

RUBBER RESEARCH INSTITUTE OF CEYLON

ANNUAL REPORT 1959

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ANNUAL REPORT OF THE RUBBER RESEARCH INSTITUTE OF CEYLON-1959

The present report is the twenty-ninth annual report of the Rubber Research Institute of Ceylon as constituted under the Rubber Research Ordinance (Cap. 302) and amended by Rubber Research Amending Ordinance No. 63 of 1946 and Amendment Acts No. 27 of 1948, No. 7 of 1950, No. 30 of 1951, No. 50 of 1953, No. 3 of 1955, No. 8 of 1957, No. 52 of 1957 and No. 2 of 1959.

DIRECTOR'S REPORT

By

E. D. C. BAPTISTE

1. GENERAL.

The Director visited the Rubber Research Institutes of Malaya, South Vietnam and Cambodia before proceeding on home leave to the U.K. During his leave he attended two meetings of the London Advisory Committee for Rubber Research (Ceylon and Malaya) and visited ten research institutions.

In accordance with a decision of the Boards of the Tea, Rubber and Coconut Research Institutes a joint meeting of Chairmen and Directors of the three Institutes, convened by the Tea and Rubber Controller, was held on 11th July.

The designation of Administrative Secretary was changed to Chief Administrative Officer and that of Smallholdings Advisory Officer to Chief Advisory Officer Smallholdings during the year.

A new cover design and format were adopted for the Institute's publications and the title "Quarterly Circular" was changed to "Quarterly Journal".

The long search for a reasonably flat, compact area of about 200 acres of old seedling rubber in the Sabaragamuwa district for the establishment of the first of three substations of the Institute has been successful. An area of approximately 220 acres of an estate was taken over by the Institute on the last day of the year under the Land Acquisition Act No. 9 of 1950.

An Oidium-resistance testing station has been established on an estate at 1,400 feet elevation where Oidium in active form is present most of the year. Arrangements were completed in December for the establishment of a breeding station on an estate in the Phytophthora-free Moneragala district where the main Hevea flowering season occurs in May and June instead of February and March, as is normally the case on the Western side of the Island, thus permitting the realization of two breeding programmes each year.

Twenty *Dothidella*-resistant IAN clones of the second backcross or outcross with the Eastern parent (PB 86 or Tjir 1) were received from the U.S.D.A. Plant Introduction Station, Miami, Florida, during the year and have been successfully established in the Institute's nurseries. These clones, which are seven-eighths of Eastern parentage and one-eighth of clone F 4542 (the *Hevea benthamiana* clone which carries resistance to *Dothidella ulei*, the fungus responsible for South American leaf blight, and tolerance to *Phytophthora palmivora*), were obtained on an exchange basis from the Instituto Agronomico do Norte, Belem, Para, by the Director during his visit to Brazil in December 1957 and are considered to be the most valuable *Hevea* material introduced into the Eastern hemisphere since the original introduction of 1876.

During his leave in England the Director arranged for the despatch from the U.S.D.A. Plant Introduction Station, Miami, Florida, of *Dothidella*-resistant clones of the second backcross with the Eastern parent. He personally dealt with the collection of the budwood from London Airport, its disinfection at the Commonwealth Mycological Institute, Kew, and its onward despatch to Ceylon.

With 51 IAN clones of the first backcross or outcross with Eastern parents and 19 clones of primary crosses introduced into Ceylon in 1958/59, ninety *Dothidella*-resistant clones are now available in Ceylon for tests of *Oidium* and *Phytophthora* resistance and for future breeding work aimed at combining high yield and disease resistance.

Fifty two of these clones have been presented to the RRI of Malaya and 20 to the IRCV, South Vietnam during the year.

In view of the widespread occurrence of magnesium deficiency symptoms in young plantings and mature areas of certain clones, the method of Physiological Diagnosis, developed by French workers in South Vietnam for the early diagnosis and correction of mineral deficiencies in *Hevea* by means of leaf and latex analysis, will be tried out under Ceylon conditions.

In accordance with a ruling of the Rubber Research Board to the effect that Heads of Departments should visit rubber research institutions in other countries, the Acting Soils Chemist visited Malaya and South Vietnam and the Chief Advisory Officer Smallholdings visited Malaya during the year.

A discussion on *Phytophthora* was held at the P.A. of Ceylon on 23rd October and was attended by representatives of Agency houses and District branches of the P.A. A free exchange of views took place with the Senior Scientific Officers of the Institute to the benefit of all participants in the discussion. It was agreed that the growing incidence of *Phytophthora* leaf and bark diseases constitutes the most serious threat to the rubber industry of Ceylon since the *Oidium* menace of the late forties and the Institute was asked to give top priority to the problem since, in view of the urgency and seriousness of the situation, planting opinion is strongly in favour of a concerted effort to bring this new menace under control.

The Institute has appealed to the Industry for increased revenue to meet the cost of the projected increase of research activities.

Among the distinguished visitors entertained at Dartonfield during the year were Mr. R. M. E. Michaux, Chairman of the International Rubber Research Board and International Rubber Development Committee; Mr. P. Compagnon, Research Director of the Rubber Research Institutes of South Vietnam, Cambodia and Ivory Coast; Dr. V. Schmidt, formerly Director, Research Institute of Sumatra

Planters' Association and Mr. D. Rhind, Member of the London Advisory Committee for Rubber Research (Ceylon and Malaya).

The Director served as *ex-officio* Vice-Chairman of the Rubber Research Board and as a member of the Smallholdings and Administrative Committees of that Board. He also served as a member of the Rubber Replanting Advisory Board, of the Central Board of Agriculture and on the committee of the Kalutara District Planters' Association.

2. STAFF.

Senior Staff.—The Director, Dr. E. D. C. Baptiste, was on duty until 28th March when he left on an official visit to Vietnam and Cambodia before proceeding on home leave to the U.K. He resumed duties on 20th July on his return from leave.

The Botanist, Mr. C. A. de Silva, acted for the Director from 29th March to 19th July. He was on duty throughout the year.

The Plant Breeder, Mr. W. E. Manis, was on duty throughout the year. The Assistant Plant Breeder, Mr. D. M. Fernando, was on end-of-contract leave from 1st May to 31st July.

The Plant Pathologist, Dr. A. Riggenbach, was on overseas leave from 5th December 1958 until 22nd June 1959 when the work of the Department was in charge of the Assistant Plant Pathologist, Mr. O. S. Peries. This Officer proceeded to the U.K. on 24th September for post-graduate studies at the University of Bristol under the Technical Co-operation Scheme of the Colombo Plan.

The Rubber Chemist, Dr. K. F. Heinisch, was on duty throughout the year.

The Assistant Soils Chemist, Mr. A. J. Jeevaratnam, acted as Soils Chemist during the year. He was away for a period of five weeks as from 11th November, spending 10 days at the Rubber Research Institute of Malaya and 23 days at the "Institut des Recherches sur le Caoutchouc au Vietnam".

The designation of the Administrative Secretary was changed to Chief Administrative Officer as from 25th March. The Chief Administrative Officer, Mr. C. D. de Fonseka, was away on end-of-contract leave from 1st July to 30th September.

The Smallholdings Department continued at full strength during the year. The designation Smallholdings Advisory Officer was changed to Chief Advisory Officer Smallholdings as from 24th July. The Officer, Mr. R. T. Wijewantha, was away in Malaya from 9th to 21st December on a tour of inspection of rubber smallholdings.

The Estate Superintendent, Mr. L. Wijeyegunawardena, was on end-of-contract leave for the period 17th March to 1st June, during which time the Assistant Superintendent acted for him.

Intermediate Staff.—The Research Assistant, Chemistry Department, Mr. M. Nadarajah, resumed duties on 2nd June on the successful completion of a post-graduate course for the degree of M.Sc. of the University of Birmingham.

The Research Assistant, Botany Department, Mr. L. B. Chandrasekera, and the Assistant Estate Superintendent, Mr. Douglas de S. de Fonseka, were on duty throughout the year.

The Senior Assistant Advisory Officer of the Smallholdings Department, Mr. H. H. Peiris, and 2 Assistant Advisory Officers, Messrs. K. Wilson de Silva and D. E. A. Abeywickrema, were on duty throughout the year.

A graduate officer, Miss I. Wanigasekera, was appointed to the newly created post of Librarian with effect from 2nd January. She left the services of the Institute on 30th September to take up a post with the British Council in Colombo.

Mr. D. H. Abeywickrema was appointed to the newly created post of Works Inspector with effect from 16th January.

Miss R. Abdul Cader and Miss V. Sivapalan were appointed Research Assistant, Soils Department and Research Assistant, Plant Pathology Department, respectively, with effect from 2nd November.

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

| | |
|---|--------------------------|
| One Office Assistant | One Accounting Assistant |
| Four Clerk-Typists | One Pay Clerk |
| One Record Clerk | One Book-keeper |
| Two Junior Clerks | One Storekeeper |
| One Assistant Librarian | Two Accounts Clerks |
| 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 reports.

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

| | | | | |
|-----------------------|-----|-----|-----|-----|
| Senior Staff Grade I | ... | ... | ... | 8 |
| Senior Staff Grade II | ... | ... | ... | 3 |
| Intermediate Staff | ... | ... | ... | 9 |
| Assistant Staff | ... | ... | ... | 119 |
| Minor Staff | ... | ... | ... | 48 |
| Total | | | | 187 |

3. MEETINGS.

The Director attended the following meetings:—

| | | | |
|---|---|-------------------------------|-------------------|
| Rubber Research Board | 5 | 27/2, 25/3, 24/7, 19/10, 7/11 | (Director) |
| | 1 | 23/5 | (Acting Director) |
| Administrative Committee, R.R.B. | 4 | 13/2, 13/3, 10/8, 8/10 | (Director) |
| | 2 | 13/5, 17/7 | (Acting Director) |
| Smallholdings Committee, R.R.B. | 1 | 17/7 | (Acting Director) |
| Smallholdings Selection Committee, R.R.B. | 2 | 2/9, 12/10 | (Director) |
| | 2 | 22/6, 17/7 | (Acting Director) |
| Salaries Committee, R.R.B. | 2 | 24/3, 12/10 | (Director) |
| | 1 | 2/6 | (Acting Director) |

| | | | |
|--|----|--|-------------------|
| Building Committee, R.R.B. | 3 | 13/3, 24/3, 12/10 | (Director) |
| | 1 | 29/6 | (Acting Director) |
| Rubber Replanting Advisory Board | 19 | 5/1, 15/1, 27/1, 11/2, 26/2, 11/3, 23/3, 27/7, 7/8, 13/8, 27/8, 11/9, 24/9, 5/10, 30/10, 12/11, 27/11, 10/12, 21/12 | (Director) |
| | 9 | 8/4, 21/4, 6/5, 19/5, 2/6, 9/6, 22/6, 3/7, 14/7 | (Acting Director) |
| Planters' Association of Ceylon | 4 | 6/2, 20/3, 11/8, 15/12 | (Director) |
| District Planters' Associations: | | | |
| Kalutara | 2 | 4/3, 21/10 | (Director) |
| Sabaragamuwa | 1 | 2/12 | (Director) |
| Low-Country Products Association | 2 | 21/3, 20/8 | (Director) |
| Carson Cumberbatch & Co., Ltd., Visiting Agents' Conference | 1 | 16/2 | (Director) |
| Ceylon Chamber of Commerce | 1 | 25/3 | (Director) |
| Staff Committee, R.R.I.C. | 6 | 6/8, 14/8, 28/8, 22/10, 26/10, 28/11 | (Director) |
| | 1 | 4/6 | (Acting Director) |
| London Advisory Committee for Rubber Research (Ceylon & Malaya) | 2 | 20/5, 3/7 | (Director) |
| Department of Census and Statistics, Agricultural Census | 1 | 19/6 | (Acting Director) |
| Ceylon Association for the Advance- ment of Science | 1 | 26/10 | (Director) |
| Coconut Research Institute Technical Seminar | 1 | 18/12 | (Director) |
| Discussion on Phytophthora at P.A. of Ceylon | 1 | 23/10 | (Director) |
| Tea Research Institute | 1 | 23/12 | (Director) |
| Committee of Directors and Chairmen of Tea, Rubber & Coconut Research Institutes | 1 | 11/7 | (Acting Director) |

4. VISITS.

Estates.—The Director paid 35 visits to 26 Estates during the year.

He also paid 8 visits to Nivitigalakele Station and 4 visits to Hedigalla Station.

Institutes.—The Tea Research Institute and the Ceylon Institute of Scientific and Industrial Research were visited.

Smallholdings.—The Director, accompanied by the Smallholders representative on the Rubber Research Board and by the Chief Advisory Officer Smallholdings, visited a number of smallholdings in the Yatadolawatta area to watch sulphur dusting carried out under the Smallholdings Department Co-operative Dusting Scheme.

A tour of inspection was made of smallholdings replanted under the Rubber Replanting Subsidy Scheme. Thirty replanted holdings in nine ranges were visited in the course of a three-day tour of the Kelani Valley, Kegalle, Galagedara and Ratnapura districts.

The Acting Director attended the Annual Field Day of the Smallholdings Department.

Visits in Malaya, Vietnam, Cambodia and Europe.—With the approval of the Rubber Research Board the Director visited Vietnam and Cambodia before proceeding on leave in the U.K. On his way to Saigon the Director had a stop-over of two days in Malaya to obtain the necessary visas (Vietnam and Cambodia not being represented in Ceylon).

The opportunity was taken to visit the Rubber Research Institute of Malaya where discussions were held with the Director and Members of the Botanical Division on the subject of breeding Hevea clones for resistance to South American Leaf Blight. The Experiment Station of the Institute was visited in the company of the Director, the Head of the Soils Division and the Acting Head of the Botanical Division.

The Director was the guest in South Vietnam of Mr. J. Simon, the Director-General of the French Rubber Research Institutes of Paris (IFC), Vietnam (IRCV), Cambodia (IRCC) and Ivory Coast (IRCA), and of Mr. P. Compagnon, the Director of Research of the IRCV, IRCC and IRCA.

In Vietnam three full days were spent at the Institut des Recherches sur le Caoutchouc au Vietnam at Laikhê where the work on Diagnostic Physiologique was fully discussed with its originator, Mr. E. R. Beaufils, the Head of the Department of Production Research, and the French members of his Department working on mineral and organic analyses. Discussions were also held with Mr. M. Liponski, the Head of the Department of Consumption Research of the Institute.

During his stay in Vietnam, the Director visited, with Mr. Compagnon, the Plantation Quanloi (Société des Plantations de Terres Rouges), Plantations Minh-tranh and Locninh (Société des Caoutchoucs d'Extrême-Orient), Plantation Daùti-êng (Michelin), Plantations Anlôc and Binhlôc (Société Indochine des Plantations Hévéa).

In Cambodia the Director visited the new Institut de Recherches sur le Caoutchouc au Cambodge (IRCC), Plantations Chup and Tapao (Compagnie du

Cambodge), Plantation Prek Kak (Compagnie des Caoutchoucs du Mekong), Plantation Mimot (Société des Plantations Réunies de Mimot).

The hospitality and assistance received from all quarters are gratefully acknowledged.

In Paris visits were paid to the laboratories of the Institut Francais du Caoutchouc, of the Recherches Scientifiques et Techniques d'Outre Mer (O.R.S.T.O.M.) and of the Section Technique d'Agriculture Tropicale.

In England the following institutions were visited:—

The British Rubber Producers' Research Association,
The John Innes Horticultural Institution,
The East Malling Research Station,
The Long Ashton Agricultural and Horticultural Research Station,
The Horticultural Science Laboratories of the University of Bristol,
The Plant Physiology Department of the Imperial College of Science and Technology, London, and
The Botany School, University of Cambridge.

5. VISITORS.

There were 123 visitors during the year which included the following:—

1st half year:

Mr. R. M. E. Michaux, Chairman, International Rubber Research Board and International Rubber Development Committee.
Mr. C. A. Meakin, Director, Grand Central (Ceylon) Rubber Co., and Ceylon Representative on London Advisory Committee for Rubber Research (Ceylon and Malaya).
Mr. L. C. Zunaiga, Bureau of Plant Industry, Philippines.
Dr. G. Heim, Agronomist, CIBA Ltd., Basle, Switzerland.
Dr. Vincent Schmidt, Director, Research Institute of Sumatra Planters' Association.
Professor, C. M. Donald, Professor of Agriculture, University of Adelaide.
Dr. A. Halusa, Austrian Ambassador for India and Ceylon, New Delhi.
Dr. G. F. Bloomfield, Liaison Officer, British Rubber Producers' Research Association, Welwyn Garden City, England.
Mr. S. Lipton, University of New South Wales, Australia.
Mr. Daniel W. Levandowsky, Horticulture Adviser (Tropical), U.S.O.M., Vietnam.
Dr. Hans Braun, Representative of Austrian Nitrogen Works, Ltd., Austria. Chinese Delegation to Ceylon.
Dr. F. J. Simmonds, Director, Commonwealth Institute of Biological Control, Ottawa, Canada

2nd half year:

Mr. G. B. Blaken, U.K. Treasury Representative in South Asia.
Mr. D. Rhind, London Advisory Committee for Rubber Research (Ceylon & Malaya).
Mr. R. W. Newsam, U.K. High Commission in Ceylon.

Mr. H. W. Marston, Foreign Research and Technical Programs Division of the United States Department of Agriculture.
 Mr. W. Hughes, Board of Trade, London.
 Mr. R. W. B. Carter, U.K. Trade Commissioner, Ceylon.
 Mr. A. J. Riker, Department of Plant Pathology, University of Wisconsin, U.S.A.
 Mr. P. Compagnon, Research Director, Rubber Research Institutes of Vietnam, Cambodia and Africa.
 Dr. A. R. Ingoet, Yangambi, Belgian Congo.
 Mr. H. J. Kahn, Fisons Pest Control, Cambridge, England.
 Mr. Jack Morris, Food and Agriculture Officer, U.S.O.M., Ceylon.
 Mr. L. Gouin, International Potash Institute—Potascheme, Bangalore.
 Dr. D. L. Gunn, Director, Tea Research Institute of Ceylon.
 Mr. R. B. Stewart, Visiting Agent, R.E.A. & Cumberbatch Ltd., Malaya.
 Mr. C. A. K. Salgado, Chemical Division, R.R.I. of Malaya.
 Dr. Karl Kumcar, Austrian Trade Commissioner, Ceylon.
 Dr. Carl Wessely, Federal Chamber of Commerce, Vienna.
 Dr. Otto Schiller, Professor of Agricultural Economics, University of Stuttgart.
 Three members of the Canadian Photographic Survey Corporation.
 Four members of the Parliament of the Federal Republic of Germany.
 Delegation of Soviet Scientists including 2 members of U.S.S.R. Academy of Science.
 Seven members of the Administrative Committee of the Rubber Research Board.

6. PUBLICATIONS.

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

(1) For information of the Rubber Research Board:

- (a) Director's Report for 1958
- (b) Director's Report for 1st half-year 1959
- (c) Research Programmes for 1960

(2) Contributions to 1958 Annual Reports of the Planters' Association of Ceylon and of the Low-Country Products Association:

“Work of the Rubber Research Institute of Ceylon in 1958”

(3) Contribution to the Lanka Year Book 1959:

“Work of the Rubber Research Institute of Ceylon in 1958”

(4) Contribution to the Rubber Control Silver Jubilee Supplement:

“Rubber Cultivation and Research” by the Acting Director.

(5) Contribution to the Times of Ceylon Annual Industrial and Agricultural Supplement:

- (a) “Rubber Research in Ceylon” by the Acting Director.
- (b) “Rubber Changed the Face of Civilization” by the Chemist.

(6) For publication in R.R.I.C. Quarterly Journal:

- (a) "Editor's Note" in the 1st Quarterly Journal for 1959
- (b) "Mother Tree of Clone PB 86" in the 1st Quarterly Journal for 1959
- (c) "A Note on Guatemala Grass as Mulch for Rubber Plants" (Joint Author) in the 2nd Quarterly Journal for 1959

The following roneoed leaflet was issued:—

Phytophthora Questionnaire 1959 dated 26-5-59

The following publications were issued:—

- (a) Annual Report of the Rubber Research Institute of Ceylon for 1958
- (b) 1st Quarterly Journal for 1959
- 2nd Quarterly Journal for 1959
- 3rd Quarterly Journal for 1959
- 4th Quarterly Journal for 1959 (in press)
- (c) Advisory Circular No. 66—Manuring of Rubber (Superseding Advisory Circulars No. 59 & 59A)
- (d) Smallholdings Folders No. 6—Tapping (English)
No. 6—Tapping (Sinhala)

7. CORRESPONDENCE.

Correspondence figures for 1959 were as follows:—

| | | <i>Inward</i> | <i>Outward</i> |
|--------------------------------|---|----------------|------------------|
| Director | { | General ... | 1,134* ... 858 |
| | } | Technical ... | 138** ... 302† |
| Administrative Department ... | | 3,600 ... | 3,347 |
| Botany Department ... | | 262 ... | 191 |
| Plant Pathology Department ... | | 552 ... | 669 |
| Soils Department ... | | 382 ... | 332 |
| Chemistry Department ... | | 470 ... | 433 |
| Estate Department ... | | 401 ... | 1,145 |
| Smallholdings Department | { | General ... | 5,315 ... 11,499 |
| | | With Rubber | |
| | | Controller ... | 645‡ ... 8,596§ |
| | | 12,899 | 27,372 |

* includes 469 applications for various posts.

** includes 42 letters handled by Acting Director.

† includes 73 letters handled by Acting Director.

‡ includes New Planting applications, etc.

§ includes 4721 preliminary reports, 2821 final inspection reports and 1054 special reports, etc.

8. NOTES ON DEPARTMENTAL REPORTS.

Botany.—Thirty eight foreign and local clones have been established in large-scale clone trials on two collaborating estates in the Kalutara district. Notes have been made of the secondary characters of the foreign clones under local conditions.

Selected RRIC clones in experimental tapping during 1959 are indicating a high standard of yields. Over 80 per cent of these clones, with trees ranging in age from 12 to 18 years, are yielding over 20 lb. dry rubber per tree per year. Clone RRIC 28 with a single surviving tree in tapping has given 56.6 lb. dry rubber per tree in 1959, while ten RRIC clones, with a fuller complement of trees of the originally established budgrafts, are yielding over 30 lb. dry rubber per tree per year.

In the fourth year of tapping of a large-scale clone trial, planted on a wide avenue system, clone RRIC 86 is yielding up to the standard of the control clone PB 86 with 12.8 lb. dry rubber per tree per year. Clone RRIC 52 in the same trial is yielding up to the standard of clones RRIM 501 and 513 with 9.2 lb. dry rubber per tree per year. The number of trees in tapping of each clone varies from 110 to 140.

Experimental plantings of clonal seedling families obtained by hand pollination show, on the whole, a high incidence of Brown Bast which seems to affect the highest yielding trees early in their tapping history. These seedlings planted from 1941 to 1947 have given average yields of up to 15 lb. dry rubber per tree per year, without any selective thinning of the original stand of 130 to 140 plants per acre.

Experiments on yield stimulation indicate the necessity for restricting the width of bark to be stimulated to about 2 inches for single-cut tapping systems, because of the lower bark consumption with the Michie-Golledge knife compared with that obtained in countries further East. In the wet low-country districts only light scraping is considered safe, because of bark splitting and *Phytophthora* infection. Under these conditions yield stimulants of a thinner consistency and good penetrating qualities give the best results.

Buddings of mixed clones, planted in 1936 and yielding 700 to 800 lb. dry rubber per acre per year, have given 46 per cent increased yields in the second year of treatment with six-monthly applications of a yield stimulant to scraped bark. A liquid proprietary stimulant applied to unscraped bark has given only 14 per cent increased yields in the same experiment.

Upward tapping of moderately yielding clones in virgin bark has resulted in a 36 per cent increase in yield over normal downward tapping in renewed bark, the tapping in both cases being alternate daily on a half circumference.

A crown budding experiment established in 1945 shows a positive effect of high-yielding clones used as crowns on the yield of the centre section, clone PB 86 being outstanding in this respect. There is no significant difference in the yield of the centre section between heights of crown budding of 5 feet and 8 feet.

Promising results have been obtained in experiments designed to promote early flowering in young budded plants with the object of accelerating the progress of breeding work. Flowering took place 16 months after treatment, when the budded plants were $2\frac{1}{4}$ years of age.

The **Plant Breeding Section** of the Botany Department is located at Nivitalakele Station, where local and imported clones are represented in multiplication nurseries.

The hand-pollination programme extended from February to April. Of 39,565 pollinations made only 270 fruits were harvested and 335 hand-pollinated seedlings, representing 37 families, were obtained. These poor results were mainly due to pathological factors which reduced a fruit set of 5.7% to a fruit harvest of 0.7%.

Extensive tests have been carried out for the control of *Oidium*, *Gloeosporium* and *Phytophthora* which cause heavy losses of flowers and fruits and consequently much interference with breeding work.

Twenty *Dothidella*-resistant clones of the second backcross or outcross with the Eastern parent (PB 86 or Tjir 1), bred at Belterra, Brazil, have been successfully

established in Ceylon. The first budwood consignment of 13 of these clones, forwarded from London in June by the Director, after disinfection at the Commonwealth Mycological Institute, Kew, gave the excellent average of 88 per cent of final budding successes, four clones giving 100 per cent of budding successes.

A further consignment of six IAN first backcross clones, all on to PB 86, received during the year from the Firestone Plantations Company, Liberia brings up to 51 the number of Dothidella-resistant first backcross or outcross clones now established in Ceylon for use in future breeding work.

Flower inducement experiments have been continued and some success has been obtained. This is important as success would mean a reduction of possibly as much as three years of the waiting period before the Dothidella-resistant and Phytophthora-tolerant clones introduced from the Western hemisphere can be used for breeding purposes.

A testing station of $2\frac{3}{4}$ acres for Oidium-resistance has been established on Kepitigalla Estate, at 1,400 feet elevation where conditions favour the presence all the year round of the pathogen in an active state, and 237 clones, including most clones of the recent introduction, have been established there.

A search was started late in the year for a suitable area in which to establish a station for Phytophthora-resistance tests.

Arrangements were completed during the year and a site was selected for the establishment of a breeding station in the Moneragala district, a Phytophthora-free area, where the flowering period differs from that of the Kalutara district. A 5-acre portion of a 1956 replanting with Tjir 1 seedlings was selected for that purpose and crown budding at a height of 6 to 7 feet will be carried out in early January 1960 with clones selected for use in the Institute's breeding work.

Plant Pathology.—The incidence of Oidium leaf disease was comparatively mild in most districts. Spraying with a wettable sulphur gave good results provided effective coverage of the foliage was obtained and this was achieved by carrying the machine along every other row in square-planted areas. Electroducting showed no advantage over ordinary dusting for the control of the disease.

An Oidium survey was carried out in field and nursery buddings of Dothidella-resistant clones introduced from the Western hemisphere.

The incidence of Phytophthora leaf fall and of bark rot was the heaviest recorded to date and this was due in the main to the exceptionally long duration of the S.W. monsoon rains which extended almost continuously from May to mid-October, without the usual dry spell during August and September, and to the relatively low prevailing temperature, factors which were in favour of the development and spread of the causal fungus and against the regular, timely application of control measures.

The rainfall in June was, on the average, $1\frac{1}{2}$ times and in July 3 times higher in 1959 than in the corresponding months of 1958. Control measures recommended for "normal" conditions failed in some cases to give the same degree of protection but these recommendations were not always followed on some estates.

The Institute's advice regarding the number of dusting rounds and the amount of copper fungicide per acre per round takes into account the danger of increasing the copper content of Ceylon rubber beyond the upper limit of 8 parts per million imposed by the Rubber Manufacturers' Association of New York.

