7, RRIC 45, RRIC 52, RRIC 88, RRIC 89, PB 28/59, PB 86 and RRIM 513. Growth is good, and as reported earlier clones RRIC 45 and RRIC 52 continue to show vigorous growth. The area was well weeded and manured and attention given to root diseases.

1962 Replanted Area (16¾ acres) at Nivitigalakele.—This area was planted with the following clones : RRIC 5, RRIC 39, RRIC 51, RRIC 86, RRIC 90, RRIC 91, RRIC 92, RRIC 93, RRIC 94, RRIC 95, RRIC 96, RRIC 97, PB 86, IAN 45-717, RRIM 623, RRIM 628, RRIM 701 and 17 ten-tree clones. Growth is quite satisfactory, but fairly uneven due to the variability of the growth characteristics of each clone. Weeding, manuring and attention to root diseases were carried out.

1963 Replanted Area (14 acres) at Nivitigalakele.—This is planted with five plots of 300 points each of clones RRIC 59, RRIC 60, RRIC 64, RRIC 75 and PB 86 and four plots of 150 points each of clones RRIC 6, RRIC 39, RRIC 41 and RRIC 98. A further 150 points of PB 86 were planted. The growth of plants is quite satisfactory. Routine agricultural operations were carried out with special attention given to root diseases.

1964 Replanting Area (10 acres) at Nivitigalakele.—The planting of this area was undertaken during the South West monsoon and was completed in May with the following clones : RRIC 41, RRIC 45, RRIC 52 and RRIC 86. Extra bud-grafts of each of the clones were planted in trenches in their respective plots in the field to be used later as stumped buddings for future vacancies that may occur. Mixed covers of *Pueraria phaseoloides* and *Desmodium ovalifolium* were established and are spreading well. Growth is good. Close attention was paid to weeding, manuring and root diseases.

1965 Replantings — 10 acres at Nivitigalakele, 13 acres at Hedigalla and 14½ acres at Dartonfield.

Uprooting and clearing operations were undertaken. Good progress was made and the areas will be ready for planting in the South West season of 1965.

NURSERIES

Seedling and Budwood Nurseries — Dartonfield

(a) Routine weeding and clearing of drains were carried out in all the nurseries. Plants were manured in accordance with the Institute's recommendations.

(b) Plants bearing over-matured budwood were lopped.

Seedling and Budwood Nurseries — Nivitigalakele

(a) Weeding, clearing of drains and manuring were done.

(b) Vigorous-growing stocks in these nurseries were budded to meet the following requirements :

Nivitigalakele — 1964 Replanted area	...	1,440	Budded stumps
Botany Division Experiments	...	40	„ „
Plant Pathology Division Experiments	...	45	„ „
		1,525	
Total	...	1,525	„ „

(c) *Budwood Issues :*

Outside estates	...	785 yards
Nivitigalakele buddings	...	135 "
Plant Breeding Section Experiments	... 213	
Botany Division	... 180	
Soils	... 68	•
Plant Pathology Division	... 25	486 "
To Vietnam	... 5	
To Nigeria	... 3	8 "
Total	... <u>1,414</u>	

LABOUR AND HEALTH

(a) *Labour Force.*—The regular labour force was inadequate and temporary casual labour was employed to meet requirements.

(b) *Line Rooms.*—Line room accommodation was satisfactory. Routine repairs to cottages, where necessary, were carried out accordingly.

(c) *Wages.*—Wages were paid during the year in accordance with the Wages Boards Ordinance in force.

Dartonfield Group

<i>Working Ceylonese</i>	<i>Resident</i>	<i>Non-Resident</i>	<i>Total</i>
Men ...	117	197	314
Women ...	97	151	248
Children ...	—	—	—
 <i>Working Immigrants</i>			
Men ...	42	—	42
Women ...	26	—	26
Children ...	—	—	—
	<u>282</u>	<u>348</u>	<u>630</u>

(d) *Annual Holidays.*—Annual holidays with pay were given to all labourers who were entitled to these in accordance with the Ordinance.

(e) *Maternity Benefits.*—Twenty-seven full maternity benefit and five medical wants benefit payments were made.