Field experiments to compare different brands of copper-based fungicides and to compare dusting with spraying were carried out during the Phytophthora season.

Experiments for the control of Phytophthora Bark Rot were also carried out. The treatment of neglected advanced cases presented new problems.

Promising results have been obtained with two chemicals for the destruction of flowers in an attempt to prevent or reduce fruit set, since young fruit when attacked act as a reservoir of Phytophthora spores which pass on to the foliage causing leaf fall.

Laboratory work during the year was concerned mainly with the control of White Root disease and with the growth requirements of the causal fungus, *Fomes lignosus*.

Borer attacks following Bark Rot were reported from several estates but only dead wood is affected.

Soils.—An Advisory Circular, in which manuring recommendations are based on broad classifications of soil type, was issued during the year.

The inclusion of magnesium in the form of magnesium sulphate in all NPK fertilizer mixtures is now recommended on a wider scale for immature replanted areas on all soil types. This is considered necessary in view of the increasing incidence of magnesium deficiency symptoms in young replantings, severe enough to cause defoliation in certain areas.

Additional remedial measures advised by the Institute consist of a reduction of the potash content of fertilizer mixtures which are recommended for use on all soil types not diagnosed as inherently deficient in potash, as exemplified by the substitution of R 4:6:3 for R 4:6:5.

A field experiment has been laid down on a collaborating estate to determine the optimum ratio of potassium to magnesium in the nutrition of Hevea in relation to different cultivation practices.

The need for increasing the organic matter content of soils by mulching along clean weeded strips of planting rows in young replantings was emphasized in an article published in the Institute's Quarterly Journal.

Fifteen field experiments were in progress during the year. The response obtained in the manurial trials were somewhat inconsistent, phosphorus giving the best response at one centre, nitrogen or potassium having the biggest effect at other centres. One experiment gave significant responses to all three major elements, nitrogen, phosphorus and potassium.

The varied nature of the responses has emphasized the undesirability of making general fertilizer recommendations on the basis of results obtained from isolated field experiments.

Suspected leaf symptoms of potassium deficiency and terminal shoot die-back observed in a manurial trial in the KV district have been confirmed by chemical analysis to be due to a low potassium content.

Analysis of leaves of clones PB 86 and Glenshiel 1 have shown a significantly higher nitrogen and magnesium content of the Glenshiel 1 leaves but no significant difference in the potassium, phosphorus and calcium content of the leaves of these two clones.

Analysis of bark samples for nitrogen, phosphorus, potassium, calcium and magnesium seems to confirm the findings of the R.R.I. of Malaya that bark analysis is almost as satisfactory as leaf analysis for a study of responses to phosphorus and to potassium.

It has been found that the aluminium content of leaves of *Tripsacum laxum* (Guatemala grass) is only about one-sixth that of *Mikania scandens* or *Pueraria phaseoloides* and that the content of the major elements of the aerial parts of this grass is significantly lower than that of the common weed *Eupatorium odoratum*.

Chemistry.—During the period under review the main emphasis, apart from the usual advisory service, visits and the experimental work involved therein, has been on the continuation of the experimental work on the subject of the limitation of contamination by copper, mainly of scraps, when dusting formulations are used to control defoliation caused by *Phytophthora*, and on the determination of dirt content of Ceylon rubber with a view to conformity to a possible future specification.

Copper compounds, which have been found to be the most effective and cheapest fungicides in checking *Phytophthora*, act slowly on rubber causing tackiness of the rubber and brittleness of the goods manufactured from it. The upper limit for copper content of rubber has, therefore, been fixed at 8 parts per million by the Rubber Manufacturers' Association of New York.

The copper oxide and copper oxychloride used as dusts for the control of *Phytophthora* leaf fall are insoluble in water and are absorbed on the rubber particles in the latex and on the scrap, so that only a small part is removed during manufacture. It is important, therefore, that no effort be spared to prevent or reduce contamination by suitable action in the field.

The experiments carried out indicate that the risk of contamination above the RMA limit can be considerably reduced by an extensive blending of latex and scrap from dusted and undusted areas. It is also recommended that all cups should be inverted during dusting and that no tapping should be carried out on the day of dusting.

Some experiments have been carried out with two types of rainguards in connexion with copper contamination, but the results have not yet been fully analysed for reliable conclusions to be drawn.

Of 817 samples analysed for dirt content 440 had been received from two leading Colombo packing houses. As from September 1959 three Estates have been under regular weekly control for an estimation of variations in dirt content during a one year period. Preliminary results indicate that the average dirt content for first grade crepe is about 0.025% and for first grade sheet about 0.05%.

Other experiments were mainly concerned with problems of coagulation or prevention of pre-coagulation in the field.

One of the factors responsible for instability of latex and premature coagulation would seem to be the use of coconut shells as latex cups, especially when they have been used for a long time. In preliminary trials it has been found that a significant difference in quality exists between latex collected in coconut shells and latex collected in aluminium cups, with an average value of the microfloculate of 0.07% for aluminium cups and 0.12% for coconut shells.

For improved control of latex coagulation in the factory a simple method using bromo cresol green indicator paper strips has been suggested for the rapid determination of the acid value of the latex.

It has been established in several cases that the quality of sheet and crepe could be improved by using formic acid in place of acetic acid as a coagulant. The coagulating rate of formic acid is quicker than that of acetic acid and formic acid has, in addition, an antiseptic value.

Investigations into the cause of discolouration of bleached crepe rubber have shown iron compounds to be the main cause of the discolouration. Oxalic acid has been found to improve the colour-holding properties of the crepe.

Preliminary investigations have been carried out into the type of mould usually growing on sheet and on crepe rubber and several modern fungicides have been tested for the prevention of mould growth.

Some work has also been done in connexion with the disposal of the acidic effluents from rubber factories and an experimental 500-gallon tank installation, in which the effluents are neutralized by means of limestone and quick lime, has been constructed on an estate.

Smallholdings.—The Smallholders' representative on the Rubber Research Board and the Director made a three-day tour of inspection of smallholdings replanted under the Rubber Replanting Subsidy Scheme. They also inspected a number of smallholdings to watch sulphur dusting carried out under the Smallholdings Department Co-operative Dusting Scheme.

A Publicity Unit to provide Audio-Visual instruction to Smallholders and to also assist in propaganda work was formed in the latter part of the year.

A fully equipped mobile unit commenced to function on 26th October and by the end of the year a total of 34 propaganda meetings-cum-exhibitions had been held in various parts of the Island. These proved to be a great success and on an average 300 people had attended each meeting.

The Sulphur Dusting Scheme was further extended this year and 6,247 acres of smallholdings, an increase of 28% over the previous year and an all time record, were successfully sulphur dusted. Dusting machines were loaned to 67 Co-operative Groups and sulphur dust was provided at subsidized rates by Government.

Eighty two co-operative groups have been organized for the forthcoming 1959/60 Sulphur Dusting season. There are fifteen new groups and 17 additional Mistral IIB dusting machines have been purchased to cope with the increased acreage. The total acreage to be dusted will be approximately 8,170 acres in 2,509 holdings. About 230 metric tons of approved sulphur dust will be used in the subsidized acreage of 6,040 acres during the forthcoming season.

A Fomes survey of all smallholdings replanted during the five-year period 1953 to 1957, completed during the first half of 1959, has shown the incidence of holdings infected to be 22.2 per cent. This same survey revealed that 20.8 per cent of holdings replanted in 1956 and 8 per cent of holdings replanted in 1957 are now showing infection by the White Root disease. Advice regarding treatment of the disease has been given to owners of the infected smallholdings, and, in addition, 36 demonstration plots have been laid down in different ranges.

Rubber Instructors and Replanting Assistants lined 4,040 acres on 2,954 smallholdings for soil conservation work and 4,750 acres on 3,702 smallholdings for planting holes, in Subsidy replanting areas. They marked 1,885 tappable trees on 56 smallholdings for opening of tapping cuts.

Rubber Instructors advised on the building of 53 demonstration and 33 ordinary smokehouses and completed 28 demonstration and 14 ordinary smokehouses during the year. They also paid 2,743 routine advisory visits to smallholders' smokehouses. They gave demonstrations of sheet-making (738), of tapping (257), of disease control (696) and 430 miscellaneous demonstrations during the year.

Random checks on the planting material issued from the Commodity Purchase Depots to subsidy replanters consisted of 187 visits by Rubber Instructors and examination of 20,314 plants.

The field staff paid 8,712 visits to holdings replanted in 1959 and 15,611 visits to holdings replanted in previous years under the Subsidy Scheme.

Work in connexion with New Planting of rubber amounted to 16,597 visits to holdings and 4,654 preliminary reports on the suitability of holdings for new planting. Field officers of the Department lined 827 acres in 629 holdings for soil conservation work and 917 acres in 649 holdings for planting holes. They also marked 2,089 trees in 98 new-planted holdings for opening of tapping cuts.

The Annual Field Day and 34 Village Propaganda meetings-cum-exhibitions were held during the year.

Estate.—The Institute's stations of Dartonfield, Nivitigalakele and Hedigalla, 1,491 acres in extent, bear the following planted acreages:—

| | <i>Experimental areas</i> | | <i>Nursery areas</i> | | |
|----------------|---------------------------|-------------------|-------------------------|-----------------|--------------------------------|
| | Immature | Mature | R.R.I.C. (seedlings) | (buddings) | R.R.S.S. (Tjir 1 seedlings) |
| Dartonfield | 29 | 105 $\frac{3}{4}$ | 2 | 3 $\frac{1}{2}$ | — |
| Nivitigalakele | 20 | 126 | 7 | 7 $\frac{1}{4}$ | — |
| Hedigalla | 514 $\frac{1}{4}$ | 196 $\frac{3}{4}$ | — | — | 57 |

The rainfall for the year at Dartonfield, Nivitigalakele and Hedigalla Stations amounted to 151.7, 167.7 and 220.8 inches respectively. The first quarter was particularly dry, bordering on conditions of drought. The S.W. monsoon reached its peak in June and was accompanied by strong winds causing considerable wind damage to trees on the outlying divisions. The third quarter was very wet, a fall of approximately 50 inches being recorded.

Weather conditions were not conducive to the harvesting of crop, particularly at Hedigalla. The crop harvested was 271,074 lb. or 3,926 lb. short of the estimate of 275,000 lb.

Weather conditions during the first quarter, being particularly dry, considerably reduced the activity of Oidium. The application of control measures by sulphur dusting against the spread of a mild attack presented no difficulty.

The rainfall distribution during the second and third quarters afforded very favourable conditions for the development and spread of Phytophthora leaf and

bark diseases and consequently a high incidence of these diseases was a notable feature this year. Routine measures for the control of leaf fall, using copper-based fungicides, proved fairly effective. With the use of the organo-mercuric fungicide Antimucin and of Kankerdood there was an appreciable reduction in the spread of bark rot on trees which had previously been affected. It was apparent, however, that a complete measure of control has not yet been achieved.

Additions to budwood nurseries were effected as a result of several consignments of budwood of the Dothidella-resistant IAN clones received from Florida and Liberia during the year.

A 57-acre nursery of Tjir 1 seedlings continued to be maintained for the Rubber Replanting Subsidy Scheme on Hedigalla Station. Requirements of the Rubber Control Department of budded stumps and seedlings for the South-West and North-East plantings were met from this nursery.

Apart from minor buildings constructed during the year, five Intermediate Staff bungalows and five Assistant Staff Grade I bungalows were completed to house the increased staff employed at the Institute.

An agreement has been entered into with the Department of Government Electrical Undertakings to obtain A.C. Power Supply to the Institute. The switch-over from Direct Current now obtaining to Alternating Current supply will satisfy the long desired and essential requirement of the Laboratories which have been handicapped for want of A.C. supply.

The Visiting Agent paid two visits to Dartonfield Group during the year.

REPORT OF THE BOTANY DEPARTMENT

BY

C. A. DE SILVA

SUMMARY

Field Experiments and Laboratory Work.—The total acreage of the three stations of the Institute was 1,011 acres in 1959. The experimental areas supervised by the Botany Department for the test tapping of selected planting material extended over an area of 349 acres.

The immature experimental areas, planted from 1953 to 1957 with selected foreign and local material, cover an area of 578 acres. Girth measurements of the trees are taken at intervals of approximately 12 months.

In recent years the general drive for increased yields, from old seedling rubber and from moderately high-yielding budded rubber, has been a topical subject of considerable interest. The results of our preliminary investigations on methods of obtaining increased yields and results obtained in other countries form the basis for our present recommendations.

Other investigations of this Department deal with plant breeding for high yields and disease resistance, avenue systems of planting, selective thinning out of high initial stands of budded rubber and clonal seedlings, and crown budding experiments.

Small-scale greenhouse and laboratory experiments have also been carried out and some interesting preliminary results have been obtained in 1959.

The results of field experiments for 1959 are commented on as concisely as possible. A separate report is submitted on the work of the Plant Breeding Section of the Botany Department.

Advisory Work.—The advisory work of the Botany Department has been largely confined to recommendations on comprehensive replanting programmes, on tapping problems connected with yield stimulation, on increased intensities of tapping and on the use of rainguards for obtaining increased yields.

Tapping for increased yields calls for most carefully considered recommendations. The necessity for obtaining increased yields in general from uneconomic rubber is fully appreciated.

Short talks have been given, on the more important aspects of rubber planting, to agricultural undergraduates of the University of Ceylon, Government Trainee Teachers, Field Officers of the Smallholdings Department, and Graduate students of Jaffna College.

Tapping Experiments.—Tapping experiments have been carried out for obtaining increased yields from moderately high-yielding budded trees of just over 23 years of age. This rubber is yielding about 700 lb. dry rubber per acre per year.

Proprietary yield stimulants, formulated with the plant growth substances 2,4,5-T and 2,4-D, have been used for application to both scraped and unscraped bark.

“Ready-Rub”, a stimulant of a comparatively thin consistency, recommended for application to unscraped bark, has given poorer results than those obtained from stimulants of a thicker consistency for application to lightly scraped bark. Increased yields of 14 to 46 per cent over the control have been obtained in these experiments in 1959.

Two proprietary formulations, A 1319 and A 1320, recommended for application to unscraped bark, have given, in the first month of experimental tapping, poorer results than a new “RRIC” mixture and “Dilatex” applied to scraped bark.

Tapping of upward “V” cuts, alternate daily on a half circumference on virgin bark above the normal tapping panel, has given a 37% increase in yield over the control in the second year of experimental tapping.

Performance of Clonal Seedlings and Local Clones.—Hand-pollinated seedlings have been planted on Hedigalla and Nivitigalakele Stations from 1941 to 1947. No selective thinning out of the poorer trees has been carried out in these experimental areas.

At the age of 16 to 18 years the hand-pollinated seedlings, representing crosses of clones PB 86, Mil 3/2, Wag 6278, Tjir 1 and RRIC 8, have given an average yield of 17 lb. dry rubber per tree per year. The accumulated cases of Brown Bast are about 24%, while the Bark Rot and Canker cases are negligible.

1,156 legitimate seedlings of PB 86 and Tjir 1 crosses have given at 12 to 13 years of age an average yield of 14 lb. dry rubber per tree per year. The accumulated cases of Brown Bast and Phytophthora bark diseases are negligible.

352 “selfed” seedlings of clone Tjir 1, planted in 1949, have given 7.8 lb. dry rubber per tree per year in the 4th year of tapping in 1959, without any selective thinning out of the poorer trees.

Five-tree clones of the original budgrafts established from hand-pollinated seedlings of the earlier programmes have been planted from 1941 to 1947.

The experimental tapping results in 1959 show that over 80 per cent of the selected RRIC clones, ranging from 12 to 18 years of age, are yielding over 20 lb. dry rubber per tree per year. Ten RRIC clones are yielding over 30 lb. dry rubber per tree per year in the 9th year of tapping.

The local clones Nab 12, 15 and 20, with 20 trees of the original budgrafts of each clone in tapping, have given yields ranging from 14 to 17 lb. dry rubber per tree per year in the 14th year of tapping, compared with a yield of 19.1 lb. dry rubber per tree per year of the control clone PB 86 in the same clone trial.

Clones RRIC 4, 5 and 7 in another trial have given yields of 20 lb. dry rubber per tree per year in the 7th year of tapping, with approximately 70 trees of each clone in tapping in 1959.

Clone RRIC 52, which is under observation for its vigorous growth and other excellent secondary characters, has given a yield of 25 lb. dry rubber per tree per

year, with 3 of the 5 original budgrafts in tapping. In a large-scale clone trial of 150 trees of this clone a yield of 9.2 lb. dry rubber per tree per year has been obtained in the 4th tapping year. This yield is up to the standard of yields of clones RRIM 501 and 513 in the same trial.

Girth and bark measurements were taken in 1959. These data have been summarized for the various clones in test-tapping, together with other secondary characters.

Foreign clones.—Clone PB 86 is the highest yielding clone in most of the clone trials. The high susceptibility of this clone to *Phytophthora* leaf and bark diseases in recent years calls for a careful selection of the conditions of growth for large-scale planting.

Clone Ch 26, which gave a yield of 10.6 lb. dry rubber per tree per year in the second year of tapping, yielded 8.0 lb. per tree per year in the third year of tapping. The drop in yield is due to the heavy wind damage sustained in 1959.

The yields of clones AVROS 255, LCB 1320 and RRIM 513 justify their inclusion in the planting recommendations of the Institute.

Wide Avenue Planting 6' × 45'.—Under this system of planting clones RRIC 86 and PB 86 are giving approximately the same yields in the third year of tapping. The yields of clones RRIM 501, 513 and RRIC 52 are of the same order in the third year of tapping in the same clone, with over 100 trees of each clone in tapping.

Crown budding Experiment.—The crown budding experiment on 10 acres at Hedigalla Estate, initiated in 1945, shows a positive effect of high-yielding crowns on the yields of the budded centre-sections. Clone PB 86 as a crown has raised the yields of all clones used as centre-sections and is outstanding in this respect.

There are no significant differences in the yields of centre-sections for the heights of crown budding of 5 feet and 8 feet.

Tapping of Clone LCB 870 on Glendon Group, Neboda.—The test tapping of this low-yielding *Oidium*-resistant clone was continued in 1959. Sixty four trees in the 4th year of tapping have given a yield of only 3.4 lb. dry rubber per tree per year. The introduction of the "double-four" system of tapping, 2S/2, d/4, 100%, in the last three months of 1959 shows an improvement in yield. The tapping will be continued on the double-cut system.

Growth Measurements in Immature Areas.—Girth measurements were taken in all immature areas in 1959. The girth figures which are below normal standards of good growth in the first 2 to 3 years at Hedigalla Station have shown a marked improvement in the rate of girth increase in the 4th and 5th years of age.

Girth increments of 3.6 to 6.0 inches per year have been recorded over large acreages.

Minor Investigations.—A method for inducing early flowering and fruit set in *Hevea* proved to be very promising on trees of about 2 years of age. The results have been published in the Institute's Third Quarterly Journal for 1959.

Other minor investigations included the rooting of *Pueraria* cuttings with growth-promoting substances, latex vessel counts in renewed bark from the 1st to the 10th year of renewal and a study of the epidermal structure of leaves of clones as a method of identification of the clones.

DETAILED REPORT

1. GENERAL.

1.1. Staff.—Mr. C. A. de Silva, Botanist, was on duty during the year under review. He acted for the Director from 29th March to 19th July 1959 in addition to his own duties.

Mr. W. E. Manis, Plant Breeder, was on duty during the year. He submits a separate report for the Plant Breeding Section.

Mr. D. M. Fernando, Assistant Plant Breeder, was on end-of-contract leave from 1st May to 31st July 1959. He was on duty for the remainder of the year.

Mr. L. B. Chandrasekera, Research Assistant, was on duty during the year.

Messrs. W. G. V. Fernando, Senior Technical Assistant, and C. Amaracone, Technical Assistant, were on duty; both officers were on annual vacation leave during the first half year of 1959.

1.2. Advisory Work.—The advisory work of the Department has been largely confined to recommendations on comprehensive replanting programmes and to problems connected with a general drive for obtaining increased yields from uneconomic rubber areas.

Enquiries on methods of increasing yields by yield stimulation on the use of new types of rainguards for increasing the number of normal tapping days in the wet districts and on the adoption of increased intensities of tapping on double-cut systems, have called for most carefully considered recommendations.

In many instances there is no immediate provision for replanting moderate-yielding pre-war rubber within ten years of the introduction of double-cut system of tapping of over 100 per cent relative intensity.

The leaflets distributed by the Smallholdings Department of this Institute and by the Rubber Replanting Subsidy Scheme on various aspects of rubber planting mainly on smallholdings have substantially reduced the volume of advisory work of the Botany Department.

The number of local and overseas visitors has increased considerably in recent years and the Botanist has co-operated fully with the other members of the staff in showing the visitors round the laboratories and experimental stations of the Institute and in discussing rubber problems of mutual interest.

Short talks on the more important aspects of rubber planting have been given to final year undergraduates reading for the degree in Agriculture of the University of Ceylon, Government trainee teachers, field officers of the Smallholdings Department and students of Jaffna College reading for London University external degrees.

Correspondence :

| | | | |
|---------|-----|-----|-----|
| Inward | ... | ... | 262 |
| Outward | ... | ... | 191 |

Leave :

| | | | |
|----------|-----|-----|----|
| Casual | ... | ... | 19 |
| Vacation | ... | ... | 6 |
| Sick ... | ... | ... | — |

1.3. Visits.

| | | | |
|--------------------------|-----|-----|----|
| To Estates | ... | ... | 9 |
| To Experimental Stations | ... | ... | 47 |
| To Colombo | ... | ... | 23 |

The visits to Colombo were made in the writer's capacity as Acting Director and in connexion with the export and import of budwood.

• **1.4. Meetings.**—The writer attended the following meetings in his capacity as—

(a) *Acting Director:*

| | | | | |
|--|-----|-----|-----|---|
| Rubber Research Board | ... | ... | ... | 1 |
| Rubber Replanting Advisory Board | ... | ... | ... | 9 |
| Administrative Committee, R.R.B. | ... | ... | ... | 2 |
| Smallholdings Committee, R.R.B. | ... | ... | ... | 1 |
| Smallholdings Selection Committee, R.R.B. | ... | ... | ... | 2 |
| Salaries Committee, R.R.B. | ... | ... | ... | 1 |
| Building Committee, R.R.B. | ... | ... | ... | 1 |
| Staff Committee | ... | ... | ... | 1 |
| Department of Census and Statistics, Agricultural Census | | | | 1 |
| Committee of Directors and Chairmen of Tea, | | | } | 1 |
| Rubber, and Coconut Research Institutes | | | | |

(b) *Botanist:*

| | | | |
|---|-----|-----|---|
| District Planters' Association Meetings | ... | ... | 2 |
|---|-----|-----|---|

1.5. Publications and Lectures.—The following contributions were published in the Quarterly Journals of the Rubber Research Institute of Ceylon:—

- A Note on the "Grooming" of Rubber Trees.
- A Method of Inducing Floral Stimulus for Early Flowering of *Hevea brasiliensis*.
- Yield Stimulation of Rubber Trees.

A lecture was given at a meeting of the Kelani Valley Planters' Association on "Tapping for Increased Yields".

2. YIELD STIMULATION EXPERIMENTS.

The absence of the correct type of monoclonal blocks on the Institute's experiment stations presents considerable difficulties for carrying out yield stimulation experiments as suitable areas have already been used for manuring and dusting trials which would interfere with the differential treatments that may be introduced for yield stimulation. The Botany Department has, perforce, to make use of areas where clones are planted in 25-tree plots or in very small blocks where treatments with different yield stimulants and methods of application have to be assigned to single tree plots or to five-tree plots in order to eliminate clonal effects.

With an alternate daily system of tapping and a bark consumption of about $\frac{1}{2}$ inch per month with the Michie-Golledge knife, used in Ceylon, a strip of bark of only $1\frac{3}{4}$ to 2 inches wide below the tapping cut can be treated with safety at any one time if bark cracking and *Phytophthora* bark diseases are to be avoided in the wet districts.

With this degree of bark scraping the thinner preparations of yield stimulants are more effective for increasing yields.

Preparations made for application to unscraped bark do not penetrate sufficiently through the outer corky layers for maximum effect, at least under the conditions of our experiments.

The descriptions and yield results of two preliminary experiments are given on pages 22 and 23. These experiments give some indications of the level of increased yields that can be expected from the type of budded trees used in the experiments.

The first experiment was laid down in 1958 on 23-year-old buddings of clones PB 25 and AVROS 49, yielding approximately 700 lb. dry rubber per acre per year. Yield recording was carried out on a per tree basis over a period of two months. The trees were then grouped in five single-tree plots in order of merit from the five highest-yielding to the five lowest-yielding trees. Six treatments, consisting of four proprietary preparations, with either 2,4,5-T or 2,4-D as active principle, and two controls were then allocated at random within each group of five single-tree plots. In this way the initial yields of 16 replications of single-tree plots of each treatment were equalized, before the treatments were introduced.

The 2,4,5-T preparations were RRIM mixture, Dilatex and Ready-Rub, the last being a liquid formulation for application to unscraped bark. The 2,4-D preparation, Brunostim, was of rather thick consistency.

The control consisted of two lots of five single-tree plots with scraped or unscraped bark below the tapping cuts.

The yield data for 1959, given below, have been recorded on 80 normal tapping days. The stimulant applications, with or without scraping, were made on a strip of bark 2 inches in width below the cut on the normal tapping panels, at six-monthly intervals. The same area of bark was scraped on the control trees.

Yield Stimulation Experiment No. 1. 1936 Replanted Area, Dartonfield.

Tapped S/2, d/2, 100%

Yield in grams d.r. per tree per tapping

| Treatments | RRIM Mixture | Dilatex | Brunostim | Ready Rub. | Control | |
|------------------------|--------------|---------|-----------|------------|---------|-----------|
| | | | | | Scraped | Unscraped |
| Yield 1959 | 54.1 | 45.9 | 44.0 | 42.5 | 37.8 | 37.1 |
| As per cent of control | 146 | 124 | 119 | 114 | 102 | 100 |

The second experiment was carried out on two moderate yielding clones, SR 9 and Rub 393, in five-tree plots. Four proprietary preparations were used, namely:—

- (1) Dilatex.
- (2) "RRIC" mixture prepared with 2,4,5-T
- (3) A 1319 and A 1320, proprietary preparations containing amyl esters of a mixture of isomers of trichlorophenoxyacetic acid and 2,4-D for application to unscraped bark.

There were 7 replications of each treatment in five-tree plots and of a control. Applications were made on an area of bark of 2-inch width below the normal tapping cuts tapped on the S/2, d/2, 100% system.

The five-tree plots were tapped for two months before the application of the treatments and the preliminary yields were equalized for each treatment in a layout similar to that of experiment No. 1.

The applications of yield stimulant were made on 10th November 1959 to be continued at six-monthly intervals in 1960.

Only 22 test tappings were recorded in 1959 and the preliminary results are presented without comment below.

**Yield Stimulation Experiment No. 2. 1936 Replanted Area, Dartonfield
Yield in grams d.r. per tree per tapping**

| Treatments | Dilatex | "RRIC" mixture | A 1319 | A 1320 | Control |
|------------------------------|---------|-------------------|--------|--------|---------|
| Preliminary Yields ... | 32.6 | 32.7 | 32.6 | 32.5 | 33.0 |
| Experimental Yields ... | 56.2 | 54.7 | 49.7 | 50.3 | 45.2 |
| As Percentage of Control ... | 124 | 121 | 110 | 111 | 100 |

3. TAPPING EXPERIMENTS.

3.1. Trial with Upward Cuts in Virgin Bark on Budded Trees, 1935 Clearing, Nivitigalakele.—Forty local clones yielding about 600 to 700 lb. dry rubber per acre per year, have been used in 25-tree plots in this tapping experiment.

The treatments were as follows:—

(a) *Upward tapping*:—On a half circumference "V" cut just above the normal tapping panel, with the Michie-Golledge knife on a new method of shaving the bark outwards.

(b) *Control*:— A normal half-spiral cut tapped downwards on renewed bark on the normal tapping panel.

Three tapping tasks with a total of 838 trees were used in half-tasks balanced for initial yielding capacity on preliminary tapping results, from April to June 1958, before the introduction of the upward tapping.

The half-circumference cuts were tapped upwards and downwards on alternate days and the results for 1958 and 1959 are presented below for all normal tapping days.

**Upward Tapping Experiment, 1935 Clearing, Nivitigalakele
Tapped V/2, d/2, 100%
Yield in lb. dry rubber**

| Period | Upward tapping on virgin bark | Normal downward cuts on renewed bark (Control) | Yield increase | Percentage increase |
|---|----------------------------------|--|-------------------|------------------------|
| Preliminary Yields April-June 1958 ... | 519.0 | 519.3 | | |
| Experimental Yields August-December 1958 ... | 1604.1 | 1093.5 | 510.6 | 46.7% |
| January-December 1959 | 2119.0 | 1550.2 | 568.8 | 36.7% |

A reduction of about 40 per cent in the size of the normal tapping task is generally necessary when the upward tapping system is adopted.

In mid-December two yield stimulants, "Dilatex" and RRIC mixture, were applied to the upward cuts in virgin bark as well as to the cuts in bark of first renewal tapped downwards, as a control. The experiment with the superimposed treatments will be continued in 1960.

3.2. Test Tapping of Clones and Clonal Seedlings.—The test tapping of clonal seedlings was carried out as in previous years, and the results are presented in Table I. There is a marked drop in the yield of the 1939 and 1940 H.P. seedlings in the 1941 and 1942 clearings at Nivitigalakele in 1959.

At Hedigalla Station the yields of clonal seedlings, represented by PB 86 and Tjir 1 crosses and "selfed" seed of Tjir 1, show a general improvement in yields in 1959.

The agricultural knowledge required for carrying out the correct method of selective thinning out of high initial stands of clonal seedlings is a limiting factor for obtaining the best results from this type of planting material, which, in certain cases, give yields of the same order as those of high-yielding clones.

The best yielding trees seem to succumb to Brown Bast quite early in the tapping history of clonal seedlings, and it is advisable, therefore, to tap clonal seedlings on a reduced intensity of 67% during the first three years of tapping.

The results presented in Table I are from experimental areas which have been planted at an initial density of about 130 to 140 seedlings per acre; no selective thinning of poor-yielding trees having been carried out at any time.

In general, the selected five-tree and three-tree clones in test tapping have kept up to the order of yields of the previous year. The yield and growth data are presented in Table II, together with information on incidence of disease and wind damage.

A fair proportion of the planting material on the Hedigalla Station, with its high rainfall and wet weather conditions, was subjected to a serious attack of *Phytophthora* bark diseases in 1959 during the susceptible period. The position was considerably worsened by the presence of clone LCB 870. This clone, which is reputedly resistant to *Oidium*, has been subsequently found to be very susceptible to *Phytophthora* diseases. It has been used on a fairly large scale, mainly in crown budding experiments.

The clones in test tapping show an increase in Bark Rot and Canker cases in 1959 which is, however, not reflected in poorer yields in most of the experimental areas of selected five-tree and three-tree clones. The clones in the 1947 clearing on higher ground, however, show a general deterioration in yields in 1959.

The reduced numbers of trees in tapping in 1959 provide some indication of the secondary characters of the R.R.I.C. clones in the various trials. A study of the yields, as well as the numbers of trees in tapping, should be a fair guide for a preliminary selection of these clones for planting on a limited scale in experimental areas.

3.3. Test Tapping of Foreign Clones and Local Clones established from Imported Clonal Seedlings.—The test tapping of these clones has been continued in 1959. The results are presented in Tables III to IX.

Clones Nab 12, 15 and 20, with clones RRIM 501 and PB 86, were originally planted in four replicated 200-tree plots of each clone. The test tapping was carried out once a month on 40-tree plots from 1958. The trees in some of the plots have since been removed for building sites. The results presented in Table III give a general indication of the performance of the Nab clones.

TABLE I
Test Tapping Results of Hand-Pollinated Clonal Seedlings
Tapped on S/2, d/2, 100%

| R.R.I.C. Station | Origin of material | Year of planting | Seedling Parentage | No. of trees tapped 1959 | Yield in lb. d.r. per tree per year | | No. of Trees Affected | | |
|------------------|-----------------------|------------------|---------------------------|--------------------------|-------------------------------------|------|-----------------------|------------|-------------|
| | | | | | 1958 | 1959 | Canker & Bark Rot | Brown Bast | Wind damage |
| Nivitigalakele | 1939 H.P. Seedlings | 1941 | RRIC 8 × Mil 3/2 | 42-39 | 16.9 | 13.9 | 9 | 16 | 1 |
| | | | RRIC 8 × Pil A 44 | 37-35 | 10.2 | 9.9 | 2 | 10 | — |
| | | | Pil A 44 × Wag 6278 | 15-16 | 10.7 | 9.0 | 3 | 1 | — |
| | | | RRIC 8 × Wag 6278 | 38-34 | 21.5 | 16.4 | 4 | 11 | 2 |
| | | | Pil A 44 × RRIC 8 | 15-13 | 7.6 | 7.8 | 2 | 6 | — |
| | | | Control—Wag 6278 (budded) | 40-38 | 14.6 | 13.3 | 2 | 3 | 1 |
| Nivitigalakele | 1940 H.P. Seedlings | 1942 | RRIC 8 × Hil 28 | 126-122 | 16.0 | 15.0 | 9 | 25 | 4 |
| | | | RRIC 8 × Tjir 1 | 83 | 21.7 | 17.8 | 3 | 24 | 12 |
| Hedigalla | 1941 H.P. Seedlings | 1943 | PB 86 × PR 107 | 19 | 20.7 | 22.0 | 7 | 2 | — |
| | | | PB 86 × Tjir 1 | 21 | 15.7 | 17.7 | — | 4 | — |
| | | | RRIC 8 × Tjir 16 | 13 | 16.7 | 16.4 | 1 | 1 | — |
| | | | Control Wag 6278 (budded) | 22 | 11.7 | 14.6 | 1 | — | — |
| Hedigalla | 1943 H.P. Seedlings | 1946 | PB 86 crosses | 93 | 15.0 | 18.4 | 23 | 4 | 7 |
| | | | Control Tjir 1 (budded) | 31 ^a | 12.3 | 15.0 | — | — | — |
| Hedigalla | 1944 H.P. Seedlings | 1946 | PB 86 crosses | 144 | 14.4 | 14.7 | 21 | 4 | 4 |
| Hedigalla | 1945 Clonal Seedlings | 1947 | PB 86 crosses | 657 | 11.9 | 13.4 | 23 | 12 | 13 |
| | | | Tjir 1 crosses | 262 | 10.3 | 10.7 | 13 | 5 | 3 |
| | | | Tjir selfs | 325 | 6.0 | 7.8 | 10 | 2 | 3 |

TABLE II

**Test Tapping Results of Clones Established from Hand-Pollinated Seedlings
Tapped S/2, d/2, 100%**

| RRIC Station | Origin of material | Year of planting | Clone | No. of trees tapped 1959 | Yield in lb. d.r. per tree per year | | No. of trees affected | | | Mean girth in ins. 1959 | Bark thickness in mms. | | |
|--------------|---------------------|------------------|------------------|--------------------------|-------------------------------------|------------------|-----------------------|------------|-------------|-------------------------|------------------------|-------------------|---|
| | | | | | 1958 | 1959 | Canker and Bark Rot | Brown Bast | Wind damage | | Virgin bark | Renewed bark 1959 | |
| | | | | | | | | | | | | | |
| Nivitigaleke | 1939 H.P. seedlings | 1941 | RRIC 13 | 3 | 24.6 | 24.8 | — | — | — | 43.8 | — | 8 yrs. | |
| | | | " 9 | 3 | 21.2 | 23.2 | — | — | — | 51.5 | — | 11.0 | |
| | | | " 51 | 5-4 | 23.4 | 22.5 | 1 | 2 | — | 51.0 | — | 12.0 | |
| | | | " 17 | 3-4 | 24.2 | 21.8 | 1 | 2 | 1 | 50.3 | — | 10.5 | |
| | | | " 16 | 4 | 18.0 | 19.3 | — | 3 | — | 46.8 | — | 13.0 | |
| | | | " 24 | 5 | 17.5 | 18.9 | 2 | — | — | 48.2 | — | 7.0 | |
| | | | " 14 | 5 | 18.7 | 16.2 | — | 1 | — | 41.2 | — | 11.0 | |
| | | | Control Wag 6278 | — | — | 17.2 | — | — | — | — | — | | |
| Nivitigaleke | 1940 H.P. seedlings | 1944 | RRIC 28 | 1 | 51.9 | 56.6 | 1 | — | 2 | 52.0 | — | 9 yrs. | |
| | | | " 45 | 3 | 43.1 | 43.1 | 1 | — | — | 44.0 | — | 11.0 | |
| | | | " 31 | 3 | 33.6 | 43.1 | 1 | — | — | 49.0 | — | 12.0 | |
| | | | " 41 | 2 | 44.2 | 42.3 | — | 2 | — | 40.0 | — | 11.0 | |
| | | | " 40 | 2-3 | 25.9 | 33.3 | 1 | — | — | 49.0 | — | 9.5 | |
| | | | " 39 | 2 | 30.3 | 33.3 | 1 | — | 1 | 41.3 | — | 11.0 | |
| | | | " 59 | 3 | 26.9 | 27.5 | — | — | — | 44.0 | — | 9.0 | |
| | | | " 60 | 3 | 28.1 | 26.7 | — | 2 | — | 45.5 | — | 11.0 | |
| | | | " 42 | 1 | 30.2 | 20.9 | — | 1 | — | 34.0 | — | 10.0 | |
| | | | Control Wag 6278 | — | — | 26.2 | — | — | — | — | 11.5 | | |
| Hedigalla | 1941 H.P. seedlings | 1943 | RRIC 75 | 2 | 41.4 | 37.4 | — | 1 | 1 | 39.8 | 10.0 | 10 yrs. | |
| | | | " 37 | 4 | 27.3 | 36.6 | 3 | — | — | 36.8 | 10.0 | 19.0 | |
| | | | " 76 | 5 | 40.2 | 35.7 | — | — | — | 42.3 | 12.5 | 8.5 | |
| | | | " 79 | 4 | 31.1 | 32.0 | — | — | — | 43.5 | 9.5 | 10.5 | |
| | | | " 50 | 4 | 28.4 | 29.2 | 1 | — | — | 40.5 | 12.0 | 9.0 | |
| | | | " 33 | 5 | 27.4 | 27.7 | — | — | — | 45.8 | 11.5 | 10.5 | |
| | | | " 36 | 4 | 30.6 | 27.3 | 4 | — | — | 42.9 | 11.5 | 9.5 | |
| | | | " 35 | 5 | 28.7 | 26.4 | — | — | — | 40.2 | 10.5 | 10.0 | |
| | | | " 47 | 4 | 27.2 | 25.0 | — | — | — | 39.9 | 10.5 | 9.0 | |
| | | | " 38 | 5 | 25.2 | 22.0 | 1 | — | — | 37.2 | 11.0 | 9.0 | |
| | | | " 48 | 4 | — | 21.9 | — | — | — | 23.9 | 9.0 | 6.0 | |
| | | | " 32 | 5 | 19.9 | 21.5 | — | — | — | 35.8 | 10.0 | 8.0 | |
| | | | " 74 | 5 | 20.4 | 21.2 | 5 | — | — | — | — | — | — |
| | | | | | | Control Wag 6278 | 36 | — | 14.1 | — | — | — | — |
| Hedigalla | 1943 H.P. seedlings | 1946 | RRIC 61 | 4 | — | 26.8 | — | — | 1 | 33.3 | 9.0 | 7 yrs. | |
| | | | No. 299 | 5 | 22.1 | 26.0 | 5 | — | — | — | — | 7.5 | |
| | | | RRIC 62 | 4 | 16.4 | 25.8 | — | — | 1 | 31.4 | 8.0 | — | |
| | | | No. 258 | 4 | 19.2 | 25.1 | 4 | — | — | 33.6 | 9.3 | 8.0 | |
| | | | No. 268 | 5 | — | 22.4 | 1 | — | — | 37.3 | 10.9 | 9.1 | |
| | | | No. 241 | 5 | — | 22.2 | — | — | — | 30.8 | 8.2 | 10.3 | |
| | | | RRIC 77 | 4 | — | 20.8 | 1 | — | — | 35.0 | 8.5 | 7.8 | |
| " 54 | 5 | 25.9 | 19.7 | — | — | — | 34.4 | 9.5 | 7.0 | | | | |
| | | | Control Tjir 1 | 22 | — | 15.7 | — | — | — | — | 8.5 | | |
| Hedigalla | 1944 H.P. seedlings | 1947 | RRIC 65 | 5 | 22.3 | 21.1 | — | — | — | 31.1 | 7.5 | 5½ yrs. | |
| | | | " 66 | 5 | 15.0 | 20.7 | — | — | — | 31.1 | 7.5 | 6.0 | |
| | | | No. 134 | 5 | 17.4 | 19.0 | — | — | — | 33.1 | 8.5 | 6.5 | |
| | | | RRIC 64 | 5 | 29.3 | 16.5 | — | — | — | 31.7 | 7.5 | 7.7 | |
| | | | No. 109 | 5 | 19.6 | 16.5 | 1 | — | — | 32.4 | 7.0 | 7.0 | |
| | | | No. 293 | 5 | 17.7 | 16.3 | 2 | — | — | 33.7 | 7.6 | 6.3 | |
| | | | No. 136 | 5 | 19.8 | 15.7 | — | — | — | 33.7 | 7.6 | 7.4 | |
| | | | RRIC 78 | 4 | 25.2 | 13.2 | — | — | — | 25.6 | 7.1 | 6.2 | |
| | | | " 63 | 5 | 14.1 | 10.9 | — | — | — | 29.6 | 8.0 | 7.5 | |
| | | | | | | | 24.3 | 7.0 | 6.0 | | | | |

TABLE III

Large-Scale Clone Trial, 1952 Replanted Area, Dartonfield
Tapped S/2, d/3, 67% from April 1958
Yield in grams per tree per tapping

| Clone | No. of trees tapped 1959 | Yield April to Dec. 1958 | Yield 1959 | Girth in ins. 1959 | Thickness of virgin bark in mm. |
|--------------|--------------------------|--------------------------|------------|--------------------|---------------------------------|
| RRIM 501 ... | 133-117 | 22.3 | 34.4 | 22.4 | 8 |
| Nab 15 ... | 160 | 25.3 | 34.2 | 26.1 | 8 |
| Nab 20 ... | 160-155 | 20.0 | 32.4 | 24.2 | 7 |
| PB 86 ... | 120 | 21.1 | 28.0 | 23.8 | 6 |
| Nab*12 ... | 160 | 13.4 | 21.6 | 23.5 | 7 |

3.3.1. Nab Clones.—Test tapping was continued in 1959 of four Nab clones selected from 26 of these clones established from Tjikadoc seedlings in 1939. The results are summarized in Table IV.

TABLE IV
1939 Clearing, Nivitigalakele
Trees tapped on S/2, d/2, 100% from 1945

| Clone | No. of trees tapped 1959 | Yield in lb. d.r. per tree per year | | Canker and Bark Rot cases | Brown Bast cases | Wind damage cases |
|-------------------|--------------------------|-------------------------------------|------|---------------------------|------------------|-------------------|
| | | 1958 | 1959 | | | |
| Nab 12 ... | 18-17 | 15.7 | 16.9 | 2 | 5 | 2 |
| Nab 15 ... | 20-19 | 17.6 | 15.0 | 3 | 4 | — |
| Nab 17 ... | 18 | 21.1 | 16.4 | — | 10 | 2 |
| Nab 20 ... | 11-10 | 13.9 | 14.2 | — | 7 | 7 |
| Control PB 86 ... | 19 | 19.1 | 19.1 | — | 4 | — |

Under the conditions of this experiment the Nab clones have yielded less than the control clone PB 86.

The general data on the performance of selected foreign clones planted in 1940 are presented in Table V.

TABLE V
Clone Trial, 1940 Clearing, Nivitigalakele
Tapped S/2, d/2, 100% from January 1947

| Clone | No. of trees tapped 1959 | Yield in lb. d.r. per tree per year | | Canker and Bark Rot cases | Brown Bast cases | Wind damage cases |
|--------------------|--------------------------|-------------------------------------|------|---------------------------|------------------|-------------------|
| | | 1958 | 1959 | | | |
| RRIM 501 ... | 16-15 | 13.7 | 10.7 | 1 | 9 | 7 |
| PB 6/50 ... | 21-20 | 20.5 | 17.6 | 3 | 6 | 2 |
| AVROS 352 ... | 11 | 16.5 | 12.4 | 5 | 13 | 6 |
| PR 107 ... | 20-19 | 16.0 | 14.8 | 9 | 4 | 2 |
| RRIM 513 ... | 22-21 | 12.1 | 10.3 | 2 | 6 | — |
| AVROS 255 ... | 16-15 | 18.6 | 16.6 | — | 9 | 6 |
| War 4 ... | 24-23 | 18.3 | 14.2 | 8 | 5 | — |
| RRIC 1 ... | 18-17 | 16.6 | 16.0 | 3 | 7 | — |
| Lun N ... | 19 | 15.9 | 10.5 | 3 | 6 | 2 |
| Control Tjir 1 ... | 20-17 | 18.8 | 14.9 | 1 | 8 | — |

There has been a general fall in yield in 1959, due mainly to severe defoliation caused by *Phytophthora* during the prolonged S.W. Monsoon. The yields of clones AVROS 255 and RRIC 1 remain satisfactory in the 13th year of tapping compared with that of the control clone Tjir 1. All the clones are growing in a steep rocky area of Western aspect and facing the strong afternoon sun. This area has late drying conditions, which during the wet monsoon periods favour the incidence of *Phytophthora* bark diseases.

The 1946 clearing at Nivitigalakele is located in an unfavourable position in the path of the annual monsoon storms that pass through this station. The inherent undesirable secondary characters of the clones are indicated in Table VI.

TABLE VI

Large-Scale Clone Trial 1946, 21 Acres, Nivitigalakele
Tapped S/2, d/3, 67% from 1953
Tapped S/2, d/2, 100% from 1956
Yield in lb. d.r. per tree per year

| | AVROS 255 | AVROS 352 | PB 6/9 | PB 6/50 | LCB 1320 | CHM 3 | Tjir 1 | PR 107 |
|-----------------------|--------------|--------------|-----------|------------|-------------|---------|---------|---------|
| No. of trees 1959 ... | 277-270 | 249-236 | 298-297 | 302-296 | 292-284 | 270-254 | 251-235 | 298-271 |
| Yield 1958 ... | 15.2 | 12.1 | 11.5 | 13.1 | 13.9 | 15.2 | 12.5 | 12.6 |
| „ 1959 ... | 10.1 | 8.9 | 7.9 | 9.9 | 9.2 | 10.7 | 9.1 | 9.0 |
| Brown Bast cases ... | 31 | 10 | 44 | 20 | 18 | 20 | 19 | 17 |
| Bark Rot Cases ... | 5 | 15 | 4 | 2 | 2 | 1 | 2 | 51 |
| Wind damage cases ... | 43 | 68 | 11 | 16 | 31 | 75 | 55 | 14 |

Clones AVROS 255, AVROS 352, LCB 1320, CHM 3, Tjir 1 are susceptible to wind damage, while clone PR 107 is very susceptible to *Phytophthora* bark diseases.

There is a general deterioration in yield in 1959 due to loss of tapping days and an increase in Brown Bast and wind damage cases. The yields of clones AVROS 255 and LCB 1320 are still fairly satisfactory under the difficult conditions of growth in this clone trial.

The test tapping in the 1944 small-scale clone trial has been continued with the selected clones listed in Table VII.

TABLE VII

Small-Scale Clone Trial, 1944 Clearing, Hedigalla
Tapped S/2, d/2, 100% from May 1951
Yield in lb. d.r. per tree per year

| Clone | No. of trees 1959 | Yield | | Canker and Bark Rot cases | Wind damage cases |
|----------------------|-------------------------|-------|------|---------------------------------|-------------------------|
| | | 1958 | 1959 | | |
| RRIC 52 ... | 3 | 34.5 | 25.1 | — | 1 |
| PB 5/122 ... | 4 | 23.5 | 23.8 | — | 1 |
| PB 6/5 ... | 4 | 17.6 | 18.0 | 1 | 2 |
| RR 25 ... | 3 | 25.0 | 20.8 | 2 | — |
| Control Wag 6278 ... | 5 | 18.5 | 20.1 | 1 | — |

Clone RRIC 52 is moderately high yielding in the early years and somewhat late maturing for high yields. The performance of this most vigorous clone is being tested in small-scale trials on a limited number of commercial estates. The best grown and highest yielding tree of the clone in this clearing was killed outright by lightning early in 1959.

Clone RRIC 52 is represented in the 1949 large-scale clone trial, with clone PB 86 and other high-yielding clones as controls, and will be referred to again. It is partially resistant to *Oidium heveae* and appreciably tolerant to *Phytophthora* diseases. It has been used as a parent in breeding and selection programmes in recent years.

3.3.2. RRIC Clones No. 2 to 7.—These clones No. 2 to 7 were the final selections for trial on a larger scale from 120 three-tree clones established from high-yielding PBIG seedlings imported in 1934. The test tapping results for 1958 and 1959 are summarized in Table VIII.

TABLE VIII

1945 Clearing, Hedigalla
Tapped S/2, d/3, 67% from 1953 to 1955
Tapped S/2, d/2, 100% from 1956
Yield in lb. d.r. per tree per year

| Clone | RRIC 2 | RRIC 3 | RRIC 4 | RRIC 5 | RRIC 6 | RRIC 7 | Control Tjir 1 |
|------------------------------------|--------|--------|--------|--------|--------|--------|-------------------|
| No. of trees 1959 | 73 | 73 | 68 | 75 | 75 | 73 | 73 |
| Yield 1958 | 11.6 | 9.2 | 13.1 | 15.0 | 11.8 | 17.0 | 12.8 |
| „ 1959 | 14.9 | 12.5 | 20.4 | 20.4 | 14.2 | 19.8 | 14.4 |
| Canker and Bark Rot cases | 16 | 5 | 14 | 10 | 21 | 4 | 7 |
| Wind damage cases | — | — | 2 | — | — | 2 | — |
| Girth in inches | 33.9 | 29.0 | 29.2 | 32.2 | 28.5 | 31.3 | 28.9 |
| Virgin bark in mms. | 7.5 | 7.5 | 9.0 | 9.0 | 8.5 | 8.0 | 8.5 |
| Renewed bark in mms. (7½ years) | 7.0 | 6.5 | 7.5 | 8.0 | 7.5 | 6.5 | 8.0 |

There is a marked improvement in yields for the RRIC clones in this trial in spite of the increased incidence of Canker and Bark Rot cases in 1959, a particularly bad year for *Phytophthora* diseases. The 1945 area is also in a valley with late drying conditions, which favour the incidence of *Phytophthora* diseases. Although a good control of these bark diseases has been obtained in the previous year with the use of Antimucin, an organo-mercuric fungicide, it is evident that a stronger concentration than that used in 1959 is necessary for more effective control of *Phytophthora* bark diseases.

3.4. Test tapping in 1950 Clearing, Hedigalla.—Test tapping was continued in the three small-scale clone trials in the above clearing. The first two have a layout of 25-tree plots of each clone replicated threefold and the third trial has 25-tree plots of each clone replicated fourfold. The results are presented in Tables IXA, IXB and IXC. In 1959 whole plots of some clones were affected with Bark Rot and Canker. Especial attention was given in this area for controlling *Phytophthora* diseases and the figures for bark disease in 1959 show some improvement in reduced numbers of infected trees. A few clones still remain badly infected, especially clone LCB 870, which is responsible for the spread of *Phytophthora* diseases in the clearing. This clone, with a prolific fruit set, is heavily infected with *Phytophthora* during the susceptible season and spreads the disease to neighbouring trees.

TABLE IX A

Trial No. 1, Chemara Clones
1950 Clearing, Hedigalla
Tapped S/2, d/3, 67% from March 1957
Yield in lb. d.r. per tree per year

| Clones | Ch 2 | Ch 3 | Ch 4 | Ch 8 | Ch 26 | Ch 29 | Ch 31 | Ch 32 | LCB 870 | PB 86 (control) |
|---------------------|------|------|------|------|-------|-------|-------|-------|---------|-----------------|
| Yield 1958 ... | 6.0 | 7.0 | 4.9 | 4.1 | 10.6 | 6.7 | 4.5 | 7.0 | 2.9 | 8.2 |
| Yield 1959 ... | 6.0 | 8.0 | 5.2 | 5.3 | 8.0 | 6.3 | 7.1 | 7.1 | 2.8 | 8.2 |
| Bark Rot cases ... | 5 | 7 | 4 | 12 | 1 | 10 | 3 | 11 | 54 | 7 |
| Brown Bast cases... | — | — | — | — | 1 | 4 | 1 | — | — | 1 |
| Wind damage cases | 1 | 21 | 14 | — | 40 | 2 | 1 | 1 | 2 | 1 |

Clone Ch 26, the highest-yielding clone in this trial, shows a sharp drop in yield in 1959 due to heavy damage suffered in a storm, thus confirming its high susceptibility to wind breakage experienced in Malaya.

TABLE IX B

Trial No. 2, Small-Scale Clone Trial
Tapped S/2, d/3, 67% from 1958
Yield in lb. d.r. per tree per year

| Clone | RR 108 | PB 86 | RR 134 | 154/41 N | 141/41 N | RR 116 | RR 195 | PB 9/82 | Dar 34 | LCB 870 |
|-------------------|--------|-------|--------|-------------|-------------|--------|--------|---------|--------|---------|
| Yield 1959 ... | 8.5 | 8.0 | 7.4 | 6.3 | 6.1 | 5.9 | 5.8 | 5.3 | 4.9 | 4.2 |
| Yield 1958 ... | 6.8 | 8.3 | 6.9 | 6.6 | 5.5 | 6.0 | 5.3 | 4.7 | 4.6 | 2.8 |
| Bark Rot cases | 12 | 34 | 7 | 11 | 15 | 8 | 4 | 6 | 31 | 68 |
| Wind damage cases | 3 | 1 | 1 | 11 | 2 | — | 3 | 12 | — | 1 |

Clone RR 108 has given a yield of the same order as clone PB 86 in the second year of tapping, the latter clone shows a high number of Bark Rot cases in 1959 in this trial.

TABLE IX C

1951 Clearing Hedigalla
Trial No. 3, Small-Scale Clone Trial
Tapped S/2, d/3, 67% from 1958
Yield in lb. d.r. per tree per year

| Clone | PB 86 | RR 181 | RR 119 | RR 39 | RR 52 | RR 53 | RR 163 | RR 38 | DAR 33 | RR 54 | LCB 870 |
|-------------------|-------|--------|--------|-------|-------|-------|--------|-------|--------|-------|---------|
| Yield 1959 ... | 6.4 | 5.3 | 5.0 | 4.9 | 4.4 | 4.2 | 3.7 | 3.3 | 3.1 | 3.1 | 2.4 |
| Yield 1958 ... | 6.6 | 5.1 | 4.2 | 4.8 | 4.8 | 4.4 | 4.7 | 4.0 | 3.9 | 4.1 | 3.0 |
| Bark Rot cases | 19 | 5 | 9 | 17 | 32 | 45 | 4 | 7 | 28 | 22 | 41 |
| Wind damage cases | 10 | 11 | 5 | 28 | 7 | 11 | 8 | 4 | 3 | 19 | 3 |

3.5. Test Tapping: Large-Scale Clone Trial, Planted 6' × 45', 1949 Clearing, 35 Acres, Hedigalla.—The clones are planted in the trial in 25-tree plots replicated sixfold in a balanced incomplete randomised block layout. The yields and secondary characters of selected clones are presented in Table X.