(f) *Feeding Children and Milk Food.*—Free rations and $\frac{1}{4}$ lb bread were issued to each non-working child. Milk foods were issued to all infants whose mothers were incapable of nursing them.

(g) *Health.*—The health of the members of the Institute's staff and of the estate labourers was satisfactory during the year.

(h) *Anti-mosquito measures.*—DDT/Gammexane spraying was carried out throughout the year, at regular intervals, in and around the bungalows and lines under the supervision of the Apothecary.

(i) *Births*.—Thirteen children were born during the year on the Group.

(j) *Deaths*.—There were four deaths on the Group this year.

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

Influenza	...	...	1,201
• Ulcers	...	...	381
Ankylostomiasis	...	...	28
Diarrhoea and Enteritis	...	...	130
Ear diseases	...	...	12
Other diseases	...	...	3,021
Total	...	...	<u>4,773</u>

RUBBER REPLANTING SUBSIDY SCHEME NURSERY AT HEDIGALLA

Supervision.—The Estate Superintendent, R.R.I.C., paid supervisory visits to this nursery during the year.

Staff.—Mr. L. Samaranayake, Assistant Nursery Manager.

Rainfall.—212.79 inches were recorded this year as against 245.27 inches in 1963. There were 279 wet days in the year.

Seedling Nursery

(a) The nursery acreage of 57 remained unchanged. In accordance with the decision of the Rubber Replanting Advisory Board, one third of the total nursery acreage was allowed to be fallow for one year on a three-year rotation scheme. The area not planted was sown with *Crotalaria anagyroides*.

(b) Nineteen acres of nursery beds were prepared during the second quarter of the year to receive Tjir 1 seed from the July/August seed-fall. This area was planted in September.

Maintenance.—The seedling and budwood nurseries were satisfactorily maintained throughout the year. Routine weeding, manuring and attention to paths and drains were carried out.

Pests and Diseases.—The incidence of *Oidium* was marked and regular rounds of sulphur dusting was carried out in February and March.

A mild attack of *Phytophthora* and *Gloeosporium* occurred during the wet months of the year necessitating several rounds of spraying with Colloidal Copper as recommended by the Visiting Agent.

Planting Material.—The issues of planting material from this nursery by the Rubber Control Department during 1964 was as follows :

	<i>S.W. Planting</i>	<i>N.W. Planting</i>	<i>Total</i>
Clonal Seedlings ...	6,373	6,334	12,707
Budded Stumps ...	14,053	20,594	34,647
	<u>20,426</u>	<u>26,928</u>	<u>47,354</u>

Estimates.—An estimate for maintenance of the Nursery for 1964 was prepared and submitted to the Rubber Replanting Advisory Board.

Visiting Agent.—Mr. E. O. B. Lover paid regular visits to this nursery.

REVIEW OF R.R.I.C. SUB-STATION, KURUWITA

By

B. COCKING

GENERAL

Weather conditions during 1964 were generally favourable to rubber harvests and it is gratifying to have been able to exceed the estimated crop at a cost of production more than 15 cents under estimated cost.

Staff changes and adverse weather affected working results and ground conditions in clearings during 1963 but I am glad to say that the Sub-station is again in very good order at the end of 1964.

Staff

Our permanent S. F. A., Mr. H. B. H. de Silva, resumed duties from 4th March 1964 and Mr. M. C. Perera who had been the Acting S. F. A. returned to Dartonfield. Mr. G. D. A. Weerasooriya continued to be responsible for smoked sheet manufacture during the year. Mr. W. B. Jonklaas, our Visiting Agent, paid two visits during 1964 and has been most helpful to us with all our problems.

Acreage

			A.	R.	P.
Mature polyclonal rubber	...	...	40	1	23
Replanted 1961	...	...	83	3	20
" 1962	...	...	38	3	00
" 1963	...	...	22	1	37
" 1964	...	...	18	2	09
Uprooted for replanting in 1965	...	...	18	2	27
Nurseries	...	...	1	1	24
Roads, deniyas, forests and buildings	...	...	23	2	10
			<hr/>		
		Total	247	2	30
			<hr/> <hr/>		

During the year the balance acreage of old seedling rubber has been felled and cleared for replanting in 1965. This leaves us only approximately 40 acres of pre-war polyclonal rubber for tapping in 1965. But during the year it is anticipated that a further 10 acres would be uprooted for replanting in 1966. With smaller replanting programmes ahead of us the nursery acreage has also been reduced.