TABLE X

Clone Trial, Planted 6' × 45', 1949 Clearing, Hedigalla
Tapped S/2, d/3, 67% from July 1956
Tapped S/2, d/2, 100% in 1959
Yield in lb. d.r. per tree per year

| Clone | No. of trees tapped | Yield 1959 | Canker and Bark Rot cases | Brown Bast cases | Wind Damage Cases | |
|--------------|---------------------|------------|---------------------------|------------------|--------------------------|----------|
| | | | | | Branch and stem breakage | Uprooted |
| NAB 17 ... | 121 | 13.8 | 21 | — | 1 | 27 |
| RRIC 86 ... | 108 | 12.8 | 6 | — | 8 | 41 |
| PB 86 ... | 126 | 12.1 | 5 | — | 6 | 22 |
| Nab 20 ... | 111 | 11.0 | — | 2 | 14 | 34 |
| No. 29 ... | 137 | 9.7 | — | — | 7 | 21 |
| RRIM 513 ... | 146 | 9.7 | 9 | — | 4 | 8 |
| RRIM 501 ... | 126 | 9.6 | 3 | 1 | 10 | 21 |
| RRIC 87 ... | 137 | 9.3 | 3 | — | — | 13 |
| PB 6/50 ... | 147 | 9.2 | 26 | — | 9 | 21 |
| RRIC 52 ... | 114 | 9.2 | 9 | — | 2 | 36 |
| Nab 16 ... | 123 | 9.2 | 27 | — | 18 | 23 |
| Lun N ... | 130 | 8.3 | 3 | 1 | — | 17 |
| RRIM 504 ... | 137 | 8.2 | 31 | — | 4 | 10 |
| Dar 38 ... | 127 | 7.8 | 13 | — | 9 | 19 |

Clone RRIC 86 is yielding up to the standard of clone PB 86. The large number of wind damage cases in this clone is due to an unprecedented monsoon storm in 1959, which struck the clearing at certain vulnerable points. Trees blown down by wind are differentiated in Table XII from branch and stem breakage. The major part of the damage can therefore be attributed to location and poor anchorage. The above remarks can be applied to a number of other clones which have been damaged by wind in this trial.

Clone RRIC 52 is yielding up to the standard of clones RRIM 501 and 513 under the conditions of the experiment. Its branching habit and vigorous growth is not suited to close planting in the rows of the wide avenue planting spaced 6 ft. × 45 ft. The clone should do better at a spacing of 12 ft. × 20 ft.

Clone RRIM 513 has stood up better to the storm than clone RRIM 501; the latter clone is no longer recommended for large-scale planting in Malaya due to recent evidence of high susceptibility to wind breakage.

3.6. Test Tapping on Commercial Estates.—The test tapping of the Oidium-resistant clone LCB 870, planted in a block of 63 trees on Glendon Estate has amply confirmed the extremely poor yielding characteristics of this clone. The average yield was 2.3 lb. dry rubber per tree per year for the past three years.

Clone LCB 870 has been planted on a very limited scale on a few commercial estates in about 1952 and 1953, when its yielding capacity had not been fully tested,

The test tapping on Glendon Estate was continued in 1959 and the tapping system on a single cut, S/2, d/2, 100%, was changed to a double-cut system, 2S/2, d/4, 100%, in October 1959 with the object of obtaining increased yields. It is known that this change to double cut tapping every fourth day may give up to 20 per cent increased yields in high-yielding budded rubber.

The results given below provide some preliminary information which does indicate a possible improvement in yield on the double-cut system introduced in October 1959 although these latter months of the year are known to be the better yielding months. The test tapping of this clone on the double-cut system in 1960 will be observed with considerable interest.

Test Tapping of Clone LCB 870, Glendon Estate
First tapped on S/2, d/2, 100% in 1955
Yield in lb. d.r. per tree per year

| 1959 Monthly Yields | Jan. 3.3 | Mar. 2.1 | Apr. 2.3 | May 3.0 | June 3.3 | July 4.2 | Aug. 3.4 | Sept. 4.4 | Oct. 3.7* | Nov. 4.0 | Dec. 4.2 | Mean 3.4 |
|---|-------------|-------------|-------------|------------|-------------|-------------|-------------|--------------|--------------|-------------|-------------|-------------|
| *Tapping system changed to 2S/2, d/4, 100%. | | | | | | | | | | | | |

4. GROWTH MEASUREMENTS IN IMMATURE AREAS.

Vigour of growth for early maturity is an important characteristic of clones. There is also an appreciably high correlation between girth and yield in budded trees. A study of girth development during the early years of growth is, therefore, an important observation.

The girth at a height of 3 feet above the highest point of the union of scion and stock is taken as a criterion for the growth of clones, and girth measurements are taken once in 12 months. In large-scale clone trials of 4 to 5 acres of each clone every 5th or 10th tree is marked permanently for girth measurements.

4.1. Clone Trial, 1953 Clearing, 10 Acres, Nivitigalakele.—In this trial clones RRIC 44 and 45 were budded in the field in 1955 on two-year old clonal seedlings. The growth of clone RRIC 45 in this area is outstanding.

| Clone | No. of trees | Mean girth in inches | | Girth Increase 1958/59 |
|---------|--------------|----------------------|------|---------------------------|
| | | 1958 | 1959 | |
| RRIC 44 | 696 | 10.4 | 13.4 | 3.0 |
| RRIC 45 | 715 | 11.8 | 15.3 | 3.5 |
| PB 86 | 60 | 16.2 | 18.7 | 2.5 |

Budded stumps of clone PB 86 were planted in this clearing in 1953 along with the clonal seedlings which were subsequently budded in the field in 1955. The control clone PB 86 is, therefore, two years older than the R.R.I.C. clones.

4.2. Clone Trial, 1954 Clearing, 10 Acres, Nivitigalakele.—This clone trial was planted in May 1954. Two hundred trees of each clone are planted in 40-tree plots in a randomized block layout. The girth measurements, taken in July-August 1959, are summarized below.

| Clone | IRCI 10 | IRCI 7 | PB T 207 | PB 6/5 | PB 24/3 | PB 28/59 | PB 24/51 | RRIM 501 | Mean |
|-------------------------------|------------|-----------|-------------|-----------|------------|-------------|-------------|-------------|------|
| No. of trees ... | 197 | 195 | 190 | 193 | 191 | 179 | 182 | 192 | — |
| Mean girth in inches 1959 ... | 17.3 | 19.8 | 18.8 | 18.0 | 18.3 | 19.8 | 18.5 | 18.9 | 18.7 |
| Mean girth in inches 1958 ... | 14.5 | 16.7 | 15.3 | 14.8 | 14.9 | 16.3 | 15.0 | 15.3 | 15.3 |
| Girth increase 1958/59 ... | 2.8 | 3.1 | 3.5 | 3.2 | 3.4 | 3.5 | 3.5 | 3.6 | 3.4 |

4.3. Five-tree Clone Trial, 1952 Clearing, 25 Acres, Hedigalla.—The 640 five-tree clones in the above 25-acre clearing were brought into tapping in 1959 at $6\frac{1}{2}$ years of age, when about 70 per cent of trees had reached the girth of 18 inches and over for experimental test tapping. A preliminary selection will be made of the highest yielding five-tree clones, with good secondary characters, for test tapping on a per tree basis in 1960.

4.4. Large-Scale Clone Trial, 1953 Clearing, 114 $\frac{3}{4}$ Acres, Hedigalla.—Each clone is planted in 200-tree plots replicated five or sixfold. Planting in this clearing was carried out in May-June 1953. Girth measurements were taken in June-July 1959 prior to the commencement of tapping. Tapping blocks representing criteria of tappability at 18" and 20" girth will be taken into tapping in 1960.

A summary of the girth measurements over the whole acreage is given below. The rate of growth of the trees increased considerably from about the 4th year of age and the growth at 6 years of age is very satisfactory.

Large-Scale Clone Trial, 1953 Clearing, Hedigalla
Average Girth Measurements as a percentage of the total

| Clone | Under 18" | 18" to 20" | 20" and above | Total No. of trees |
|--------------|-----------|------------|---------------|--------------------|
| LCB 1320 ... | 10.0% | 9.5% | 80.5% | 879 |
| RRIC 5 ... | 8.8% | 12.1% | 79.1% | 905 |
| RRIC 2 ... | 13.2% | 14.4% | 72.4% | 895 |
| RRIM 501 ... | 13.7% | 16.2% | 70.1% | 863 |
| RRIC 7 ... | 14.7% | 19.2% | 66.1% | 905 |
| RRIC 3 ... | 19.8% | 21.1% | 59.1% | 744 |
| Tjir 1 ... | 25.5% | 20.0% | 54.5% | 866 |
| Lun N ... | 19.2% | 26.5% | 54.3% | 895 |
| RRIC 4 ... | 21.5% | 27.8% | 50.7% | 889 |
| Wag 6278 ... | 27.2% | 23.8% | 49.0% | 897 |
| Mil 3/2 ... | 28.8% | 22.6% | 48.6% | 906 |
| RRIC 1 ... | 26.5% | 34.6% | 38.9% | 876 |
| LCB 870 ... | 24.7% | 36.9% | 38.4% | 875 |
| RRIC 6 ... | 29.8% | 38.3% | 31.9% | 934 |
| RRIM 513 ... | 34.5% | 39.5% | 26.0% | 878 |

4.5. Large-Scale Clone Trial, 1954 Clearing, 148 Acres, Hedigalla.— Clones RRIC 16 to 37 are planted in the above area in single monoclonal blocks of approximately 800 to 840 trees of each clone, with extra blocks representing control clones.

The girth measurements taken in July-August 1959 representing approximately 12 months growth, together with the girth figures for 1958, are summarized below:—

Average Girth Measurements in Inches

| Blocks | Clone | No. of trees | Girth | | Girth Increase 1958/59 |
|---------|-----------|--------------|-------|------|------------------------|
| | | | 1958 | 1959 | |
| J and K | RRIC 22 | 800 | 10.8 | 16.3 | 5.5 |
| | " 31 | 840 | 11.8 | 16.1 | 4.3 |
| | " 35 | 840 | 10.7 | 15.9 | 5.2 |
| | " 24 | 800 | 10.2 | 15.6 | 5.4 |
| | " 26 | 840 | 9.9 | 15.4 | 5.5 |
| | IRCI 10 | 906 | 9.8 | 14.4 | 4.6 |
| | RRIC 21 | 800 | 9.6 | 14.2 | 4.6 |
| | " 25 | 840 | 8.8 | 13.9 | 5.1 |
| | " 23 | 800 | 9.5 | 13.7 | 4.2 |
| | " 29 | 840 | 8.8 | 13.6 | 4.8 |
| | " 32 | 800 | 9.2 | 13.5 | 4.3 |
| | " 27 | 840 | 8.2 | 13.4 | 5.2 |
| | PB 86 | 800 | 7.4 | 11.9 | 4.5 |
| | PR 107 | 231 | 6.8 | 10.8 | 3.4 |
| | RRIC 30 | 840 | 6.0 | 10.4 | 4.4 |
| | NL 1 | 100 | 7.8 | 13.7 | 5.9 |
| | | Mean | 9.1 | 13.9 | 4.8 |
| H | AVROS 255 | 1274 | 10.8 | 15.5 | 4.7 |
| | PR 107 | 1244 | 7.8 | 11.9 | 4.1 |
| | | Mean | 9.3 | 13.7 | 4.4 |
| D & E | RRIM 501 | 800 | 10.8 | 16.8 | 6.0 |
| | RRIC 18 | 800 | 11.5 | 16.5 | 5.0 |
| | " 36 | 800 | 10.9 | 15.7 | 4.8 |
| | " 16 | 800 | 10.0 | 15.0 | 5.0 |
| | " 34 | 800 | 10.6 | 14.5 | 3.9 |
| | " 28 | 800 | 10.4 | 13.5 | 3.1 |
| | " 37 | 800 | 8.5 | 13.3 | 4.8 |
| | " 17 | 800 | 8.9 | 13.1 | 4.2 |
| | " 19 | 800 | 8.8 | 12.9 | 4.1 |
| | " 33 | 800 | 8.2 | 12.6 | 4.4 |
| | " 20 | 800 | 7.4 | 12.2 | 4.8 |
| | | | Mean | 9.0 | 14.1 |

The 148 acres of this clearing stretch over undulating and steep land opened in virgin jungle. The rate of growth has increased considerably in the 4th and 5th years of age. This has been the general experience in all the new-planted areas. The soil is greatly improved by the decay of timber left on the land about the 4th year, and the competition between the rubber and the heavy covers of Pueraria wane off about the same time.

4.6. Large-Scale Clone Trial, 1955 Clearing, 78 Acres, Hedigalla.— Twelve RRIC clones are planted in this trial in monoclonal blocks of 750 trees of each clone. This layout will provide 3 tapping tasks of each clone in the future for ease of recording yields commercially throughout the year.

The girth measurements, taken in August-September 1959 to cover approximately 12 months growth, are summarized below:—

Average Girth in Inches

| Clone RRIC No.'s | 11 | 12 | 14 | 9 | 47 | 49 | 41 | 43 | 40 | 50 | 13 | 46 | Mean |
|---------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Girth 1959 | 15.8 | 15.2 | 15.1 | 14.8 | 13.9 | 13.8 | 13.4 | 13.1 | 12.6 | 12.6 | 11.9 | 11.9 | 13.7 |
| „ 1958 | 9.9 | 9.4 | 9.5 | 8.9 | 8.7 | 8.6 | 8.1 | 7.9 | 6.7 | 8.0 | 7.0 | 7.0 | 8.3 |
| Increase 1958/59 | 5.9 | 5.8 | 5.6 | 5.9 | 5.2 | 5.2 | 5.3 | 5.2 | 5.9 | 4.6 | 4.9 | 4.9 | 5.4 |

4.7. Large-Scale Clone Trial, 1956 Clearing, 60 Acres, Hedigalla. This area was planted in 2 sections in 300-tree mono-clonal blocks of both foreign and local clones. Eighteen clones with clone PB 86 as a control were planted in the South-West monsoon planting season in June 1956. Eleven clones were planted in the North-East monsoon planting season in September-October 1956. Four clones, namely, GT 1, WR 101, AVROS 385 and AVROS 427 were planted in the South-West planting season at Dartonfield Estate in 1956 in a supplementary clone trial.

The girth measurements at Hedigalla were taken in September-October 1959 and are summarized below:

Average Girth Measurements in Inches

| Clone | No. of trees | Girth (1959) | Clone | No. of trees | Girth (1959) |
|------------|--------------|--------------|-------------|--------------|--------------|
| IRCI 9 | 300 | 10.8 | PR 257 | 297 | 7.5 |
| „ 5 | 300 | 10.7 | PR 258 | 300 | 7.5 |
| RRIM 603 | 299 | 10.4 | RRIM 617 | 300 | 7.3 |
| PB 86 | 295 | 9.8 | RRIC 59 | 295 | 7.2 |
| RRIM 618 | 300 | 9.5 | | | Mean 8.8 |
| AVROS 1191 | 300 | 9.4 | RRIC 42* | 300 | 7.9 |
| RRIM 605 | 299 | 9.2 | IRCI 3* | 300 | 7.7 |
| PR 252 | 300 | 9.0 | AVROS 1851* | 300 | 7.6 |
| RRIM 612 | 300 | 8.7 | IRCI 1* | 300 | 7.5 |
| RRIC 55 | 300 | 8.5 | RRIC 39* | 300 | 7.4 |
| RRIC 54 | 300 | 8.4 | AVROS 1328* | 300 | 7.0 |
| PR 228 | 295 | 8.4 | TR 1406* | 300 | 7.0 |
| PR 253 | 300 | 8.4 | IRCI 6* | 300 | 6.8 |
| PR 247 | 300 | 8.3 | AVROS 1447* | 300 | 6.8 |
| | | | RRIC 48* | 300 | 6.5 |
| | | | PR 256* | 300 | 5.7 |
| | | | | | Mean 7.1 |

*Planted approximately 4 months later than the other clones in the table.

The growth of most clones at 3 to 3½ years of age is poor. It improves from the fourth year and the trees can generally be brought into tapping at 6½ to 7 years of age.

The girth data at 3½ years of age of the four clones planted on Dartonfield in 1956 are summarized below. This replanted area is very rocky and steep and is not representative of replanted areas in general.

**Small-Scale Clone Trial, 1956 Clearing, Dartonfield
Planted June 1956**

| Clone | No. of trees | Girth in inches Dec. 1959 |
|---------------|--------------|------------------------------|
| WR 101 ... | 275 | 10.7 |
| AVROS 385 ... | 294 | 10.4 |
| GT 1 ... | 295 | 9.9 |
| AVROS 427 ... | 286 | 9.2 |

4.8. 1957 and 1958 Replanting Programmes.—The last block of 17¼ acres on Hedigalla Station was planted in the North-East planting season of 1957, when 196 ten-tree clones, established from H.P. seedlings of the 1945, 1954, and 1955 crosses, were included in this clone trial, together with 25 ten-tree clones established from selected H.P. seedlings of LCB 870 crosses. The latter material will be tested for *Oidium* resistance and yielding capacity by the Plant Breeding Section. The growth measurements will be presented in a later report.

In 1957 and 1958 the main part of the planting programme was carried out on two commercial estates in the Kalutara district.

A collection of 38 foreign and local clones were planted out in 300-tree plots with several control plots of clone PB 86. Tree-to-tree plans of the planted areas were completed in 1959 and every 5th tree was permanently labelled with aluminium tags for growth measurements from year to year. The growth figures and a general description of the clones growing under local conditions, will be published in a separate report in 1960.

Owing to an unavoidable delay in acquiring the first of three 200-acre substations of old rubber land for the Institute in 1959, no replanting programme was carried out in the year under review. The experimental planting of new clones established from H.P. seedlings which have accumulated in the Institute's nurseries, will begin in 1960.

4.9. Export and Import of Planting Material in 1959.—The Botany Department has given the necessary attention to the export and import of the following consignments of budwood:

A total of 41 yards of budwood of IAN clones, which are resistant to *Dothidella ulei* and tolerant to *Phytophthora* diseases generally, were imported in five consignments in 1959 from the Firestone Plantations Company, Liberia and the Plant Introduction Station, Miami, Florida, U.S.A.

A total of 90 yards of budwood of FX, IAN, RRIC and Nab clones were exported in six consignments in 1959 to the U.S.A., Liberia, Malaya and Indochina.

5. CROWN BUDDING INVESTIGATIONS.

Large-scale crown budding investigations were initiated from 1945 to 1952, when the prospect of crown budding with clone LCB 870 which was found to be resistant to *Oidium* leaf disease, was thought to be a practical proposition. Clone LCB 870 was, subsequently, found to be very poor yielding and highly susceptible to leaf and bark diseases caused by *Phytophthora palmivora*.

Our experience of crown budding in the field, with the after-care of these budgrafts for about 6 months before the crowns are finally established, has shown that crown budding is not a practical proposition for carrying out on a commercial scale. Moreover, the susceptibility of clone LCB 870 to *Phytophthora* has ruled out the usefulness of this clone for crown budding in the wet low-country districts.

The results of our investigations are presented again in 1959 for their general interest.

Test tapping in the crown budding experiments will be discontinued from 1960, except for the large-scale crown budding experiment in the 1945 clearing at Hedigalla.

5.1. Large-Scale Clone Trial, 1952 Clearing, 35 Acres, Dartonfield:
Effects of Crown Budding on the Growth of Centre Sections.—One half of 200-tree plots in this large-scale clone trial was crown budded with clone LCB 870 at a height of 8 feet from ground level, after approximately two years' growth. Five clones were planted in this clone trial, namely, clones Nab 12, 15 and 20 and RRIM 501, with clone PB 86 as control.

The girth measurements, summarized in Table XI, indicate the set-back to trees after the crown budding operation in the field, up to 1959. The non crown-budded clones were tapped in April 1958 and the crown-budded clones in April 1959.

A comparison of the yields for the first 6 months of tapping in the crown-budded and non crown-budded clones indicate that crown budding at a height of 8 feet has not appreciably depressed the yields of the high-yielding centre sections. The comparison is, however, not accurate for further comment as several plots have been depleted of the full complement of trees due to the elimination of trees for building sites.

Test tapping in this experimental area will be discontinued in 1960, as part of the area has been earmarked for the path of transmission lines of the Department of Electrical Undertakings.

TABLE XI
Girth in Inches

| | Trees not crown budded | Trees crown budded | Girth differences |
|--|------------------------|--------------------|-------------------|
| Prior to crown budding at the end of 2nd year of growth | 6.4 | 6.3 | 0.1 |
| August 1955 | 10.9 | 7.6 | 3.3 |
| " 1956 | 14.6 | 10.3 | 4.3 |
| " 1957 | 18.4 | 14.3 | 4.1 |
| " 1958 | 20.8 | 17.4 | 3.4 |
| November 1959 | 24.0 | 20.7 | 3.3 |

5.2. Large-Scale Crown Budding Experiment, 1945 Clearing, 11 $\frac{3}{4}$ Acres, Hedigalla.—Three high-yielding clones, PB 86, Tjir 1 and Glen 1 and three comparatively low-yielding clones AVROS 256, PM 17 and Rub 393 have been used as budded centre sections and as budded crowns at heights of 5 feet or 8 feet from ground level.

The layout of the experiment is on a balanced "split-plot" arrangement with the main blocks replicated threefold. The smallest units are three-tree plots, which are used for comparing the effects of crown budding at the two heights of budding.

The yield results for 1959 are summarized in Table XII, which, incidentally, represents the experimental layout of a single main block.

TABLE XII
Crown Budding Experiment, 1945 Clearing, Hedigalla
Tapped S/2, d/2, 100%
Yield in grams per tree per tapping

| Budded centre section | Height of budding | Crowns | | | | | | Mean |
|-----------------------|-------------------|-------------|-------------|-------------|-------------|-------------|-------------|------|
| | | Tjir 1 | AVROS 256 | PB 86 | PM 17 | Glen 1 | Rub 393 | |
| Tjir 1 | 5 ft. | 49.2 | 33.9 | 39.1 | 23.5 | 42.6 | 30.4 | 36.4 |
| | 8 ft. | 38.9 | 28.8 | 48.5 | 28.2 | 41.3 | 26.7 | 35.4 |
| AVROS 256 | 5 ft. | 31.3 | 25.3 | 37.4 | 27.0 | 29.2 | 24.8 | 29.2 |
| | 8 ft. | 46.2 | 24.7 | 41.6 | 27.4 | 31.3 | 26.3 | 32.9 |
| PB 86 | 5 ft. | 39.6 | 33.7 | 54.6 | 27.8 | 39.1 | 32.4 | 37.9 |
| | 8 ft. | 43.0 | 35.3 | 50.3 | 30.7 | 43.3 | 31.2 | 38.9 |
| PM 17 | 5 ft. | 39.1 | 29.3 | 50.3 | 25.6 | 33.3 | 32.5 | 35.0 |
| | 8 ft. | 34.5 | 39.0 | 47.3 | 26.2 | 37.3 | 25.4 | 35.0 |
| Glen 1 | 5 ft. | 40.2 | 34.6 | 41.5 | 29.5 | 36.5 | 34.5 | 36.1 |
| | 8 ft. | 27.6 | 36.8 | 37.4 | 35.7 | 44.7 | 34.8 | 36.1 |
| Rub 393 | 5 ft. | 35.7 | 36.7 | 41.2 | 26.7 | 33.4 | 30.6 | 34.1 |
| | 8 ft. | 46.4 | 37.4 | 37.0 | 26.4 | 38.7 | 30.6 | 35.7 |
| Mean | | 39.2 | 33.0 | 43.7 | 27.9 | 37.6 | 30.0 | 35.2 |

The 1959 results again indicate no substantial differences in the yields of the budded centre-sections which are crown budded at a height of 5 feet and 8 feet.

The inherently high-yielding clones Tjir 1, PB 86 and Glen 1 used as crowns have improved the yields of the centre section of the low-yielding clones. Clone PB 86 is outstanding in this respect.

Twenty seven trees have been affected with Phytophthora Bark Rot in 1959.

6. LABORATORY AND MINOR FIELD INVESTIGATIONS.

Laboratory investigations have been somewhat restricted in 1959, while the transfer of the Botany Department to new quarters is still pending. This transfer will be completed in 1960.

A number of small investigations of practical interest have, however, been carried out by the Research Assistant under laboratory and greenhouse conditions under the supervision of the Botanist.

Reference is made to a few of these investigations in the following resumé of the work in 1959.

6.1. Early Flowering and Pod Set of Hevea.—In exploring the possibility of carrying out hand pollinations for breeding programmes as early as possible, one to two-year old budgrafts of clones FX 25, FX 2784 and RRIC 52 were bent down to a horizontal position and later ring barked for early flowering and pod set. The results were quite promising and were published in the Institute's 3rd Quarterly Journal 1959.

6.2. Rooting of Pueraria Cuttings with Growth-Promoting Substances.—This creeping legume which is used as a standard ground cover in young clearings is established by seed and rooted cuttings. Cuttings treated with b-Indolylbutyric acid at a dilution of 10 p.p.m. gave a substantial increase in rooting percentage over untreated cuttings. The experiment was carried out in sand culture under greenhouse conditions.

6.3. Effects of Crown Budding with the Low Yielding Clone LCB 870.—Tapping of crown budded trees, above and below the union of crown and centre section, at a height of approximately 8 feet, has given interesting results compared with downward tapping of non crown-budded trees of the same clone at the same height. Clone LCB 870 yields about 2 to 3 lb. d.r. per tree per year.

The cut on the low-yielding crown section was tapped upwards and the cut on the high-yielding centre section was tapped downwards, a few inches above and below the union situated at 8 feet. Suitable controls were introduced to determine the effect of the upward and downward tapping on the same tree.

Preliminary results for the first three months of experimental tapping are given below:

| Type of Tree | Method of Tapping | Average yield per tree per tapping in gms. | Yield in gms. per inch of cut |
|----------------------|--|--|-------------------------------|
| Non crown-budded ... | Downward from 8 ft. ... | 21.9 | 1.8 |
| Crown-budded | Upward above the union at 8 ft. on crown-section ... | 2.0 | 0.2 |
| | Downward below the union at 8 ft. on centre-section on the same tree ... | 9.6 | 0.8 |
| Crown-budded ... | Downward below the union at 8 ft. on centre-section ... | 9.8 | 0.9 |

The full results will be published in due course.

6.4. Epidermal Structure of Clones.—Investigations on laboratory methods of identifying clones have drawn our attention to studies of epidermal structures of the lower sides of leaves of various clones as a means of clone identification.

Samples of mature leaves of about $\frac{1}{2}$ inch diameter were treated for 24 hours with a 10 per cent solution of potassium hydroxide. The lower epidermis was then separated out with a scalpel. Pieces of the lower epidermis were treated for 5 minutes with a 1% solution of ferric chloride and mounted in water containing tannic acid. Drawings of the lower epidermis were made under the microscope with the aid of a camera lucida.

The drawings of the epidermal cells, with the distribution of the stomata, show an appreciable uniformity within each clone. Clones Tjir 1 and PB 86 were used for these preliminary studies. This work will be continued with leaves of high yielding clones.

REPORT OF THE PLANT BREEDING SECTION

By

W. E. MANIS

SUMMARY

The Plant Breeding Section has, perforce, during 1959 devoted much attention to pathological problems. The epiphytotic Phytophthora outbreak, the worst yet experienced in Ceylon, has made necessary changes in planning for future breeding projects. A new mechanical method for the control of Phytophthora on Hevea pods has been devised. A site for a future breeding station in Moneragala, a Phytophthora-free area, has been selected where actual Hevea breeding may be possible in 1964 or 1965 with top-budded crowns of various selected clones.

New additions have been made to the Institute's clone collection, notably the Dothidella-resistant second backcross and outcross clones from which flowers should be available as early as 1962 or 1963.

Flower inducement experiments are being continued. Flowers have been produced on one and a half-year old plants of one clone in nine months after treatment. Production of flowers, at present and for some years to come, will be a limiting factor in breeding for Dothidella resistance and for Phytophthora tolerance.

A permanent Oidium-testing station has been established at 1,400 feet elevation on Kepitigalla Estate, where 236 clones have been established for tests of Oidium resistance.

The 1959 hand-pollination programme was successful from the standpoint of fruit set but was a failure in terms of fruit harvested; Phytophthora being the cause of the failure. A total of 39,565 hand pollinations, representing 104 different crosses, were made during February, March and April. From these pollinations there were in the Nivitigalakele nurseries at the end of December, 335 seedlings representing 37 families.

DETAILED REPORT

Introduction

The first one and a half years of the Plant Breeding Section have been mainly exploratory. Only now with the experience of a complete breeding season, during which Hevea has been closely observed from the defoliation period, through the Oidium season, the flowering and fruiting seasons, an epiphytotic outbreak of Phytophthora, to the final seed harvest, can some evaluation be made of the factors that make Hevea breeding in South-West Ceylon a somewhat specialized plant science. It is at this juncture that one can confidently begin a programme with the assurance of eventually obtaining, in quantity, seeds from which future selections may be made.

To satisfy the requirements needed to obtain seeds from hand pollinations, two methods of approach have been deemed necessary. Both are pathological controls. In the Kalutara district, where the mean annual rainfall recorded on Dartonfield Group over the period 1955 to 1959 is 157.9 inches on Dartonfield, 159.2 inches on Nivitigalakele and 195.5 inches on Hedigalla, the fungous diseases referred to as Oidium, Gloeosporium and Phytophthora need be controlled. The first two diseases mentioned are amenable to control through the application of specific fungicides. The latter disease, Phytophthora, because of its ubiquity, its method of transmission, and the effective aid for its rapid development made possible by the water-retaining receptacle on top of the Hevea fruit, is more difficult to control. This fact was very much in evidence during the excessive rainfall of 1959. It should be noted here that effective commercial control for both Oidium and Phytophthora is unfortunately not adequate for the objectives of a hand-pollination programme. As a result of experience obtained in 1959 a practical and inexpensive polyethylene covering over the individual Phytophthora-susceptible fruit is the present answer. This, supplemented by fungicidal control, gives the necessary protection to bring the fruits, developed from our hand-pollination programme in the Kalutara district, through to maturity.

The other pathological control method which may be applied is that of location, *i.e.* the selection of a more favourable climatic environment for Hevea fruit development. With this object in view an area has been selected in a Phytophthora-free district for the establishment of a breeding station.

The Institute's breeding programme for the next few years is perforce limited to breeding for Oidium resistance and for general Hevea improvement. Only a relatively few of the Western Hemisphere Dothidella-resistant clones, now established in Ceylon, have been given a thorough test for Phytophthora tolerance. All the more recent clonal introductions do, however, have in their genetic make-up, genes from the *Hevea benthamiana* clone, F 4542, which is the contributor of Phytophthora tolerance as well as Dothidella resistance. In the next year all these clones will be established in a suitable environment for tests of their reaction to Phytophthora. Reliable readings for Ceylon conditions will not be available before 1962.

All these new introductions, except the most recent ones, are now in a test planting at high elevation on an estate where environment is ideal for the all the year round perpetuation of Oidium in an active state. Reliable readings from this test area should be obtained during 1961 and 1962.

Actual breeding with the Dothidella-resistant clones is a programme for the future. Flowers of some of the primary crosses and some of the first backcross and outcross clones may be available in 1961 or 1962. Flowers of the more important second backcross and outcross clones introduced this year are not likely to be available until 1962 or 1963.

1. GENERAL.

1.1. Staff.—The Plant Breeder was on duty during the year.

The Assistant Plant Breeder, Mr. D. M. Fernando, was on duty except for end-of-contract leave from 1st May to 1st August.

The Technical Assistant, Mr. C. Amaracone, continued to perform the clerical duties of the Section during this period.

Mr. W. D. Armon has been appointed as the first full time Field Attendant to the Plant Breeding Section.

The Plant Breeder addressed the University of Ceylon Botanical Society on "Hevea Species of the Amazon Basin, Their Contribution to Hevea Improvement" and the Sabaragamuwa District Planters' Association on "The Future Plans of the Institute's Hevea Breeding Programme."

2. CLONE ACQUISITIONS.

Budwood of the first lot (13) of the 26 Dothidella-resistant, second backcross and outcross clones, (BC₂), arranged for exchange between Brazil and Ceylon by the Director in 1957, was received in June. These clones, which originated in Brazil, were personally forwarded from London by the Director. They had been grown for a full year, under quarantine, at the U.S. Department of Agriculture, Plant Introduction Station, Miami, Florida. This introduction consisted of clones:

| | | | | |
|----------|----------|----------|----------|----------|
| IAN 6165 | IAN 6500 | IAN 6587 | IAN 6753 | IAN 6758 |
| 6166 | 6584 | 6640 | 6754 | |
| 6497 | 6586 | 6641 | 6757 | |

Budding success on this lot was 88%. Six to fifteen buddings of each clone were established.

A second lot of budwood consisting of 9 BC₂ clones was received in August. Budding success on this lot was 7%. Clones established at this time were: IAN 6645 (4 buddings) IAN 6756 (5 buddings) and IAN 6834 (3 buddings). This and the previous lot of budwood were supposedly given the same treatment and handling and no positive explanation for the poor condition of the latter shipment, on its arrival in Ceylon, is possible. Unaccompanied live plant material shipped by air, the only satisfactory means, is subject to a high degree of risk.

A third lot of budwood of BC₂ clones, duplicating one clone and replacing four out of the six clones lost in the second consignment, arrived in October. Final budding success was 70%. The following clones were established: IAN 6163 (3 plants), IAN 6167 (21 plants), IAN 6499 (6 plants), IAN 6585 (23 plants) and IAN 6645 (12 plants).

Up to date 20 out of the 26 Dothidella-resistant second backcross and outcross "exchange" clones have been established in the Nivitigalakele multiplication nurseries. Budwood for further multiplication and use in Phytophthora and Oidium trials will be available during 1960. Flowers for a regular breeding season, February-April, are not likely to be available until 1962 or 1963.

Two shipments of IAN first backcross clones, all on to PB 86, were received from the Firestone Plantations Company, Liberia. The first lot, budded five weeks after despatch, owing to delay in transit, surprisingly gave two successful buddings of clone IAN 2361. A second shipment arrived in December. The budding success of this lot was 56%. The clones, and the number of buddings of each, successfully established are: IAN 2321 (41), IAN 2322 (33), IAN 2328 (17), IAN 2363 (21), IAN 2900 (22). With these additions a total of 51 first backcross and outcross Dothidella-resistant clones are now present in Ceylon for Phytophthora and Oidium testing, for field trials, and for breeding work when flowers become available.

A local clone, Galapitamada 1, reputed to be resistant to Oidium, was added to the Institute's clone collection.

3. FLOWER INDUCEMENT.

(a) Budding on to young shoots sprouted from pollarded 24-year-old budded and seedling trees at Nivitigalakele, was started in February.

For the initial budding three Dothidella-resistant and Phytophthora-tolerant clones, fifteen Dothidella-resistant clones (12 of which are first backcrosses to PB 86) and PB 86 itself were used. This operation resulted in 66% success, which is considered satisfactory in view of the scepticism of the budders, the time of the year and the use of green budwood on green sprouts.

Subsequent buddings have been made throughout the year and there are now established new tops of the following clones:—

| | | |
|------------|----------|----------|
| PB 86 | IAN 2664 | IAN 2965 |
| FX 637 | IAN 2667 | IAN 3434 |
| FX 3810 | IAN 2668 | IAN 3762 |
| FX 3925 | IAN 2954 | IAN 3711 |
| IAN 45-717 | IAN 2958 | IAN 3714 |
| IAN 45-873 | IAN 2960 | IAN 3763 |

The earliest anticipated flowering from this type of material is approximately two and a half years and some usable flowers may be expected during the normal flowering season of 1962.

(b) A flower-inducement experiment was started in January with a limited number of one and a half year-old buddings of clones FX 516, FX 617 and F 4542. Twenty different treatments, involving various uses and combinations of ring barking, stem bending, lopping, root pruning, defoliating and spraying foliage (weekly with 3% glucose), were tried. For most treatments five plants of each clone were used. In October, nine months after treatment, fourteen plants, all of clone F 4542, were flowering. Of these, five were ringed with no other treatment, four were ringed, with stem bent and foliage sprayed with glucose, two were ringed and stem bent, two were ringed and completely defoliated and one was ringed and foliage sprayed with a 3% glucose solution.

None of the control buddings flowered.

4. NURSERIES.

The 1957 Twinned Seedling nursery has been used for the propagation of recently imported clones and the preparation of budded stumps for the Oidium testing station.

The 1958 Twinned Seedling nursery has had routine maintenance, as have had the seedlings derived from the 1956, 1957 and 1958 hand-pollination programmes. No twinned seedlings were made in 1959.

The 1959 H.P. seedling nursery of thirty seven different crosses has shown signs of *Helminthosporium* infection. The nursery has been manured and old coir dust has been obtained for mulching, with the objectives of controlling *Helminthosporium*.

Preliminary trials on seed germination under transparent polyethylene indicate that the use of this material has certain advantages over the standard practice of germinating seeds in sand. The time required for the preparation of germination beds and the laying out of the seed is greatly reduced. The mud-sealed cover can be lifted readily and all seed easily examined for the first signs of germination. The freshly germinated seed is removed daily for planting in nursery beds. There is no set back and root formation is generally better than in plants which are allowed to develop their lateral roots before transplanting. This trial is to be repeated using black polyethylene.

5. EXPERIMENTS ON R.R.I.C. STATIONS.

The Hedigalla field experiments transferred to this Section, have been given routine care by the Estate Department. Initial girth measurements have been taken in the 1955 Hedigalla clearing planted with the LCB 870 crosses, 744 seedlings and 5-point buddings of 10 clones. It is from this planting that selections have been made for inclusion in the Kepitigalla *Oidium* trials.

6. EXPERIMENTS ON COMMERCIAL ESTATES.

6.1. Kepitigalla Group.—The need for testing the *Dothidella*-resistant clones for their reaction to *Oidium* is obvious. The need for further testing of the earlier LCB 870 crosses is equally important.

Kepitigalla Estate, because of past experience by the Institute, was chosen as an ideal location for an *Oidium* testing area. The exact site is a steep hillside at 1,400 feet elevation adjoining an old *Oidium*-infested *Hevea* planting struggling to survive and which is a constant source of *Oidium* inoculum. This, with the combination of elevation, temperature and humidity, makes a desirable testing ground. The area selected for the *Oidium* trials is $2\frac{3}{4}$ acres in extent and approximately two acres are now in use.

Double planting rows, 3 ft. by 3 ft. staggered, are along contour terraces on the hillside. Row to row is approximately 10 feet. Since the sole purpose of this planting is to determine the *Oidium* resistance or susceptibility of the clones on trial, the close spacing was deliberately adopted.

Test clones are planted in five-tree plots, with two replications of each clone. Tjir 1, a clone highly susceptible to *Oidium*, is used as a control and is planted between each five-tree test plot. The main planting was done during the first two weeks of November. A few clones and controls, not ready at that time, have been added subsequently. There are now planted at Kepitigalla 236 test clones and the control clone making a total of 237 clones represented. The total number of plants is 2,849. In a few instances there were less than 10 buddings of trial clones available and, if deemed necessary, the shortage will be made good at the onset of the 1960 South-West Monsoon.

All plants, test and control, are being sprayed with wettable sulphur, 4% Thiovit. Until leaves of a developing flush have hardened to a point where they are past the susceptible stage for Oidium infection, the plants are sprayed twice weekly. The area will be kept under spray until three to four leaf storeys have been formed. Spraying will then be discontinued and Oidium allowed to come in. Following the 1962 Oidium season final reliable readings on the surviving clones can be made. In the interim new additions can be made, either to new planting rows or to rows or plots of clones which prove to be so susceptible to Oidium that they do not survive the first full year of testing.

The area and the system of planting fulfil the objectives of a permanent Oidium testing station.

The clones established in this testing station consist of the following:—

- (a) 15 clones with FX designation from primary crosses made on Ford Plantations, Brazil, in 1941–1942
- (b) 4 clones of IAN-45 designation from primary crosses made at Belterra, Brazil, in 1945
- (c) 46 clones with IAN designation from first backcrosses or outcrosses made at Belterra, Brazil, from 1949–1952
- (d) 116 clones made from LCB 870 primary crosses
- (e) 34 clones made from LCB 870 first backcrosses or outcrosses
- (f) 16 clones made from RRIC 52 primary crosses
- (g) 6 single clones, namely, F 4542, LCB 1320, RRIC 52, PB 86, Tjir 1 and Galapitamada 1.

6.2. Moneragala Group.—A block of five acres of a 1956 replanting with Tjir 1 clonal seedlings on Nakkala Estate, Moneragala was selected in December as the site of a future breeding station. The old seedling rubber trees, which had been poisoned, had not completely come down at the time of selection of the site. Before crown budding of the Tjir 1 seedlings, at 6 to 7 feet from the ground, could begin, the remaining old seedlings would have to be removed. Work on removing these hazards, to labourers as well as to potential top-budded trees, began immediately. The area is to be ready for crown budding with selected breeding clones in January 1960.

The choice of Moneragala for a breeding station would extend the breeding season, flowering of *Hevea* occurring in May and June, and reduce disease control, since *Phytophthora* is not present in the district. The particular site chosen is bordered on one side by a stream which is reported to have available water during the height of the dry season. Supplementary irrigation is, therefore, quite feasible and its use would have the advantage of accelerating the growth of the trees during the dry months. Once the area has been top-budded and growth of the crown is well advanced irrigation could be stopped. The effect would be drastic, and flower stimulation could be expected. Regular breeding work in this area will not be feasible for at least four years.

7. HAND POLLINATION PROGRAMME.

The final selection and the initial preparation of budded and of selected seedling trees to be used in the 1959 hand-pollination programme were made in January. Selections were based on yield, disease reaction (mainly Oidium), secondary characters and performance in past breeding programmes.

Actual pollinations began at Hedigalla on the 7th of February. Final pollinations were also completed at Hedigalla on the 27th of April.

The peak pollination period differed between stations. This difference may be attributed to the marked variability in localized conditions and in the amount and distribution of rainfall occurring from station to station within the same district.

Pollination procedures, as previously used at this Institute, were adopted at the beginning of the season. In mid-March, with the training of a new set of pollinators, a revision of pollination techniques was considered expedient. New methods, as well as adaptations of old ones, were incorporated into the instructions issued. Some of the changes made were the stopping of hand pollinations at 12.30 p.m., the selection of female flowers and the preparation of male inflorescences in the afternoon for the following morning's pollinations, the use of polyethylene bags for handling, transport and storing inflorescences for pollen usage and an improvement in the type of small equipment used.

Oidium has been an important factor contributing to a low percentage of successful pollinations in past years' programmes. Exploratory tests were set up to obtain preliminary evaluation of some fungicides available in Ceylon.

Fungicides tested for the control of Oidium infection on flowers, prior to, during time of, and subsequent to pollinations, were: Antimucin (organo-mercuric) 1%, Lime sulphur 3%, Karathane (Dinitro-phenol) 1% and 2% and Thiovit (wetttable sulphur) 2%, 3% and 4%.

A complete innovation of spray equipment was introduced. In previous years the "Flit" type hand sprayers were used. These were replaced with knapsack turbine mist blowers and pressure sprayers of two different sizes.

All trees on which hand pollinations were to be made, or from which male flowers were to be taken, were subject to the routine Estate sulphur dusting programme. That this treatment is not adequate for a successful hand-pollination project was evidenced by the few flowers that could be pollinated at Hedigalla on the control trees to which no supplementary Oidium control measures were applied.

A sticker and spreader were added to the fungicidal preparations. Applications were weekly. These supplementary Oidium control measures began the first week in February on all trees and continued until two weeks after final pollinations terminated on individual trees.

From these exploratory tests the indications are that of the four fungicides used, Karathane 2%, applied with a mist blower, was the most promising in controlling Oidium on flowers. Lime sulphur 3%, Thiovit 3% and 4% and Antimucin 1% gave satisfactory control on one or more trees and all were superior to controls.

Following the termination of the use of fungicides for Oidium control, spraying was continued but the fungicides, except for Antimucin, were changed. This "second stage" of the disease control programme was directed towards controlling Gloeosporium and Phytophthora. Fungicides used were: Antimucin (organo-mercuric) 1%, Dithane M-22 (manganous ethylene bisdithiocarbamate) 2%, Dithane Z-78 (zinc ethylene bisdithiocarbamate) 2%, Fermate (ferric dimethyl dithiocarbamate) 4% and Tillex (organo-mercuric) 1%.

By the end of April necrotic areas were observed on small fruits from early pollinations. Infected fruits were collected and regularly taken to the Pathology

Department for observation. *Gloeosporium alborubrum* was found to be the fungus responsible for the fruit losses, as distinct from fruit drop not caused by a pathogen, up to the first week in June. *Gloeosporium* caused heavier losses of fruits at Hedigalla than at Dartonfield or at Nivitigalakele.

A combined fruit census based on counts between (1) a rough field census in Hedigalla and the serialized census at Dartonfield and Nivitigalakele in early May and (2) another census in later May and in early June, gave the following percentages of fruit retained: Antimucin 1% on 12 trees—67% retention of fruit, Fermate 4% on 6 trees—72% retention of fruit, Aluminium Sulphate 5% on 9 trees—79% retention of fruit, Tillex 1% on 2 trees—84% retention of fruit, Dithane M-22 2% on 9 trees—90% retention of fruit and Dithane Z-78 2% on 4 trees—92% retention of fruit. No categorical conclusions as to *Gloeosporium* control are drawn from these results as too many uncontrolled factors are involved. The indications that Dithane, both Z-78 and M-22, was effective in controlling *Gloeosporium*, need further testing and it will be recommended for inclusion in the 1960 *Gloeosporium* control programme on hand-pollinated Hevea fruit.

Table I presents the daily rainfall in inches from February to August on the Hedigalla Station. A similar pattern obtains at Dartonfield and Nivitigalakele. It will be noted that rainfall did not interfere with *Oidium* control measures. Actual interference with spraying, as caused by rain, began in May. This was not, then, considered a serious handicap. By the end of May *Phytophthora* was appearing, building up for the unexpected epiphytotic outbreak which started off in the first week of June and continued uninterrupted through July. Not only were conditions ideal for the development and dissemination of *Phytophthora* but spraying procedures were proving to be ineffective, as determined by the *Phytophthora* infected pods collected, and fixed spraying schedules were disrupted.

The fruit was not drying. Attempts were made to artificially dry the fruit with a strong blast of air from the knapsack turbine mist blowers. The time element with this size turbine was, however, too great to be practical. The fungicides with the sticker used were not adhering to the waxy Hevea pods. The spraying schedule was changed in mid-June from weekly to twice weekly whenever possible regardless of any previously fixed schedule. Concentrations of some fungicides were doubled and instructions were given to cover fruit so that residual spray material could be seen on the fruit after spraying, with the hope that some fungicide might hold on despite constant washings by incessant rains. Fermate was replaced with Dithane M-22. The stipulations laid down for the original exploratory fungicidal trials were disregarded in an attempt to salvage some of the fruit. Antimucin at 2% on clone RRIC 52 at Hedigalla caused defoliation, some injury to branches and stimulated germination of seed in the pods. Aluminium Sulphate 5% when applied twice weekly caused defoliation but did not injure branches.

The naturally set fruits on the adjacent trees and on the trees having hand-pollinated fruits were removed. Losses continued up to the end of July. It was noted that infection and penetration of most fruits occurred on the top of the fruit where water was retained, because of the natural shape of the pod.

To assist the drying of fruits ready for bagging, the cotton knit bags, formerly used to prevent loss of seeds at time of dehiscence, were replaced with bags made of plastic screening which dried immediately, if drying was possible.

At Hedigalla all green hand-pollinated fruits remaining on the third of August were protected with an individual polyethylene covering. A six-inch disk of 0.004 gauge polyethylene was cut along a radius and this opening permitted the disk to

be centered on the fruit pedicle. The two edges of the radial cuts were then overlapped about three inches, thus forming a wide inverted cone. With a hand stapler the polyethylene was firmly fixed around the pedicle and the overlapped edges were stapled. From the time of applying these coverings until the final seed harvest, almost a month and a half later, the fruits were closely observed. Fungicidal sprays were continued but on a weekly basis. Only one green fruit was lost. Naturally-set fruits in nearby areas, not yet infected on the first of August, continued to become infected throughout the month. The protected fruits remained completely dry following heavy rains. Pedicles were not constricted. The polyethylene is soft enough to stretch, yet at the same time forms a tight seal. To prevent any possible recurrences of the disastrous results obtained during the 1959 season polyethylene coverings will be applied to all hand-pollinated fruit in 1960 before the *Phytophthora* season gets under way. This simple and inexpensive mechanical protection, if properly applied and supplemented by fungicidal control, should effectively protect the fruit from *Phytophthora* attack.

The results of the 1959 hand-pollination programme are shown in Table II. The clones used as male parents are RRIC 7, 13, 36, 41, 45, 51, 52, 74, 86; T 108, 170, 306, 327, 360, 792; Nab 20; BD 10; Ch 26 and LCB 1320.

The checking of fruits serialized in May is satisfactory considering the *Oidium* problem; subsequent checkings are not. The June to July losses on clone LCB 870 at Hedigalla and on the LCB 870 crosses, T trees, at Dartonfield, in spite of fungicidal control, is confirmatory evidence of the high susceptibility of LCB 870 and its first generation progeny to *Phytophthora*.

The low numbers of fruits set on trees of clones RRIC 36 and RRIC 74 at Hedigalla and on clone RRIC 41 at Nivitigalakele (Table II) are attributed to poor *Oidium* control. This was influenced by the closed-in location of the trees, and by the physical difficulties encountered in spraying at extreme heights.

The T trees at Dartonfield are favourably located and easily worked. Clones RRIC 52, RRIC 86, PB 86, Ch 26 and Nab 20 at Hedigalla also are favourably situated for most aspects of the hand-pollination work as they have an open Eastern exposure and low branches, factors definitely affecting results where the pathological problems exert a major influence.

TABLE I

Daily Rainfall distribution in inches from February to August 1959
at Hedigalla Station

| Day | February | March | April | May | June | July | August |
|------------|----------|-------|-------|-------|-------|-------|--------|
| 1 | 1.40 | — | 1.55 | .53 | 2.35 | — | .10 |
| 2 | .20 | — | — | .34 | 1.30 | .18 | .05 |
| 3 | .65 | — | .05 | .22 | .25 | .25 | — |
| 4 | .60 | — | 1.00 | .30 | .68 | .55 | — |
| 5 | 1.40 | — | 1.32 | 1.55 | .11 | .26 | .10 |
| 6 | — | — | .80 | .04 | .03 | .55 | 1.53 |
| 7 | — | — | 1.70 | .60 | 1.00 | .15 | .18 |
| 8 | .09 | — | .02 | 1.25 | 4.55 | .75 | 1.08 |
| 9 | .55 | — | .40 | .05 | 2.50 | .85 | .02 |
| 10 | — | — | .13 | 1.65 | 1.10 | .08 | .24 |
| 11 | — | — | — | .60 | .42 | .44 | .35 |
| 12 | — | — | — | .40 | .05 | .50 | .20 |
| 13 | — | — | .92 | 1.22 | .50 | 1.43 | — |
| 14 | 3.10 | 1.77 | — | .30 | .24 | .36 | .95 |
| 15 | — | .59 | 3.35 | .60 | .80 | 2.22 | — |
| 16 | — | .65 | — | .90 | 1.10 | 2.63 | .38 |
| 17 | — | 1.40 | .05 | .20 | 4.15 | .34 | .80 |
| 18 | — | .10 | .19 | .15 | 4.68 | — | — |
| 19 | .32 | .28 | 1.90 | 1.90 | 2.15 | .14 | — |
| 20 | 1.40 | — | .70 | .39 | .68 | .49 | .30 |
| 21 | — | .20 | .07 | — | .40 | .39 | .24 |
| 22 | — | 1.45 | .25 | .05 | 1.12 | .53 | .80 |
| 23 | .08 | 3.40 | — | .35 | .70 | .32 | 1.18 |
| 24 | — | — | — | .30 | .16 | — | 1.50 |
| 25 | — | — | — | .95 | .39 | — | .26 |
| 26 | — | — | 2.00 | .32 | .29 | — | — |
| 27 | — | .85 | .55 | .83 | .25 | — | .18 |
| 28 | — | — | — | .40 | .40 | — | .32 |
| 29 | — | — | .18 | .23 | .05 | .77 | 2.17 |
| 30 | — | .16 | 1.60 | 1.42 | — | .50 | 3.10 |
| 31 | — | .30 | — | .18 | — | .22 | — |
| Totals ... | 9.79 | 11.15 | 18.73 | 18.22 | 32.40 | 14.90 | 16.03 |

TABLE II
Results of the 1959 Hand-Pollination Programme

| Station | Cross | No. of pollinations made (Feb.-April) | No. of fruits formed (May) | No. of fruits harvested (Aug.-Sept.) | No. of seeds germinated and planted | No. of seedlings obtained (Dec.) |
|----------------|---------------------|---------------------------------------|----------------------------|--------------------------------------|-------------------------------------|----------------------------------|
| Hedigalla | RRIC 36 × 8 clones | 1,237 | 54 | 0 | 0 | 0 |
| | RRIC 52 × 7 clones | 5,951 | 280 | 27 | 35 | 23 |
| | RRIC 74 × 6 clones | 917 | 14 | 1 | 3 | 3 |
| | RRIC 86 × 3 clones | 1,092 | 72 | 14 | 32 | 24 |
| | Nab 20 × 3 clones | 295 | 52 | 14 | 40 | 39 |
| | Ch 26 × 4 clones | 338 | 47 | 44 | 91 | 86 |
| | PB 86 × 7 clones | 1,922 | 71 | 18 | 38 | 29 |
| | LCB 870 × 4 clones | 1,493 | 114 | 2 | 3 | 3 |
| | BD 10 × BD 10 | 132 | 0 | 0 | 0 | 0 |
| | Total | 13,377 | 704 | 120 | 242 | 207 |
| | Percentage | | 5.2% | 0.9% | Germn-75.4% | 64.5% |
| Darton-field | T. 16 × 3 clones | 2,220 | 39 | 10 | 13 | 11 |
| | T. 108 × 7 clones | 2,620 | 315 | 0 | 0 | 0 |
| | T. 170 × 3 clones | 1,665 | 217 | 0 | 0 | 0 |
| | T. 180 × 3 clones | 1,520 | 117 | 0 | 0 | 0 |
| | T. 290 × 5 clones | 1,618 | 143 | 0 | 0 | 0 |
| | T. 306 × 3 clones | 420 | 38 | 17 | 19 | 12 |
| | T. 327 × 3 clones | 2,365 | 25 | 12 | 15 | 11 |
| | T. 713 × 6 clones | 1,529 | 84 | 25 | 35 | 31 |
| | T. 792 × 3 clones | 1,007 | 59 | 0 | 0 | 0 |
| | Nab 20 × T. 170 | 388 | 64 | 0 | 0 | 0 |
| | PB 86 × Nab 20 | 2,313 | 124 | 19 | 13 | 11 |
| | Total | 17,665 | 1,225 | 83 | 95 | 76 |
| | Percentage | | 6.9% | 0.5% | Germn-55.9% | 44.7% |
| Nivitigalakele | RRIC 13 × T. 108 | 81 | 0 | 0 | 0 | 0 |
| | RRIC 41 × 6 clones | 748 | 6 | 2 | 5 | 5 |
| | RRIC 45 × 3 clones | 896 | 77 | 42 | 22 | 18 |
| | RRIC 51 × 7 clones | 4,545 | 188 | 2 | 3 | 3 |
| | LCB 1320 × 6 clones | 2,253 | 49 | 21 | 28 | 26 |
| | | Total | 8,523 | 320 | 67 | 58 |
| | Percentage | | 3.7% | 0.8% | Germn-63.0% | 56.5% |

REPORT OF THE PLANT PATHOLOGY DEPARTMENT

BY

ALFRED RIGGENBACH

SUMMARY

The Plant Pathologist was on overseas leave during the first half of 1959 and resumed duties on 22nd June.