Weather

Comparative Rainfall Figures for 1963 and 1964

	1963	1964
January	6.14	6.63
February	9.87	5.25
March	10.34	12.48
April	20.95	19.12
May	17.90	29.83
June	21.94	12.22
July	23.24	29.58
August	18.71	11.20
September	24.94	16.45
October	25.99	23.61
November	17.03	12.94
December	8.45	5.05
Total	<u>205.50</u>	<u>184.36</u>

Though rainfall has been less, weather conditions during the year generally followed the pattern of the previous season until mid-November since when very little rainfall has been recorded.

Crop	1963	1964
Estimated	50,000 lb	35,400 lb
Harvested	48,360 lb	40,037 lb

The estimated crop for the season has been comfortably exceeded and we achieved a yield of 720 lb per acre against an estimate of 600 lb. Good weather conditions and the intensive tapping of old seedling rubber prior to uprooting have contributed to this satisfactory result.

Tapping	1963	1964
Estimated cost	30.00	28.00
Actual cost	28.17	24.27

There has been a further reduction in cost of tapping this season. The standard of work remains good and there has been a regular outturn to work.

Weeding

Previously only two rounds of cheddy weeding have been necessary to maintain fair ground conditions in mature areas but this year the growth of cheddies was more prolific and an extra round was found necessary.

Buildings

All buildings are in excellent condition and very little upkeep was necessary during the year. An additional latrine has been erected for the convenience of factory labourers.

Roads

Field roads and the main cart road are in very good order and the Gona-pitiya-Kuruwita road has also been fully repaired. The Sub-station is therefore now conveniently accessible from Kuruwita. We still require a suitable vehicle for general purposes, and being without a telephone, much expenditure is incurred on messengers as well as on hired transport.

Manufacture

Our latex crop continues to be manufactured into smoked sheet and our sales average inclusive of unmanufactured scrap is 86 cents per lb for the year. Manufacturing costs are reasonable.

Curing cost estimated	...	7.51	cts.	per lb
" " spent	...	6.89	"	"
Fuel for power estimated	...	4.80	"	"
" " spent	...	4.79	"	"

Labour

Labour statement as at 31st December, 1964

Working men	...	12
" women	...	11
Non-working adults	...	2
" " children	...	38
		—
Total	...	63
		==

With the exception of 7 mal-contents (the residue of the labour originally taken over from Paradise Estate) the rest of the labour force worked very well during the year.

Clearings

Replanting 1961 : — 83A. 3R. 20P.

The incidence of *Fomes* in this clearing has been much less during the year and there has been an impressive improvement in growth. Due to heavy rains in the latter half of 1963 Mikania growth became very heavy in this clearing and over-expenditure has been incurred in its removal during 1964 but I consider this over-expenditure to have been well worthwhile.

Replanting 1962 : — 38A. 3R. 00P.

There continues to be variance in growth amongst the 23 plots of experimental clones in this field but there has been a marked improvement during 1964. *Mikania* has been eradicated during the year and the clearing is now under clean cover crops.

Replanting 1963 : — 22½A.

This clearing is making good progress and *Pueraria* cover crops are well established.

Replanting 1964 : — 18½A.

8½ acres of this clearing were planted in July and the balance for the Plant Breeding Section was completed in October during the North-East monsoon. There is consequently some disparity in growth between the two blocks comprising the 18½ acres. However, the young plants are all growing well and cover crops are spreading.

Replanting 1965 : — 18½A.

Stacking and burning have been completed in this clearing. Holing is now in progress and the entire acreage will be ready for replanting by the 15th of April, 1965.

Summary of Costs

Revenue expenditure estimated	Rs. 31,162/-	being	88.03	cents per lb.
" " spent	Rs. 29,143/98	"	72.79	" " "