The Assistant Plant Pathologist, Mr. O. S. Peries, acted for the Plant Pathologist during the latter's absence from the Island.

The general volume of work of the Department remained within the limits of that of the previous year.

Dry weather prevailed throughout most of the refoliation period of 1959. The climatic conditions did not favour the development of the fungus and the routine application of adequate control measures resulted in a comparatively mild incidence of the Oidium leaf disease in most rubber-growing districts. Outbreaks of the disease which occurred in a few isolated areas were effectively kept under control by regular rounds of sulphur dusting. Four field experiments for comparing two different methods of controlling the disease were carried out on four collaborating estates.

The electro-dusting method, tested in two experiments, did not show any improvement in the control of the Oidium disease over the normal dusting method. The spraying method tested in the other two experiments, gave interesting and promising results.

The incidence of Phytophthora leaf disease during the S.W. monsoon season of 1959 was the highest yet recorded in Ceylon.

The main factors responsible for the severe outbreak of Phytophthora diseases were the unusually severe and prolonged rainfall of the S.W. monsoon and the comparatively low prevailing temperature.

The rainfall recorded in the rubber-growing districts considerably exceeded the normal average, especially during June and July.

These weather conditions were most favourable for the development and spread of the Phytophthora fungus and the almost continuous rains interfered with the regular applications of control measures.

The incidence of Bark Rot or Black Stripe, caused by the same fungus, was also more severe than in previous years.

A number of field experiments, using different methods for the control of Phytophthora leaf disease, have been carried out by the Institute. The electro-dusting method failed to give any improved control compared with normal dusting but the spraying method, particularly with oil-based fungicides, gave very promising results. Small-scale experiments for the indirect control of Phytophthora diseases indicated the possibility of reducing fruit set by the use of certain chemicals which cause flower drop.

DETAILED REPORT

1. GENERAL.

1.1. Staff.—The Plant Pathologist was on overseas leave during the first half year 1959. He resumed duties on 22nd June.

The Assistant Plant Pathologist, Mr. O. S. Peries, acted for the Plant Pathologist during the latter's absence from the Island.

Mr. O. S. Peries was granted a scholarship under the Colombo Plan Technical Co-operation Scheme and left for England on 24th September for post-graduate studies at the University of Bristol.

Miss V. Sivapalan, M.Sc. (Madras), was appointed Research Assistant and assumed duties on 2nd November 1959.

Mr. H. L. Munasinghe, Senior Technical Assistant, Messrs. E. G. Mendis, M. Fernando and S. K. Samaraweera, Technical Assistants, were on duty throughout the year.

1.2. Correspondence.—The figures for 1958 and 1959 are as follows:—

| Correspondence | 1958 | 1959 |
|-------------------------|------|------|
| Incoming letters | 671 | 552 |
| Outgoing letters | 868 | 662 |

The volume of correspondence is somewhat smaller than in the previous year.

1.3. Visits.—The figures for 1958 and 1959 are as follows:—

| Visits carried out by: | Advisory | | In connexion with RRIC Experiments | |
|------------------------------------|----------|------|------------------------------------|------|
| | 1958 | 1959 | 1958 | 1959 |
| Plant Pathologist | 18 | 32 | 29 | 14 |
| Assistant Plant Pathologist | 37 | 16 | 66 | 37 |
| Total | 55 | 48 | 95 | 51 |

The Plant Pathologist and the Assistant Plant Pathologist paid altogether 89 visits (150 in 1958) to different estates. Forty eight of these visits (55 in 1958) were in connexion with pathological problems on estates and on smallholdings. In each case a report, containing observations and recommendations, was sent to the estate or agency concerned.

Fifty one visits (95 in 1958) were made in connexion with field experiments.

1.4. Visitors.—There were, as usual, a large number of visitors to the Department during the year. These visits almost invariably lead to demonstrations and discussions on the occurrence and control of diseases, on the use of new fungicides and on general topics of Hevea diseases and laboratory work.

1.5. Publications.—The Plant Pathologist contributed the following article to the Institute's 1st Quarterly Journal, March 1959:—

“Antimucin—A New Water-Miscible Fungicide for the Control of Black Stripe”

The Assistant Plant Pathologist contributed the article:—

“Studies on the Production of Toxins by *Fomes lignosus*. I. Preliminary Investigations”

and a note on the Storage of Sulphur Dust to the Institute's 2nd Quarterly Journal, June 1959.

2. LABORATORY WORK.

2.1. Diseased Specimens.—Altogether 52 specimens (65 in 1958) were received in the Plant Pathology Department for examination and report.

The study of these diseased specimens in the laboratory necessitated, in most cases, the growing of the causal fungi in culture for definite diagnosis of the disease.

The various diseases, pests, or other causes of damage found on these specimens are listed in the following table:—

| Identification of Diseases, Pests and Other Causes of Damage | No. of cases |
|--|--------------|
| 1. On <i>Hevea brasiliensis</i> : | |
| (a) <i>Fungi or bacteria</i> : | |
| <i>Botryodiplodia theobromae</i> | 6 |
| <i>Corticium salmonicolor</i> | 2 |
| <i>Fomes lignosus</i> | 5 |
| <i>Fomes noxius</i> | 2 |
| <i>Gloeosporium alborubrum</i> | 7 |
| <i>Helminthosporium heveae</i> | 1 |
| <i>Hypocrella reineckiana</i> | 1 |
| <i>Oidium heveae</i> | 7 |
| <i>Phytophthora palmivora</i> | 18 |
| <i>Ustulina zonata</i> | — |
| (b) <i>Pests and other causes</i> : | |
| Mites and various Insects | 10 |
| Scale Insects | 1 |
| Lightning Damage | — |
| Sun Damage | 4 |
| Water Damage | — |
| Wind Damage | — |
| Other causes | 9 |
| 2. On Cover Plants: | |
| (a) <i>Fungi or bacteria</i> : | |
| <i>Synchytrium ovalifolium</i> | — |
| (b) <i>Pests and other causes</i> : | |
| Insects | 2 |

3. LEAF DISEASES.

3.1. Oidium leaf disease.

3.1.1. General.—The incidence of the Oidium leaf disease, caused by the fungus *Oidium heveae*, during the 1959 refoliation season was mild in most districts and many estates reported a complete absence of the disease.

Wintering was, in general, rather late and defoliation and refoliation were, in most areas, fairly rapid. The weather conditions were dry and unfavourable for the development of the fungus and this, together with the routine use of adequate control measures, resulted in a mild or, in some cases, a negligible incidence of the disease.

°Only in very few cases, where the wintering and refoliation season was long drawn out and control measures were inadequate, was there a fairly severe outbreak of the disease.

3.1.2. Field Experiments.—Four field experiments, each on a different estate, covering a total area of 110 acres, were carried out during the Oidium season of 1959.

3.1.2.1. Electro-dusting experiments.—The electro-dusting methods operate according to the principles of electrostatics. In the delivery duct of the dusting machine the dust cloud passes through a high electrostatic field. During the passage of the dust each single dust particle acquires a positive electrostatic charge which induces an equal but opposite charge on the leaves. The positive dust particles are thus drawn to the negatively charged leaves.

Electro-dusting was carried out with the Mistral Agricola Electro-duster, a normal Mistral II AB duster fitted with the Agricola Electro-dusting device.

The experiments did not show any significant advantage of the electro-dusting method over the normal dusting method. In one experiment the leaf-fall counts in the electro-dusted area and in the normal dusted area were practically the same; in the other experiment the leaf fall figures for the electro-dusted area were even slightly higher than those for the normal dusted area.

One reason for the failure of the electro-dusting method to give better results than the normal dusting method is that efficiency of electro-dusting depends on the distance the dust particles have to travel and on the humidity of the air. The longer the distance and the higher the humidity of the air, the faster the dust particles lose their acquired electric charge.

3.1.2.2. Spraying experiments.—These experiments were designed to compare spraying with dusting. The Mistral III AB power spraying machine was used in the experiments. This power sprayer consists in principle of a normal Mistral II AB duster fitted with a spray tank, delivery tube and spray nozzle. It is a dual purpose machine as the basic unit can be used as a normal dusting machine.

The depth of coverage obtainable with the spraying machine was about 2 rows of trees in square planted areas and it was therefore necessary to carry the machine along every other inter row.

The experiments showed that, provided adequate coverage of the foliage is obtained, the control of Oidium leaf disease by the spraying method, using a wettable

sulphur formulation, is as good as, or even better than, the normal dusting method using sulphur dust. The results obtained are quite encouraging and the experiments will be repeated during the next Oidium season before a final assessment of the spraying method can be made.

3.1.3. Field Surveys.—An Oidium survey was carried out on all the clones represented in a Dartonfield 1953 replanted area of one acre, in the Hedigalla 1952 clearing (clone PR 107 crown-budded with *Dothidella*-resistant clones) and in the Nivitigalakele budwood nurseries of imported clones.

Unfortunately, due to the mild incidence of Oidium, this survey did not yield the expected results.

3.2. Phytophthora leaf disease.

3.2.1. General.—The incidence of the Phytophthora leaf disease, caused by the fungus *Phytophthora palmivora*, during the S.W. monsoon season of 1959 was the most severe recorded in Ceylon.

The main factors responsible for this severe outbreak of the leaf disease were the adverse weather conditions experienced. The monsoon was of an unexpected and unusual severity and brought heavy and almost continuous rain. The rainfall recorded in the rubber-growing districts considerably exceeded the normal average, particularly in June and July.

Furthermore, heavy rainfall was recorded in rubber planting districts which normally experience little rain in July. For example, rainfall figures for Dartonfield Station and an estate in the Kegalle district were as follows:—

| | | 1958 | | 1959 | |
|----------------------------|-----|-------|------|-------|-------|
| | | June | July | June | July |
| Dartonfield | ... | 18.33 | 4.96 | 28.30 | 12.79 |
| Estate in Kegalle district | ... | 13.41 | 2.83 | 19.59 | 16.78 |

The very wet and comparatively cool weather conditions were very favourable for the development and spread of the Phytophthora leaf disease and interfered with the regular application of dusting rounds. Control measures which, in former years had given good results under average monsoonal weather conditions, failed to give the same measure of protection under the abnormally wet weather conditions experienced in 1959, particularly in cases where the Institute's recommendations were not strictly followed on Estates.

3.2.2. Field Experiments.—Three field experiments, each on a different estate, covering a total area of 94 acres, were carried out to compare the electro-dusting and the spraying method with the normal dusting method. During the refoliation and flowering periods some small-scale experiments, for the indirect control of the Phytophthora leaf disease by causing artificial flower drop, were also carried out.

3.2.2.1. Electro-dusting experiments.—Electro-dusting was carried out with the Mistral Agricola Electro-duster, the same machine used in the electro-dusting experiments during the Oidium season.

The results obtained from these experiments were similar to those obtained in 1958. The electro-dusting method once again failed to give any improved results

compared with the normal dusting method. Leaf fall in the electro-dusted and the normal dusted areas was practically the same.

• The electro-dusting method based on electrostatic principles is impaired by high relative humidity of the air. The method works best the drier the leaves and the lower the humidity of the air, conditions hardly ever obtainable during the Phytophthora season.

3.2.2.2. Spraying experiments.—The spraying experiments were carried out with the Mistral III AB sprayer. Different water soluble and oil-based spray formulations of copper fungicides were used.

The results obtained with these different sprays were most promising but before the technique can be recommended to estates the results have to be confirmed in further experiments to be carried out during the Phytophthora season of 1960.

3.2.2.3. Indirect Control.—During the refoliation and flowering season of 1959 some small-scale field experiments for the indirect control of the Phytophthora leaf disease were carried out. As the Phytophthora inoculum usually builds up on trees or areas which bear a heavy fruit set an attempt was made to reduce fruiting by spray application of certain chemicals which cause flower drop.

The experiments yielded promising results as, by timely application of these chemicals, it was possible to reduce the setting of fruits. The experiments, however, also showed the danger in the application of these solutions which, above a certain level of concentration, destroy not only the flowers but also the young tender leaves. Unfortunately, the margin between the safe concentration causing flower drop and the critical concentration causing leaf damage is a very narrow one.

These experiments will be repeated during the 1960 refoliation and flowering seasons in an attempt to devise a reasonably safe technique for commercial application.

4. BARK DISEASES.

4.1. Black Stripe disease.

• **4.1.1. General.**—The prolonged wet weather favourable for the Phytophthora leaf disease also favoured the development of the Phytophthora bark disease. The incidence of Bark Rot was severe in many areas, especially on susceptible clones on estates where, for reasons of economy, the recommendations issued by the Institute were not carried out in their entirety.

Borer attack was reported from several estates. These boring beetles, belonging to the genus *Xyleborus*, were found to invade dead bark or wood tissue in advanced stages of bark canker, especially of the tapping panel.

4.1.2. Laboratory and Field Experiments.—The shortage of Assistant Staff, and the absence of both the Plant Pathologist and the Assistant Plant Pathologist for part of the year set a limit to the number of field and laboratory experiments which could be carried out during the year.

A number of commercial products received at the Institute were tested for their suitability as water-miscible or waterproof fungicides.

Of the materials tested in the laboratory as water-miscible fungicides only one, an organo-mercury compound, gave results comparable to those of Antimucin. The material has, however, to be tested further in field experiments to assess its value as a fungicide for the control of Bark Rot.

Three other products tested in the laboratory proved to be inferior to Antimucin.

None of the materials tested as waterproof fungicides came up to the standard of Kankerdood.

5. ROOT DISEASES.

5.1. White Root Disease, *Fomes lignosus*.—Favourable reports were received from several estates regarding the use of Tillex for the control of the White Root disease of rubber, caused by *Fomes lignosus*.

The data revealed that, on the average, about 80% of 2 to 4-year-old budded plants which are infected with *Fomes lignosus* can be saved provided the Tillex treatment is carried out at the first signs of infection.

6. FIELD EXPERIMENTS.

6.1. Dartonfield 1 acre, 1953 Replanted area.—This area is planted with mixed local and foreign clones for tests of *Oidium* resistance and for small-scale field trials.

The trees were pollarded early in the year to facilitate observations on the new foliage.

REPORT OF THE SOILS DEPARTMENT

By

A. J. JEEVARATNAM

SUMMARY

The Department continued to be under the charge of the Assistant Soils Chemist, who acted as Soils Chemist during the period under review. A Research Assistant was appointed to the Department in November 1959.

The Acting Soils Chemist was away for a period of five weeks commencing from 11th November 1959 visiting the Rubber Research Institutes of Malaya and South Vietnam and some of the plantations for the purpose of studying the application of the technique of "Diagnostic Physiologique" for determining fertilizer requirements of Hevea. The technique will be tried out under Ceylon conditions in 1960.

Manuring recommendations for Hevea in Ceylon are now based on soil distinctions and the Advisory Circular on manuring has been revised on this basis.

In addition to manuring with inorganic fertilizers, the need for emphasizing the importance of increasing the organic matter content of soils has been realised on the results of the analytical work done on soils. For this purpose, the practice of cultivating Guatemala grass between rows of rubber plants and using the grass loppings for mulching around the base of the rubber plants or along clean weeded strips has been studied and is now recommended by this Institute.

The inclusion of magnesium, in the form of magnesium sulphate, in NPK fertilizer mixtures is now recommended on a wider scale.

An increase in the incidence of magnesium deficiency, which was recorded towards the end of 1958, was again recorded towards the end of 1959. Though on mature plantings the appearance of these symptoms may be considered as a precursor to wintering, the incidence of this deficiency, particularly on young replantings of PB 86, has been severe enough to cause defoliation in certain areas. The remedial measures that have been recommended include the use of low potash fertilizer mixtures, except in areas diagnosed as particularly deficient in potash, and the addition of magnesium to all NPK fertilizer mixtures used on immature rubber.

Further, with a view to determining the correct ratio of potassium to magnesium in the nutrition of Hevea in relation to different cultivation practices, a $3 \times 3 \times 3$ field experiment with forty-tree plots has been laid down on a collaborating estate in the Kegalle District. The cultivation practices included for study are no mulching, mulching with Pueraria and mulching with Guatemala grass.

The effect of magnesium, added to NPK fertilizers, on the growth of Hevea plants in seedling nurseries forms the basis of an experiment laid down in a nursery at one of the Institute's Stations.

A large volume of analytical determinations has been done on one thousand soil samples collected, during the preliminary soil survey of the rubber-growing districts, from both estates and smallholdings.

Other laboratory investigations pertained to the analysis of Hevea leaf samples for advisory purposes, analysis of bark samples from Hevea trees, and determination of aluminium content in some of the aerial parts of Hevea and cover crop plants.

An unusual investigation carried out by the Department was to determine the chemical composition of dates, at the request of the Ministry of Commerce and Trade, in order to assess their manurial value. It was found that dates can only be a poor source of nutrients even if the practical difficulties of applying them as manure are overcome.

A total of fifteen field experiments were in progress in 1959, of which three were new experiments commenced during the period under review.

The nature of responses obtained in the manurial trials varied from place to place. Phosphorus continued to give a significant response in the experiment at Hedigalla. The $3 \times 3 \times 3$ NPK experiment on Paiyagalla estate showed a significant linear response to potassium and a significant quadratic response to phosphorus, with significant NP and PK interactions.

Of the $4 \times 4 \times 4$ experiments, the one on Halpe estate, which is reported, showed a significant response only to nitrogen. Another experiment (not reported) showed significant responses to nitrogen, phosphorus and potassium.

The varied nature of the responses recorded serve to indicate the undesirability of making general fertilizer recommendations on the basis of results obtained from field experiments.

The Advisory Service, based on analysis of leaf and soil samples, was availed of by a greater number of estates than was the case in 1958.

Requests for advice on weedkilling were on the increase during the period under review.

DETAILED REPORT

1. GENERAL.

1.1. Staff.—Mr. A. J. Jeevaratnam, the Assistant Soils Chemist, acted as Head of the Department during the year.

Miss R. Abdul Cader, B.Sc. Hons. (Ceylon) was appointed as Research Assistant to the Soils Department with effect from 2nd November 1959.

Mr. H. A. Seemon Singho was promoted to the grade of Technical Assistant with effect from 10th March 1959.

Mr. S. D. Jayaweera resigned his post as Field Assistant on 5th July 1959.

Messrs. G. P. G. Chootandasa and O. M. W. Tillekeratne reverted to their substantial posts in the Smallholdings Department on 17th May and 16th January 1959 respectively.

The following officers were on duty throughout the year:—

| | | |
|-------------------------|-----|----------------------------|
| Mr. T. Kanthasamy | ... | Senior Technical Assistant |
| Mr. A. K. Gunadasa | ... | } Technical Assistants |
| „ E. R. Chelliah | ... | |
| „ D. J. M. Samarasinghe | ... | |
| Mr. M. Abeyasinghe | ... | Field Assistant |
| Mr. K. S. A. C. Peiris | ... | } Field Attendants |
| „ R. M. B. Ranasinghe | ... | |
| •• Mr. B. A. Perera | ... | Laboratory Attendant |

1.2. Correspondence.

| | | | <i>Inward</i> | | <i>Outward</i> |
|-----------|-----|-------|---------------|-----|----------------|
| General | ... | ... | 119 | ... | 76 |
| Technical | ... | ... | 263 | ... | 256 |
| | | Total | 382 | ... | 332 |

1.3. Visits.

| | | | | |
|--------------------------------------|-----|-----|-----|----|
| Advisory | ... | ... | ... | 19 |
| Field experiments on outside estates | | | ... | 35 |
| Experiments on R.R.I. Stations | ... | ... | ... | 7 |
| Miscellaneous | ... | ... | ... | 11 |

1.4. Meetings.—The Acting Soils Chemist, as Committee Member of Section B of the Ceylon Association for the Advancement of Science, attended two Committee Meetings held at Peradeniya.

The Acting Soils Chemist also attended the Annual Field Day of the Smallholdings Department held at Kalutara on 20th June and addressed the gathering on “Composting and Related Subjects with particular reference to Smallholdings”. Two conferences, one on Fertilizers convened by the Planning Committee, Ministry of Industries and Fisheries on the 10th September 1959 and the other on the International Fertilizer Pool convened by the Department of Commerce on 6th October 1959 were attended by the Acting Soils Chemist.

The Acting Soils Chemist also attended two meetings of the Kalutara District Planters' Association.

1.5. Publications.—The Advisory Circular on manuring was completely revised and issued as Advisory Circular No. 66.

An article entitled “A Note on Guatemala Grass as Mulch for Rubber Plants”, prepared by the Director and the Acting Soils Chemist, was published in the Institute's Second Quarterly Journal for 1959.

Two answers in Question Corner of the 2nd and 3rd Quarterly Journals for 1959 dealt with particular aspects of Cover Crops and Manuring.

2. LABORATORY WORK.

The major volume of the laboratory work was done in connexion with investigations on the following subjects:—

The Advisory Service based on soil and plant analysis.

Investigations on nutrient deficiencies.

Analysis of 120 bark samples from a field experiment.

Analysis on about 1,000 soil samples collected in connexion with a soil survey of smallholdings, and the preliminary soil survey of the rubber-growing districts.

Investigations on the aluminium content of some of the vegetative parts of Hevea and cover crop plants.

2.1. Advisory Service based on Soil and Plant Analysis.—This advisory service was availed of by nineteen estates and by two colonization schemes under the Ministry of Lands and Land Development.

Most of the requests made were in connexion with the unsatisfactory growth of rubber plants in clearings due either to incorrect manuring or to magnesium deficiency.

2.2. Investigations of Nutrient Deficiencies.—Several instances of deficiency investigated were found to be due to lack of magnesium. There was one instance of potassium deficiency.

2.2.1. Zinc Deficiency.—Further instances of suspected zinc deficiency were noted by the Director on young plants on two estates in the Moneragala District.

Another instance of deficiency, reported in the Kalutara District, was also suspected to be due to a deficiency of zinc.

Analyses of healthy and deficient leaves and of whole plants did not show wide differences in zinc contents. Some of the deficient plants were sprayed with a solution of zinc sulphate, but results were inconclusive, since the deficiency was only of a transient nature.

2.2.2. Magnesium Deficiency.—Preliminary investigations carried out to study the efficiency of applying magnesium sulphate as a spray, as against pocketing, indicated that there was no advantage of spraying. The leaves showing the deficiency symptoms continued to show these symptoms until wintering.

2.3. Investigations of Nutrient Supply and Uptake under Field Conditions.—In one of the 4 × 4 × 4 experiments in progress in the K.V. District, some of the plants in treatments receiving low potassium showed potassium deficiency symptoms on the leaves and a terminal shoot die-back. Analysis of leaves from some of the treatments receiving no potassium confirmed that the potassium content in the leaves was below normal.

2.4. Clonal Variations in Nutrient Content.

2.4.1. Nutrient Content of the Leaves of Clones PB 86 and Glen 1.—Analysis reported in 1958 showed significant differences in nitrogen and magnesium contents of leaves, based on the standard error of ten separate samples of each clone. The potassium determinations on the same samples carried out in 1959 showed no significant differences in the potassium content.

| <i>Clone</i> | <i>Potassium Content as % Dry Matter</i> |
|---------------|--|
| PB 86 | 1.07 |
| Glen 1 | 1.09 |

2.5. Bark Analysis.—Following a report from the Rubber Research Institute of Malaya that bark analysis is almost as satisfactory as leaf analysis in studying responses to phosphorus and to potassium, 120 bark samples from individual trees on one block of the O, P, PK, NP and NPK plots of a 5 × 5 Latin Square experiment on three clones, namely, PB 86, LCB 870, AVROS 255, and on PB 86 top-budded with LCB 870, were analysed for N, P, K, Ca and Mg.

The levels of the different mineral elements were of the same magnitude reported by the R.R.I. of Malaya. Indications are that the findings in Malaya, that bark composition offers a means of detecting responses to fertilizers containing phosphate and potassium, will be confirmed. A full statistical evaluation of the results will be reported separately.

2.6. Soil Analysis.—Analytical work continued unabated on the 600 soil samples collected in connexion with the soil survey of rubber smallholdings, done in collaboration with the Smallholdings Department of the Institute, and the 400 soil samples collected during preliminary surveys over the rubber-growing districts of Ceylon and in connexion with advisory work.

Determinations of moisture, pH, gravel percentage (fraction above 2 mm.), organic carbon and total nitrogen have been completed on all the samples. Mechanical composition has been completed on 700 samples, whereas P and K in HCl extract has been completed on 400 samples. Few of the samples have been analysed for exchange capacity, total exchangeable cations, exchangeable calcium and exchangeable magnesium.

2.7. Investigations of the Aluminium Content of Aerial parts of Hevea and Cover Crop Plants.—Preliminary investigations were carried out to determine the aluminium content of some of the aerial organs of Hevea and Cover Crop plants, as it was suggested by the London Advisory Committee for Rubber Research (Ceylon and Malaya) that the phenomenon of aluminium accumulation in certain plants may have a bearing on plant nutrition. Some of the results obtained by using the Alizarin Red S method are reported in Table I.

TABLE I

Aluminium Content expressed in p.p.m.

| Plant | No. of samples | Leaves | Stems and leaves |
|--|----------------|----------|------------------|
| Mikania scandens | 5 | 291 ± 66 | 187 ± 49 |
| Pueraria phaseoloides | 5 | 361 ± 64 | 392 ± 74 |
| Tripsacum laxum (Guatemala grass) | 5 | 53 ± 26 | 66 ± 72 |
| Hevea brasiliensis seedlings | 5 | 171 ± 32 | — |
| Clone LCB 870 | 5 | 280 ± 36 | — |

Variation between different samples from the same plant is very high. Guatemala grass (*Tripsacum laxum*) has a very much lower aluminium content than the other plants examined.

The determination of aluminium by the modification of the Aluminon method using the Ammonium Salt of Aurintricarboxylic acid was also attempted. The values obtained by the latter method were slightly lower than the values obtained by the Alizarin Red S method.

2.8. Miscellaneous Analysis.—Early in the year the Ministry of Commerce and Trade requested that an investigation be carried out on the manurial content of dates, and on its suitability as a manure on rubber estates.

Analytical results on dates carried out are reported in Table II.

TABLE II

Nutrient Content of Dates, as a percentage of fresh weight

| | N% | P% | K% | Ca% | Mg%.. |
|----------------|------|------|------|------|-------|
| Date Seeds ... | 0.75 | 0.11 | 0.47 | 0.07 | 0.06 |
| Date Pulp ... | 0.27 | 0.06 | 0.72 | 0.10 | 0.05 |

The results show that dates do not have a high manurial value in terms of the mineral nutrients determined. For this reason, and because of other practical drawbacks in using them as manure, the Ministry was informed that dates could not be considered as suitable material for use as manure on rubber estates.

3. FIELD EXPERIMENTS.

A total of fifteen field experiments were in progress during 1959, of which three were new experiments commenced during the period under review. The experiments are made up of nine manurial trials, three miscellaneous trials and three cover crop-cum-manurial experiments. Two of the cover crop-cum-manurial experiments are reported under section 5.

3.1. Manurial Trials.

3.1.1. Hedigalla, O, P, NP, PK and NPK Trial, 13½ Acres, 1952 Clearing, Manurial/Clone Trial.—The plants that had attained tapping girth (*i.e.* 18" at a height of three feet from the union for experimental purposes) were brought into tapping from June, 1959. The manurial treatments in this experiment were changed from the beginning of 1959, according to the original plan of the experiment in which the five treatments were to be applied on a Latin Square basis up to tapping and on a Graeco-Latin Square basis thereafter. Manurial applications in 1959 were made according to the new treatments.

Girth measurements taken in July 1959 are reported in Table III.

TABLE III

Hedigalla 1959

Average Girth in Inches

| | Block 1 | Block 2 | Block 3 | Block 4 | Block 5 |
|-----|---------|----------|----------|----------|----------|
| O | 16.3 | NP 20.4 | PK 19.5 | P 19.6 | NPK 21.3 |
| PK | 19.4 | NPK 20.9 | P 19.6 | NP 19.7 | O 17.4 |
| NP | 20.4 | PK 19.3 | NPK 20.1 | O 13.7 | P 19.9 |
| NPK | 20.9 | P 19.2 | O 15.8 | PK 19.9 | NP 20.6 |
| P | 20.6 | O 16.7 | NP 20.9 | NPK 21.0 | PK 20.0 |

Treatment Mean:

| | | |
|-----|------|-------|
| O | 16.0 | |
| P | 19.8 | 23.8% |
| PK | 19.6 | |
| NP | 20.4 | 3.0% |
| NPK | 20.8 | 5.0% |

Significant difference between treatment means=0.828.

Yield.

Out of a total of 2,000 plants, only 1,300 had attained tappable girth at commencement of tapping. The highest percentage of untappable trees was from the control plots and from the crown-budded areas.

Five test tappings were done during the latter half of 1959 but, of the trees opened for tapping, 398 trees were affected with Bark Rot on which no tapping was done and 146 trees were partially affected on which all five test tappings could not be carried out. Due to the fragmentary nature of the yield results recorded, no attempt is made at this stage to evaluate the yield figures statistically.

3.1.2. 3 × 3 × 3 NPK Trial.—Paiyagalla Estate, April 1955 Replanting.

Experiment commenced in September 1956.

Routine manuring was carried out in this experiment. Girth measurements taken in June 1959 are reported in Table IV.

TABLE IV

Paiyagalla 1959

Girths in Inches

| | | A | | | | B | | | |
|----------------|----------------|----------------|----------------|----------------|--------|----------------|----------------|----------------|--------|
| | | K ₀ | K ₁ | K ₂ | | K ₀ | K ₁ | K ₂ | |
| N ₀ | P ₀ | 13.00 | 12.65 | 14.38 | 40.03 | 12.23 | 12.27 | 12.05 | 35.55 |
| | P ₁ | 13.45 | 13.89 | 13.70 | 41.04 | 12.70 | 14.03 | 13.58 | 40.31 |
| | P ₂ | 12.55 | 13.83 | 13.30 | 39.68 | 12.98 | 14.31 | 13.95 | 41.24 |
| | | 39.00 | 40.37 | 41.38 | 120.75 | 36.91 | 40.61 | 39.58 | 117.10 |
| N ₁ | P ₀ | 13.53 | 13.98 | 13.20 | 40.71 | 12.27 | 13.40 | 12.60 | 38.27 |
| | P ₁ | 13.58 | 13.14 | 14.18 | 40.90 | 14.14 | 13.69 | 13.23 | 41.06 |
| | P ₂ | 12.13 | 13.77 | 13.70 | 39.60 | 12.70 | 12.90 | 15.09 | 40.69 |
| | | 39.24 | 40.89 | 41.08 | 121.21 | 39.11 | 39.99 | 40.92 | 120.02 |
| N ₂ | P ₀ | 11.98 | 13.53 | 13.78 | 39.29 | 12.26 | 14.86 | 12.68 | 39.80 |
| | P ₁ | 14.00 | 14.35 | 14.19 | 42.54 | 13.55 | 13.25 | 14.36 | 41.16 |
| | P ₂ | 12.25 | 13.10 | 14.23 | 39.58 | 13.18 | 14.13 | 13.05 | 40.36 |
| | | 38.23 | 40.98 | 42.20 | 120.41 | 38.99 | 42.24 | 40.09 | 121.32 |
| | Block | 1 | 122.17 | | | Block | 4 | 120.86 | |
| | | 2 | 124.06 | | | | 5 | 118.92 | |
| | | 3 | 117.14 | | | | 6 | 118.66 | |
| | Total | | 363.37 | | | Total | | 358.44 | |

The analysis of the results of the experiment on Block A showed a significant linear response to potassium and a significant quadratic response to phosphorus, with significant NP and PK interactions. This trend was also noticeable on the results of the experiment on Block B.

As mentioned in previous reports, the results have to be interpreted with caution since complete randomization has not been adhered to in this experiment.

3.1.3. 4 × 4 × 4 NPK Manurial Trials.—The five NPK trials of this design on different collaborating estates have been continued. Girth figures taken in 1959 have been analysed. The girth figures for 1959 in respect of the experiment on Halpe estate, which was reported on last year, are shown in Table V.

TABLE V
Halpe 4 × 4 × 4 Experiment
1959—Girths in Inches

| | | N ₀ | N ₁ | N ₂ | N ₃ | K Totals |
|----------------|----------------|----------------|----------------|----------------|----------------|----------|
| P ₀ | K ₀ | 4.68 | 5.29 | 5.21 | 6.00 | 21.18 |
| | K ₁ | 5.45 | 5.11 | 4.98 | 5.55 | 21.09 |
| | K ₂ | 4.81 | 4.93 | 5.95 | 5.78 | 21.47 |
| | K ₃ | 5.63 | 5.72 | 6.28 | 5.14 | 22.77 |
| | N Totals | 20.57 | 21.05 | 22.42 | 22.47 | 86.51 |
| P ₁ | K ₀ | 5.20 | 5.18 | 4.50 | 4.44 | 19.32 |
| | K ₁ | 5.23 | 6.03 | 4.81 | 5.61 | 21.68 |
| | K ₂ | 5.78 | 6.18 | 5.16 | 5.78 | 22.90 |
| | K ₃ | 5.10 | 4.59 | 5.13 | 6.04 | 20.86 |
| | N Totals | 21.31 | 21.98 | 19.60 | 21.87 | 84.76 |
| P ₂ | K ₀ | 4.43 | 5.63 | 4.97 | 6.03 | 21.06 |
| | K ₁ | 4.75 | 4.50 | 5.56 | 5.89 | 20.70 |
| | K ₂ | 5.31 | 5.56 | 5.50 | 5.93 | 22.30 |
| | K ₃ | 5.06 | 5.08 | 5.89 | 5.30 | 21.33 |
| | N Totals | 19.55 | 20.77 | 21.92 | 23.15 | 85.39 |
| P ₃ | K ₀ | 4.75 | 5.50 | 5.20 | 5.81 | 21.26 |
| | K ₁ | 5.38 | 6.14 | 5.54 | 5.05 | 22.11 |
| | K ₂ | 4.55 | 6.33 | 5.70 | 5.67 | 22.25 |
| | K ₃ | 4.72 | 5.69 | 5.97 | 5.29 | 21.67 |
| | N Totals | 19.40 | 23.66 | 22.41 | 21.80 | 87.29 |

Girth Analysis.

It was originally hoped to carry out the analysis of variance on the mean girths per plot. But in practice the number of plants in every plot could not always be maintained at ten, due to the fact that supplies had to be put in and as a result of disease infection. Therefore the procedure adopted was to correct for differences in the number of plants per plot by the method of analysis of covariance.

The steps in the analysis were as follows:—

1. Analysis of covariance of total girth and number of plants.

2. Adjusted analysis of variance of tree girths on the basis of the regression obtained in (1) above.
3. The 'F' test for treatment effects from the adjusted variance as usual.
4. The treatment totals (*i.e.* total girths per plot) adjusted on the basis of the regression.
5. After the adjusted analysis of variance the linear, quadratic and cubic components have been tested.

Results.

Nitrogen.—There is a significant response to nitrogen (N).

Only the linear component is significant, *i.e.* after the first level of application the response to additional doses is negligible.

The quadratic parabola which best fits the data is as follows:—

$$Y_e = 100.85 + 6.85x - 1.25x^2$$

(where Y_e is the expected yield at a particular level x of nitrogen)

| | | | Mean girth | Observed % | Expected % |
|-------|-----|-----|------------|---------------|---------------|
| N_0 | ... | ... | 5.03 | 100 | 100.85 |
| N_1 | ... | ... | 5.48 | 109 | 106.45 |
| N_2 | ... | ... | 5.41 | 107 | 109.55 |
| N_3 | ... | ... | 5.60 | 111 | 110.15 |

Phosphoric acid.—There is no significant response to phosphorus (P) (*vide* comments on N × P interaction for the importance of P).

| | | | Tree girth | Observed % |
|-------|-----|-----|------------|---------------|
| P_0 | ... | ... | 5.43 | 100 |
| P_1 | ... | ... | 5.29 | 98 |
| P_2 | ... | ... | 5.34 | 98 |
| P_3 | ... | ... | 5.45 | 100 |

Potash.—There is no significant response to potassium (K).

Interactions.

The interactions N × K and P × K are not significant.

The N × P interaction is significant with the general indications as follows:—

In the absence of N, P at higher levels appears to have a depressing effect and in the presence of N this depressing effect of P is corrected. Therefore the application of N corrects a possible depressing effect of higher levels of P.

Mean Girths

| | | P_0 | P_1 | P_2 | P_3 |
|----------|------|-------|-------|-------|-------|
| At N_0 | Mean | 5.19 | 5.33 | 4.81 | 4.82 |
| | % | 100 | 103 | 93 | 93 |
| At N_1 | Mean | 5.26 | 5.46 | 5.25 | 5.98 |
| | % | 100 | 104 | 100 | 114 |
| At N_2 | Mean | 5.66 | 4.91 | 5.48 | 5.60 |
| | % | 100 | 87 | 97 | 99 |
| At N_3 | Mean | 5.62 | 5.50 | 5.85 | 5.43 |
| | % | 100 | 98 | 104 | 97 |

Summary of findings.

1. There is a significant response to nitrogen at the first level of application. Further increases in dosage did not show any improvement.
2. There was no response to phosphorus.
3. There was no response to potassium.
4. The significant interaction between N and P indicates that nitrogen helps to correct a possible depressing effect of higher levels of phosphorus.

The results of the other $4 \times 4 \times 4$ experiments are not reported here. It is hoped that the results of all the $4 \times 4 \times 4$ experiments, at the end of the third year from the time of commencement of the experiment, will be examined statistically and published separately in due course.

3.1.4. Experiment to investigate the effect of High and Low Potash Mixtures.—R 4:6:2, R 4:6:3, R 4:6:5 and R 4:6:8 mixtures are being tested on six clones in a clone trial area of an August 1958 replanting of an estate in the Kalutara District.

No manurial applications were given in the planting hole. The first manurial application was in December 1958. Four manurial applications for 1959 were given according to schedule.

The girth measurements taken in January 1959 are reported in Table VI.

TABLE VI

Eladuwa 1959

Girths in Inches

| Block | Clone | Treatment | | | | Mean for each clone |
|-------------------------|----------|-----------|---------|---------|---------|---------------------|
| | | R 4:6:2 | R 4:6:3 | R 4:6:5 | R 4:6:8 | |
| 1 | PB 86 | 3.49 | 3.63 | 3.65 | 3.63 | 3.60 |
| 2 | GT 1 | 3.99 | 3.98 | 4.32 | 4.20 | 4.12 |
| 3 | RRIC 28 | 4.31 | 4.16 | 4.45 | 4.18 | 4.28 |
| 4 | RRIC 45 | 4.20 | 4.14 | 3.87 | 4.09 | 4.08 |
| 5 | IRCI 2 | 4.24 | 4.36 | 4.30 | 4.36 | 4.32 |
| 6 | RRIM 605 | 3.80 | 3.69 | 3.83 | 3.80 | 3.80 |
| Mean for each treatment | | 4.02 | 3.99 | 4.07 | 4.04 | |

No statistical evaluation of the girth figures is attempted, since the measurements at the end of one year's growth cannot be expected to reflect treatment differences with any degree of accuracy.

3.1.5. $2 \times 2 \times 2$ NPK Experiment (without the Nil Level).—The first level in this experiment is equivalent to the dosage of R 4:6:2 + Mg now recommended by the Institute.

Planting Material: Tjir 1 Seedlings
Date of Planting: November 1958
Planting hole application: Nil
Plot size: Effective plot size is 40 plants with additional plants along boundary rows.

Three manurial applications were given in 1959. No girth measurements were taken in 1959, as the growth of the seedlings was not considered sufficiently advanced for measurements to be taken.

3.2. Miscellaneous Field Experiments.

3.2.1. Hedigalla, 13½ acres, 1952 Clearing, Clonal/Spacing Trial.—With the change in designation of the Agronomy Department to that of Soils Department, it was agreed that investigations of this nature come within the province of the Botany Department. On the instructions of the Botanist the area was not brought into tapping in 1959. This experiment will be reported by the Botany Department in future.

3.2.2. Proprietary Fertilizer Comparison Trial—Rayigam Estate.—The experiment in the 1955 replanting was terminated at the commencement of the year since the results obtained from it could be of only little use, due to the fact that a number of plants in the experiment have been slashed by unknown persons.

The experiment in the 1957 replanting was continued with one alteration. Since the Rumanca Complex Fertilizers do not contain any magnesium, each of a pair of "Ortil" and "PKN" treatments were given additional magnesium so that a stricter comparison may be made with the R 4:6:5 and R 4:6:2 treatments which were being tested with and without magnesium.

Girth figures taken prior to the application of fertilizers according to the altered treatments are reported in Table VII.

TABLE VII

Rayigam 1959

| Fertilizer Mixture | Girths in inches | Proprietary Fertilizer | Girths in inches |
|--------------------|------------------|------------------------|------------------|
| Usual dosage | | Usual dosage | |
| R 215 | 4.70 | Ortil | 4.90 |
| R 215 + Mg | 5.27 | Ortil | 5.30 |
| R 4:6:5 | 5.28 | PKN | 4.89 |
| R 4:6:5 + Mg | 5.38 | PKN | 5.10 |
| Double dosage | | Double dosage | |
| R 215 | 4.90 | Ortil | 5.05 |
| R 215 + Mg | 4.50 | Ortil | 5.23 |
| R 4:6:5 | 5.75 | PKN | 4.50 |
| R 4:6:5 + Mg | 5.23 | PKN | 4.11 |

The Rumanca Complex Fertilizers have not proved superior to the inorganic fertilizer mixtures in any way.

3.2.3. Nursery Manurial Trial.—Seedling nurseries, Nivitigalakele, 5 Acre Nursery. This is a 2 × 2 × 2 NPK trial with and without magnesium making a total of 16 treatments. There are four blocks of 16 plots each. Each plot consists of ten plants, with additional plants along guard rows. The experiment was laid down in a nursery planted in September 1958.

Previous manuring. At the time of levelling of beds a dressing with 3:1 mixture of rock phosphate and dolomitic lime was given at the rate of 4 cwt. per acre. Then in December 1958 Black Label Animal Meal was given at the rate of $\frac{1}{2}$ oz. per plant.

Rate of fertilizer application:

| | | |
|----|---------------------|-----------------------------|
| N | Sulphate of Ammonia | $\frac{1}{2}$ oz. per plant |
| P | Saphos phosphate | $\frac{1}{2}$ oz. per plant |
| K | Muriate of Potash | $\frac{1}{6}$ oz. per plant |
| Mg | Magnesium Sulphate | $\frac{1}{6}$ oz. per plant |

Applications were given at intervals of three months commencing in April 1959.

The diameter of the plants at a height of 3 inches from the base were taken with a caliper before the commencement of the experiment and in December 1959.

The average increase in the diameter of the plants in inches from the time of commencement of the experiment is reported in Table VIII.

TABLE VIII

Increase in diameter of plants in inches

| Treatments | Without Magnesium | With Magnesium |
|------------|-------------------|----------------|
| Control | 0.52 | 0.56 |
| N | 0.49 | 0.60 |
| P | 0.59 | 0.54 |
| K | 0.54 | 0.63 |
| NP | 0.57 | 0.60 |
| PK | 0.63 | 0.62 |
| NK | 0.64 | 0.54 |

It is considered premature to comment on the early results of this experiment.

3.3. Manurial-cum-Cover Crop Experiments.

3.3.1. $3 \times 3 \times 3$ K, Mg, Cultivation treatments Experiment.—Parambe Group, 2 Replications.

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

K levels 0, 1, 2. Level 1 is equivalent to K in R 4:6:3
Mg levels 0, 1, 2. Level 1 is equivalent to Mg in R 4:6:3 + Mg

Cultivation treatments:

- 0 — Cover Crop (*Pueraria phaseoloides*) and no mulching.
- 1 — Cover Crop (*Pueraria phaseoloides*) and mulching with *Pueraria*.
- 2 — Cover Crop (*Pueraria* and *Tripsacum laxum*) and mulching with *Tripsacum*.

Planting Material: PB 86 budded stumps.

Date of Planting: May 1959.

Planting hole application: Nil.

Plot size: 40 stumps.

Only two manurial applications and one round of mulching were done in 1959. The main purpose of this experiment is to determine the optimum levels of potassium and magnesium for clone PB 86 when manured with nitrogen and phosphorus, and in relation to mulching.

4. SOIL SURVEY.

Since recommendations for fertilizer applications, as contained in the latest Advisory Circular on manuring, are based on soil distinctions, six estates requested that a soil survey of a reconnaissance nature be carried out on their replantings in order to determine the fertilizer mixtures to be applied. These estates were surveyed and recommendations made.

Soil samples were collected from estates, colonization schemes and smallholdings visited in connexion with advisory work, the analytical results of which should serve a useful purpose if and when the project of soil survey of the rubber-growing districts is taken up again.

Some work was done on the detailed survey of the area covered by the one-inch Alutgama Topographical Sheet, but progress on this work was slow and had to be terminated when the Field Assistant engaged for this work relinquished duties in July 1959.

5. COVER CROP INVESTIGATIONS.

5.1. Rhizobial Strains for Nitrogen Fixation in Leguminous Cover Crops.—Twenty-seven cultures of rhizobial strains QA 548 and QA 549 were issued to five estates on request.

5.2. Manurial.

5.2.1. Effect of Inoculation on *Pueraria phaseoloides* in the presence and absence of added Phosphorus and Magnesium.—A preliminary trial to investigate the effect of inoculation with rhizobial strains QA 548 and QA 549 in the presence and absence of added phosphorus and magnesium (as Saphos phosphate and dolomitic lime) was laid down on area that was replanted from Tea into Rubber.

5.2.2. Deficiency Symptoms.—An instance of yellowing of the young leaves in an otherwise healthy stand of *Pueraria phaseoloides* was brought to the notice of the Institute.

Analysis of leaf samples from healthy plants and others showing deficiency symptoms indicated that there may be a case of temporary nitrogen deficiency in relation to the high amounts of potassium released at the time of the decomposition of the old rubber plants that had been allowed to rot '*in situ*'.

5.3. Survey of existing Cover Crops.

5.3.1. Guatemala Grass (*Tripsacum laxum*).—The results reported under this heading in 1958 showed that Guatemala grass is low in calcium and magnesium content. In view of this very low mineral status, the London Advisory Committee for Rubber Research (Ceylon & Malaya) suggested that this should be checked again. This was done in 1959 and the values for calcium and magnesium obtained this year are reported in Table IX.

TABLE IX

Tripsacum laxum. Ca and Mg contents in whole plant
(i.e. leaves and culms)

| Year | No. of samples | Ca% | | Mg% | |
|------|----------------|-----------|-------|-----------|-------|
| | | \bar{x} | S.E. | \bar{x} | S.E. |
| 1958 | 5 | 0.172 | 0.024 | 0.223 | 0.016 |
| 1959 | 5 | 0.215 | 0.029 | 0.163 | 0.022 |

5.3.2. Siamese Weed (*Eupatorium odoratum*).—This weed, which is now found on many rubber estates, is known locally by various names such as “Podisingho maram”, “Gas loka palu” and “val kollang”. The aerial portions slashed before flowering have been used in some cases as a mulch along rubber tree rows.

The aerial portions, i.e. the whole plant minus the roots, were analysed for nutrient content and the results obtained are compared with those for *Tripsacum laxum* in Table X.

TABLE X

Nutrient content of *Eupatorium odoratum*

| | No. of samples | N | | P | | K | | Ca | | Mg | |
|----------------------------|----------------|-----------|-------|-----------|-------|-----------|-------|-----------|-------|-----------|-------|
| | | \bar{x} | S.E. | \bar{x} | S.E. | \bar{x} | S.E. | \bar{x} | S.E. | \bar{x} | S.E. |
| <i>Tripsacum laxum</i> | 5 | 0.73 | 0.049 | 0.071 | 0.013 | 1.690 | 0.282 | 0.172 | 0.024 | 0.223 | 0.016 |
| <i>Eupatorium odoratum</i> | 5 | 3.69 | 0.121 | 0.169 | 0.007 | 2.860 | 0.067 | 1.140 | 0.013 | 0.506 | 0.017 |

N.B.—Nutrient content expressed as a percentage on the oven dry basis.

5.4. Field Experiment on Cover Crops.—The experiment, started in the Gallawatta 1957 clearing, to study the effects of different legumes and common weeds and fertilizer applications of phosphate, in the presence and absence of nitrogen and potassium, on the growth of young rubber was in progress in 1959.

Owing to the small size of the plots in this experiment, viz., the area covered by ten rubber plants and the diverse nature of the cover plants under trial, great practical difficulty was encountered in maintaining a pure stand of the covers.

6. WEEDKILLING.

Requests for advice on the control of “illuk” or “lalang” and *Eupatorium odoratum* have been on the increase. No fresh weedkilling trials were initiated during the period under review.

REPORT OF THE CHEMISTRY DEPARTMENT

By

K. F. HEINISCH

SUMMARY

The main emphasis, apart from the usual advisory correspondence, visits and the experimental work involved therein, has been on the continuation of the experimental work on the subject of the limitation of contamination with copper, mainly of scraps, when dusting formulations are used to control defoliation caused by *Phytophthora palmivora*, and on the determination of dirt content of Ceylon rubber with a view to conformity to a possible future specification.

Preliminary investigations have been carried out into the type of mould that usually grow on sheet and crepe rubber. Other experiments were mainly concerned with problems of coagulation or prevention of pre-coagulation in the field. It has already been emphasized that the d.r.c. determination by the Metrolac can only be considered as an approximate figure owing to different factors which influence the determination, and that deviations up to 10% of the true rubber content may be expected.

One of the reasons for the instability of latex seems to be the use of coconut shells as latex cups and a significant difference between the quality of latex collected in coconut shells and that collected in aluminium cups has been established.

A simple method, using bromo cresol green indicator paper, has been proposed for improved control of latex coagulation in estate factories.

The quality of sheet and crepe rubber has been improved in several cases by using formic acid in place of acetic acid for latex coagulation.

Investigations into the cause of discolouration of bleached crepe have shown iron compounds to be the main cause of the discolouration. Oxalic acid as coagulant improves the colour and the colour-holding properties of the crepe. It has been further observed that, under certain conditions, oxalic acid produces a better colour of the bleached crepe in the absence rather than in the presence of sodium bisulphite. An appreciable number of estates have been visited during the year to offer advice regarding various problems on the manufacture of smoked sheet, pale crepe and sole crepe, the prevention of pre-coagulation in the field, the construction of crepe drying towers and on the disposal of factory effluents. Work on the R.R.S. milling output rates of a 5-roller Guthrie sheeting mill, with reference to the nature of the coagulum, the depth of latex in the coagulating tank and the r.p.m. of the individual rollers, was completed. A considerable part of the Department's time was taken up with the re-arrangement and testing of certain equipment belonging to the laboratories and the technological section. The layout of the laboratories was slightly altered and thereby some 570 square feet of additional laboratory space have been obtained.

DETAILED REPORT

1. GENERAL

1.1. Staff.—The Department consisted of the Rubber Chemist, Dr. K. F. Heinisch, the Research Assistant, Mr. M. Nadarajah, the Senior Technical Assistant, Mr. D. S. Muthukuda, three Technical Assistants, Messrs. M. T. Veerabangsa, G. G. Gnanasegaram and O. M. R. Sirisena, and four Minor Staff Officers. Seven to fourteen labourers of the Estate Department have been made available, as and when required.

On a recommendation by the Director of the Institute the Rubber Chemist was elected to the Associateship of the Institution of the Rubber Industry (A.I.R.I.) in view of his numerous publications on various aspects of rubber manufacture.

The Research Assistant resumed work on 2.6.59 after a successful course of study for the M.Sc. degree under a Colombo Plan scholarship at the University of Birmingham. He was also awarded the Associateship of the Royal Institute of Chemistry (A.R.I.C.).

During his stay in the U.K. the Research Assistant spent five weeks, in April and May 1959 at the laboratories of the British Rubber Producers' Research Association. Besides visiting the various sections and obtaining information on the activities of this research organization the greater part of his time has been devoted to studying the gelling of latex with zinc oxide in the presence of different fatty acids and to the investigation into curing systems with sulphur and T.M.T.D. mixtures and with sulphur and T.M.T.M. mixtures.

An examination for the Association of the Institution of the Rubber Industry was held for the first time at the Institute from 15th to 19th June. The Acting Director and the Rubber Chemist acted as invigilators.

1.2. Advisory Services, Correspondence, etc.—The volume of the advisory work was much greater than in the previous year and a large part of the time of the officers of the Department was occupied with visits, correspondence, preparation of reports and with preliminary tests or trials carried out in the factory in connexion with the advisory services provided by the Department. The table below gives a summary of much of the data relevant to this subsection:

| | |
|---|-------|
| (a) Unsolicited samples, etc. submitted for report or test | 53 |
| (b) Rubber samples collected at Dartonfield Group in connexion with fungicide contamination experiments | 1,721 |
| (c) Rubber samples collected from estates and through the intermediary of Packing Houses for dirt content determination | 817 |
| (d) Correspondence incoming | 470 |
| (e) Correspondence outgoing | 433 |
| (f) Visitors to the Department | 59 |
| (g) Visits by the staff of the Department | 117 |
| (details below) | |

| | R.R.I.C. Estates | Other Estates | Other Visits | Total |
|----------------------------|---------------------|------------------|-----------------|-------|
| Rubber Chemist | 8 | 50 | 35 | 93 |
| Research Assistant | — | 1 | — | 1 |
| Senior Technical Assistant | 6 | 15 | — | 21 |
| Technical Assistants | — | — | 2 | 2 |

Advisory visits normally required the preparation of a detailed report on many aspects of the process followed.

1.3. Publications, etc.—The publications of the Institute issued during the period under review, and to which members of the Department have contributed, included the following:—

- (1) Annual Report 1958.
- (2) Influence of the Factory Water on the Quality of Rubber. (Quart. Journal **35** (1959) 32-37).
- (3) The Discolouration of Bleached Crepe Rubber. (Quart. Journal **35** (1959) 80-85.)
- (4) Rubber has changed the Face of Civilization, publ. in "Times of Ceylon" 13th July 1959.
- (5) A Note on a Simple Method of Control of Latex Coagulation. (Quart. Journal **35** (1959) 56-57).
- (6) Three short replies on the following subjects for inclusion in the "Question Corner" of the Institute's Journal:
 - Prevention of Rust on Sheet
 - Deformation of Rubber Bales
 - Elimination of Mould Infections in Drying Sheds.
- (7) A leaflet on "Comparison between a 4-roller and a 5-roller Guthrie Sheet-ing Mill".

1.4. Miscellaneous.—The staff of the Department spent an appreciable amount of time on re-arrangement and testing of instruments, apparatus and machines belonging to the laboratories and the technological section. One room of the laboratory has been equipped with a dehumidifier and is used as a special instrument and balance room. Due to a change in the layout of the laboratory, by combining two small rooms to a new instrument room and the conversion of a verandah, about 570 square feet of additional laboratory space have been obtained. This extension was urgently needed for chromatographic analysis, wet digestion and for storage of sensitive instruments. The purchase of the new oil-fired boiler has been finalised and its erection will commence in 1960. The Gas plant of the Institute, which has been in continuous use for about 25 years and which recently suffered several breakdowns due to corrosion has been replaced by a new Aerogen Plant. An additional portable gas plant has also been acquired solely for use in the technological section which is not connected to the main gas plant.

The laboratory has been further equipped with a Photoelectric colorimeter, a microscope and four drying ovens. The stock of chemicals and glassware has been increased. Two instruments had to be sent to England for repairs while two others were repaired locally.

Corrosion of sensitive parts of instruments has been found to be a very serious problem and the use of an effective corrosion inhibitor (Shell V.P.I. anti-corrosion powder) has been introduced. In the experience of the Rubber Chemist, this V.P.I. anti-corrosion powder provides a very satisfactory protection not only to metal parts of sensitive instruments but also to optical systems (lenses, objectives, oculars, etc.) which are often subjected to the attack of a fungus growing on the glass parts and etching its replica into the glass.

At the request of the Department of Agriculture some work on the spectrophotometric determination of the mercury content of various samples of paddy treated with mercury-based fungicides was undertaken by the Department.

Dr. G. F. Bloomfield, Senior Principal Scientist, Grade I, of the B.R.P.R.A., was a guest of the Institute from the 20th to 27th of April and visited several estates accompanied by the Rubber Chemist. Acknowledgment is made to Dr. Bloomfield and to the Technical Officers of the British Rubber Producers' Research Association for valuable advice, comments and suggestions on chemical and technological matters in connexion with the Department's work.

Various samples and photographs were prepared by the Department on special request for an exhibition held at New Delhi (India).

2. LATEX.

2.1. Approximate Determination of the d.r.c. of Fresh Latex.—Despite the number of references made on this subject in earlier publications, there have been a limited number of enquiries concerning the means of avoiding discrepancies between calculated and actual factory output. In one case this discrepancy was considerable and was mainly due to the fact that the metrolac did not give a correct reading in most of the incoming latices, which were found to be too thick and unstable, and that the defect was further aggravated by the deliberate non-addition of an anticoagulant to the latex in the field by the tappers. Under the circumstances the estate concerned estimated the dry poundage of the latex brought in by each tapper purely on the basis of a "guess figure" of $3\frac{1}{2}$ lb. per gallon.

In this connexion it must again be emphasized that the d.r.c. determined by Metrolac can only be regarded as an approximate figure owing to different factors which influence the determination and that deviation up to about 10% of the true rubber content may be observed.

It has been noted on several occasions, during estate visits, that the reading is made immediately after the insertion of the metrolac in the latex. It must be remembered that the metrolac moves quite slowly in the latex according to the viscosity of the undiluted or diluted latex and the instrument may, under certain conditions, take as much as several minutes to adjust itself. A rough surface of the instrument caused by either corrosion or adhering rubber coagulum, or froth on the latex surface, or the angle of reading, will influence the results. Fine air bubbles, occurring in the latex by shaking, stirring and pouring, affect the density of the latex and, consequently, the true reading of the metrolac. Compared with these factors, variations of the density of latex due to the composition of latex of different clones, on different estates and at different seasons of the year are of minor importance.

The metrolac reading cannot, therefore, be relied upon to give an accurate determination of the d.r.c. of the latex and it is necessary to occasionally determine the error on each Division or Estate by trial coagulation of latex and to make a correction accordingly.

In cases of flocculated (thickened) or pre-coagulated latex the metrolac cannot be used because of the large error involved and trial coagulation procedures must be adopted.

2.2. Precoagulation.—A considerable number of enquiries have been received on premature coagulation and, in some cases, visits had to be paid to the

estates concerned in order to examine in detail the extent of pre-coagulation, with particular reference to the type of clone and the measures adopted to overcome the difficulty. In most cases it has been observed that difficulties regarding pre-coagulation were mainly due to the fact that either no anticoagulant at all or the minimum amount was used in each field throughout the estate, whereas the extent of pre-coagulation between fields had varied to a marked degree. This procedure would be satisfactory in fields where the incidence of pre-coagulation is low but in fields where pre-coagulation is predominant, the addition of the normal dosage of anticoagulant, as prescribed in the relevant advisory circular, would not be quite effective and should be increased accordingly.

In cases of discolourations of bleached crepe rubber we have advised against the use of ammonia as an anticoagulant and have suggested the use of sodium sulphite or soda ash or a mixture of soda ash and formalin.

Factories using tiled receiving, bulking or coagulating tanks have been advised to disinfect these tanks at regular intervals, once or twice a month, with a $\frac{1}{2}$ per cent solution of formalin or some other suitable disinfectant, such as Izal, Lysol etc., in order to prevent the building up of bacteria, mainly in the lining between the tiles, which may, under certain conditions, cause pre-coagulation or fermentation of the coagulum.

One of the reasons for the instability of latex and premature pre-coagulation under Ceylon conditions seems to be the use of coconut shells as latex cups, especially when they have been in use for a long time. Coconut shells have a comparatively rough surface with microscopic pores and dry much more slowly than aluminium cups, favouring the development of bacteria which infect the latex and cause instability. In preliminary trials it has been found that a significant difference in quality exists between latex collected in coconut shells and that collected in aluminium cups, showing an average value of the microfloculate of 0.069% for aluminium cups and 0.117% for coconut shells. Also the content of volatile fatty acid is a little higher in latex collected in coconut shells than in aluminium cups.

Experiments have, therefore, been initiated to collect more data on the extent of pre-coagulation and to investigate whether a thin plastic coating inside the shells would give some improvement.

3. SHEET RUBBER.

3.1. Coagulation.—During visits to an appreciable number of estates and from the advisory correspondence it has been observed that the amount of acid used for the coagulation is often insufficient, resulting in a milky serum which may contain up to about 1.5 per cent of rubber. Due to the shortage of acid the coagulation proceeds too slowly and fermentation of the latex may occur resulting in a deterioration of the final quality of the product. A well-performed coagulation should give a clear to slightly opaque, yellowish serum. The usual standard figures of 5 to 6 oz. of formic acid, or 9 to 10 oz. of acetic acid, or 8 to 12 oz. of oxalic acid per 100 lb. of rubber are minimum concentrations for performing a proper coagulation. The amount of acid required may be appreciably increased if alkaline anticoagulants such as ammonia or soda ash have been used. The use of a fixed quantity of acid will not always work satisfactorily when the addition of the anticoagulant is varied according to the extent of pre-coagulation in the field.

Depending on the required hardness of the coagulum *viz.* for sheet or crepe manufacture or the milling performed *i.e.* on the same day or the day following,

the suitable pH for coagulation should lie approximately between 4.4 and 4.8. In order to ensure a proper coagulation it is therefore desirable to control the pH of the latex after the addition of the coagulant. A simple and quick determination of the pH can be done by means of Bromo Cresol Green indicator which changes colour according to the pH from blue over green to yellow in a pH range of about 3.8 to 5.4.

A short note on this subject has been published in the 3rd Quarterly Journal 1959, p. 56 and it will be issued shortly as Advisory Circular No.67, with a colour chart for facilitating the identification of the colour.

Estates in Ceylon use either acetic acid or formic acid as latex coagulant. Generally the coagulating rate of formic acid is faster than that of acetic acid, and formic acid has also an antiseptic value. It has been established that, in several cases, the quality of sheet and crepe can be improved by changing from acetic to formic acid. The Institute generally prefers the use of formic acid.

Some of the difficulties in manufacture could be traced back to the use of acid of a too high concentration. It must be emphasized that the concentration of formic acid should be 1 per cent and that of acetic acid and oxalic acid 2 per cent.

3.2. Milling.—Trials were carried out to ascertain the output rates of a 5-roller Guthrie Sheeting Milling with particular reference to the type of coagulum (*i.e.* slab and continuous strip), depth of latex in the coagulating tank and the optimum standardization figure.

(i) Standardization figure: The original tests carried out with the 5-roller battery were with coagulum from latex standardized to 2 lb./gallon. In all these trials it was found that the final thickness of the milled sheets was rather excessive for the normal period of drying, *i.e.* 4 days. Furthermore, it was also noticed that one edge of the finished sheets was very much thicker than the other, and, consequently, the drying period was unduly prolonged. Although there is a tendency to this effect in tank coagulation, the defect is more pronounced with the increase of the standardization figure. In view of this difficulty the standardization figure was reduced to $1\frac{3}{4}$ lb./gallon. The trials carried out with the standardization figure at $1\frac{3}{4}$ lb./gallon gave a final sheet which was of the standard thickness (*i.e.* 10–10½ oz./square foot wet) and the extra thickness on one of the edges was very much reduced. The optimum standardization figure of latex for sheet manufacture with a 5-roller Guthrie mill could therefore be fixed at $1\frac{3}{4}$ lb./gallon.

The previous trials, carried out in this connexion in 1957, showed that the optimum figure for a 4-roller Guthrie mill is $1\frac{1}{2}$ lb./gallon.

(ii) Depth of latex in the coagulating tank: For the 5-roller sheeting battery, when the standardization figure is $1\frac{3}{4}$ lb./gallon, the maximum depth of latex in the coagulating tank should not exceed 13 inches. A greater depth would result in a large percentage of sheets having thick edges and which will not dry in the standard period of 4 days. In the case of the 4-roller battery and a standardization figure of $1\frac{1}{2}$ lb./gallon, the depth of latex in the coagulating tank could be slightly increased, *i.e.* to $13\frac{1}{2}$ inches. In this connexion it would be appropriate to mention that the dimensions of the individual rollers of both sheeting batteries are the same, and the coagulating tanks referred to are the 90 partition D.C.L. coagulating tanks supplied by the Colombo Commercial Company.

(iii) Output rates: The previous trials carried out in 1957 with the 4-roller battery gave an average output of 887 lb./hour for slab coagulum, and 999 lb./hour

for continuous strip coagulum. The mill was working at a constant speed of 30 r.p.m. at the first roller.

The speed of the rollers of the 5-roller battery coupled to a variable speed motor is as follows:—

| Pair of rollers | 1st | 2nd | 3rd | 4th | 5th |
|-----------------|-----|-----|-----|-----|------------|
| Slow | 22 | 26 | 31 | 36 | 31½ r.p.m. |
| Medium | 31 | 36½ | 44 | 52 | 44 r.p.m. |
| Fast | 36 | 43 | 52 | 61 | 51 r.p.m. |

Slab Coagulum

| | 5-roller Guthrie | 4-roller Guthrie |
|-------------------------|------------------|------------------|
| Optimum standardization | 1¾ lb./gallon | 1½ lb./gallon |
| Optimum depth of latex | 13" | 13½" |
| Output/hour: | | |
| Slow speed | 625 lb. | |
| Medium speed | 866 lb. | |
| Fast speed | 1,027 lb. | |
| Average output/hour: | | |
| Practical speed | 925 lb. | 887 lb. |

Continuous strip coagulum

| | 5-roller Guthrie | 4-roller Guthrie |
|-------------------------|------------------|------------------|
| Optimum standardization | 1¾ lb./gallon | 1½ lb./gallon |
| Optimum depth of latex | 13" | 14" |
| Output/hour: | | |
| Slow speed | 771 lb. | |
| Medium speed | 989 lb. | |
| Fast speed | 1,190 lb. | |
| Average output/hour: | | |
| Practical speed | 1,050 lb. | 999 lb. |

Although a maximum output of 1,027 lb. per hour with slab coagulum and 1,190 lb. per hour with continuous strip coagulum could be obtained when the mill is operating at its fastest, it would not be practicable to expect commercial estates to operate a 5-roller Guthrie at this speed unless the sheet coagulation of latex is done with extreme care. For, if the coagulum is even slightly softer than normal, there will be undue tearing of the finished sheets, and when the coagulum is slightly harder than normal the tendency is to increase the final thickness of the milled product. Furthermore a break of the continuous strip coagulum at the joints would happen frequently. Hence for purposes of commercial use the mill should be operated at a speed less than its fastest and slightly more than the medium (appr. 33 r.p.m. of the first pair of rollers), in which case an output of about 925 lb. and 1,050 lb. per hour could be obtained.

From the trials carried out and based on a maximum crop size of 175 lb. it could be concluded that the use of a 5-roller Guthrie sheeting mill, in its present dimensions, has little advantage over the 4-roller type where the output is concerned, but will cause an increase in the capacity of the coagulating tanks expressed in terms of dry rubber by about 10 per cent, and this would only benefit estates where the daily crop intake is appreciably large.

3.3. Smoking.—Some estates have shown interest in an extension of the smoking capacity of present smokehouses as well as for new buildings of permanent-

type smokehouses. The modification of the R.R.S. type by constructing an outside furnace and using the ground floor as additional space for smoking proved to be successful and has been tried out for several years at our Nivitigalakele Station. This conversion has been advised to several estates and additional plans for this construction are expected to be available in due course.

Advice has been given to one estate regarding the construction of a double R.R.I.M. tunnel type smokehouse.

3.4. Defects in Sheet.—A considerable part of the advisory work, including visits to estates, has been in connexion with defects in R.S.S. The most common complaints have been rust, tackiness, prolonged drying and bubbles. The prevention of these defects has been discussed in detail in several of the publications issued by the Institute, and it is therefore not necessary to refer to them again in this report. However, it seems appropriate to comment here briefly about the use of sodium bisulphite and about the dripping period of wet sheets in the manufacture of R.S.S.

In general under properly controlled conditions the use of sodium bisulphite is not required for the manufacture of smoked sheet, but if signs of enzymatic oxidation, such as dark or discoloured patches, are observed in the wet sheets due to deviations from the standard manufacturing process, then its use at a dosage of not more than 1 ounce per 100 lb. dry rubber may be permitted. Excess of sodium bisulphite will cause tackiness in the finished sheets and, moreover, will prolong their drying rate. The presence of small bubbles may also be due to the use of excess of sodium bisulphite or of soda ash as anticoagulant.

It was observed that, in most of the sheet manufacturing estates visited, the dripping period of the wet sheets was far too long. Prolonged dripping is one of the main causes for the development of rust and fermentation. In one estate in the Southern Province wet sheets were allowed to drip throughout the night and were not introduced into the smokehouse until the afternoon of the following day. The outturn of No. 1 sheets of this particular estate for the previous three months prior to the date of visit, was about 35 per cent, while nearly 60 per cent of the sheets had been downgraded due to rust. The dripping period should not exceed $1\frac{1}{2}$ to 2 hours. Wet sheets may be allowed to drip either by suspending them on reapers or stacking them on a sloped platform or table.

Prolonged drying time, due to part-time operation of the smokehouse and not maintaining the correct drying temperature, is an important factor concerning the occurrence of bubbles, blisters, fermentation and other defects. It has been found that the work in the smokehouse, such as turning over of sheets, removal of dry sheets and insertion of wet sheets, is unduly held up sometimes until late in the afternoon. The work should be organized in such a way that the smokehouse is in continuous operation for at least 20 hours each day and the temperature is maintained within a range of 120 to 130°F. Firing should be done on a "little and often" basis, *i.e.* to use 2 to 3 logs of firewood every few hours and not to stoke the oven only once or twice a day.

3.5. Mould on R.S.S.—Owing to the presence of serum substances in smoked sheet, the apparent equilibrium moisture content of sheet is more susceptible to changes in outside relative humidity leading to microbiological action taking place on the surface, resulting in mould. The majority of complaints due to mould are found when manufacture or storage in the tropics coincides with the monsoon period. Suppression of mould requires the incorporation of a non-deleterious fungicide added to protect the material against mould growth under humid conditions.

Paranitrophenol (P.N.P.) still holds its place as the most effective and cheapest fungicide for smoked sheet. Users, as well as producers, are not entirely clear concerning the significance of the large-scale use of P.N.P. in smoked sheet. However, since some manufacturers do not like P.N.P. in sheet because it "bleeds" out in manufactured rubber goods and since the Ceylon Department of Labour has objected to the use of P.N.P. on the grounds that there is a danger of health hazards to the operatives during the manufacture of sheet rubber, experiments were carried out to find a suitable alternative to P.N.P.

To enable a systematic search it was thought desirable to identify the micro-organisms involved. The mould commonly found in Ceylon R.S.S. was found to be a *Penicillium* species and an *Aspergillus* species. As the species have been sent to the U.K. for classification, we are limiting their description to a mere indication of colour.

TABLE I

| Fungus | Description and Origin |
|---------------------------|---|
| 1. <i>Penicillium</i> sp. | A bluish green species obtained from mouldy Ceylon R.S.S. |
| 2. <i>Aspergillus</i> sp. | A yellowish species obtained from mouldy Ceylon R.S.S. |

A description of the fungicides tested against these moulds is given in Table 2.

TABLE 2

| Trade Name | Chemical Composition | Solubility |
|-------------------------------------|---|---|
| P.N.P. | Paranitrophenol | Soluble in water |
| Raschit W | Sodium salt of 6-chloro-3-oxy-1-methylbenzene | Soluble in water |
| Antimucin W.B. (liquid) | Phenyl mercuric acetate (16.75%) + glycollic solvents | Dissolved in $\frac{1}{2}$ quantity of concentrated ammonia, diluted with 20 volumes of water. |
| Shirlan | Salicylic acid anilide | 1 part + 0.2 parts sodium hydroxide + 99 parts of water. |
| Orthocide 50 or Vancide 89 (Captan) | N-trichloromethylthio tetrahydrophthalimide | Insoluble in water Soluble in acetone A water suspension was obtained by taking 10 parts Captan + 1,000 parts water containing 1 part of surface active agent (e.g. Dispersol L.N.), and stirring vigorously. |

Sheets prepared according to standard procedure, when latex is coagulated with formic or with acetic acid, were soaked in a solution containing the fungicide for 5 minutes. The concentrations of the fungicides used were 0.2%, 0.1%, 0.05% solutions or suspensions. The sheets were smoked in the tunnel smokehouse for 2½ days. Assessment of the mould-suppressing power of the chemicals was determined by taking samples of the above smoked sheet (4 cms by 10 cms) and infecting them by spraying with an aqueous suspension of mould.

The samples were kept in a desiccator containing a saturated solution of washing soda in the dark at room temperature of $26^{\circ}\text{C} \pm 2^{\circ}\text{C}$. The samples were examined for mould growth at intervals of 24 hours to determine the approximate time in days for the first appearance of mould. This procedure does not necessarily give reproducible figures (Arch. Rubb. Cult. **34**, 1957, 1) but it has the merit that it is a near approach to the commercial procedure. The fungicides in descending order of efficiency for rubber coagulated with acetic acid and formic acid are listed in Table 3.

TABLE 3

| Ranking | For Penicillium species | For Aspergillus Species |
|---------|-------------------------|-------------------------|
| 1 | P.N.P. | P.N.P. |
| 2 | Captan | Antimucin |
| 3 | Shirlan | Captan |
| 4 | Antimucin | Shirlan |
| 5 | Raschit W | Raschit W |

It is intended to publish a more detailed account of the above experiment in the Quarterly Journal of the Institute.

4. CREPE RUBBER.

4.1. Discolouration of Bleached Crepe.—Many enquiries have been received concerning the discolouration of bleached crepe and the steps that should be taken to prevent this appearance. Although the method of application and the problem of discolouration have been discussed in several papers, a short summary of the principal points, on the basis of recent experience, has been published in the Institute's Quarterly Journal, Vol. 35, Part 4 (1959).

Some experiments were carried out to establish whether an inhibition of the precipitation of iron compounds in the dilution water by polyethoxyamines could prevent the discolouration of bleached crepe caused by iron. Ethomeen C/15, a reaction product of one mol of a primary fatty amine with 5 mols of ethylene oxide recommended in U.S.P. 2,894,905 (1959) as a suitable inhibitor for the precipitation of iron-oxide from iron-containing water, has been used for the experiments.

It has been found that for normal field latex oxalic acid alone as coagulant gave the best colour for crepe, followed by oxalic acid and sodium bisulphite and then by formic acid and sodium bisulphite. After addition of iron, oxalic acid and sodium bisulphite produced a better colour than oxalic acid alone or formic acid and sodium bisulphite. The addition of Ethomeen C/15 had no marked effect on the colour and on the iron content of the crepe.

The analysis of the iron content of crepe and serum showed that rubber coagulated with formic acid with added sodium bisulphite retains more iron than rubber coagulated with oxalic acid. The percentage distribution of the iron content in dry rubber and in the serum of 1:1 diluted field latex, after addition of RPA 3 and coagulation with oxalic acid or formic acid, with and without addition of sodium bisulphite, is given in Table 4.

TABLE 4

| Coagulant | No added iron. Total iron present in field latex 25 mg/1000 c.c. | | 40 mg. iron add- ed as Ferrous Bicarbonate. Total iron pre- sent in field latex 45 mg/ 1000 c.c. | | 80 mg. iron add- ed as Ferrous Bicarbonate. Total iron pre- sent in field latex 65 mg/ 1000 c.c. | |
|---|---|--------|--|--------|--|--------|
| | Serum | Rubber | Serum | Rubber | Serum | Rubber |
| Oxalic Acid | 39.0 | 61.0 | 48.1 | 51.9 | 68.2 | 31.8 |
| Oxalic Acid + Sodium Bisulphite (normal dosage 0.05% on the d.r.c.) ... | 36.0 | 64.0 | 49.7 | 50.3 | 62.8 | 37.2 |
| Formic Acid | 33.0 | 67.0 | 48.4 | 51.6 | 52.7 | 47.3 |
| Formic Acid + Sodium Bisulphite (low dosage 0.01% on the d.r.c.) ... | 20.9 | 79.1 | 37.6 | 62.4 | 38.9 | 61.1 |
| Formic Acid + Sodium Bisulphite (normal dosage 0.05% on the d.r.c.) ... | 27.9 | 72.1 | 35.3 | 64.7 | 41.3 | 58.7 |

Preliminary trials with formaldehyde sodium sulphoxylate failed to show an improvement in the colour and colour-holding properties of crepe.

On some estates heavy reddish-purple discolourations in the form of stains have been found which could be traced back to the coloured Antimucin WBR. It appears that the dye contains a small insoluble fraction. These water-insoluble particles, which are hardly visible, dissolve in the rubber during drying and cause staining. It has been suggested that the coloured Antimucin WBR be replaced by the colourless Antimucin WR which has the same fungicidal value and, in order to facilitate the supervision of application, the colourless Antimucin at the recommended dilution may be coloured by the addition of 1 oz. Swedish red powder per gallon of the solution. The Swedish red powder is insoluble in water and rubber and does not stain the final product when incorporated in the suggested amount.

4.2. Mould infection in drying sheds.—During the wet season heavy mould infections will often be found, especially in unheated drying sheds where moist conditions are a continuous cause for mould development on lace crepe. For the elimination of mould in drying sheds and smokehouses the following procedures have been recommended:—

Spraying of a 1 per cent solution of formalin on all parts inside the drying shed, including walls, floor and roof. It does not matter if some rubber inside the shed is contaminated with the spray, but it is important to ensure that after the removal of the lace crepe the "reapers" are disinfected.

For smokehouses a spray of 0.5 per cent solution of para nitrophenol (PNP) may be applied in place of formalin. In this case it is advisable to empty the smokehouse first. PNP is not suitable for crepe drying houses because of its intensive yellow colour.

An effective method is to evaporate $\frac{1}{2}$ to 1 gallon of concentrated formalin (commercial formalin is about 38%) in the closed drying shed or in the smoke-house and to keep it closed for about 24 hours. For the evaporation, the formalin is heated in an open tin or some other suitable container on a small charcoal fire. The gaseous formaldehyde penetrates into all the crevices of the wood and the walls and destroys all germs effectively.

4.3. Lace Crepe.—Some medium-scale investigations are being carried out to compare the production costs of thin lace crepe and blankets. Ceylon is the only country that produces blanket crepe. Crepe rubber from the two largest rubber producing countries, Malaya and Indonesia, is practically always marketed and shipped in lace form. Dry milling, as applied for blanketing, implies a considerable production of heat and causes the rubber to darken much more than it does with thin lace crepe. In general, homogeneous lace crepe has a better appearance than blanket crepe. A great part of the efforts made to obtain a light colour is wasted by blanketing, which is a high power-consuming procedure.

On the other hand transport to the ports of shipment would cost more as the weight of bulky lace crepe per unit volume is less, while packing on estates would be difficult due to lack of packing facilities. If lace crepe could be packed and the bales coated on estates, inspection of the quality would be difficult and especial arrangements would have to be made for representative sampling and settlement of claims.

Experiments on output rate and milling schedule are being continued. Provisions have been made to have packing facilities for baling of crepe rubber at the Institute in due course.

5. COMPOUNDED RUBBER.

5.1. Equipment.—The instruments for technological testing of vulcanized rubber have been checked up and put in working condition. The abrasion tester, the tripsometer and flex-cracking tester, which arrived at the Institute in 1955 and which were not installed till recently, have been taken into use during this period.

The new Cradley No. 5 Multi-Cross Tube Vertical Boiler with automatic oil firing for a working pressure of 120 lb./sq. inch has arrived and will be installed and taken into operation early in 1960. This boiler will ensure the maintenance of a higher and more constant pressure and temperature for the machinery in the technical section.

5.2. Technical Classification.—The position in Ceylon with regard to TC rubber has remained substantially unchanged and no immediate large-scale production of Technically Classified rubber is anticipated in the near future.

5.3. Superior Processing Rubber.—Requests for information on the preparation of Superior Processing Rubber have been received from two estates and full technical information, as well as samples of sheet and crepe prepared at the Institute, have been supplied.

5.4. Carbon-Black Masterbatches.—A large manufacturer in Colombo has shown considerable interest in the manufacture of carbon-black masterbatches, for which the necessary information has been issued.

Some experiments have been carried out at the Institute to investigate suitable conditions for the preparation of masterbatches from fresh field latex with Furnace Black and Channel Black, both containing Pepton 22 as peptizer. Fresh field latex and slightly ammoniated latex have been used for the experiments. Formic acid was not suitable as a coagulant for Furnace Black. After the addition of formic acid (pH 4.2), the latex mixed with Furnace Black did not coagulate but formed only an unprocessable jelly, whilst the Channel Black latex mixture coagulated well in the form of big lumps. Calcium chloride, alone or in admixture with formic acid, has been found to perform a satisfactory coagulation with only minor losses of carbon black.

Furnace Black-latex mixtures treated with calcium chloride gave a good hard coagulum which could be worked on the macerator into thick blankets, having a drying time of only $2\frac{1}{2}$ days at 35°C .

Channel Black-latex mixtures treated with calcium chloride gave quite a soft coagulum which could not be milled in the wet stage to a blanket but the dried crumbs could, however, be remilled to a blanket.

The mixing cycle for compounding has been reduced with carbon black masterbatches to about 50 per cent of the time of usual compounding. Due to the accelerated ageing of the crude carbon-black masterbatch, and taking into consideration the economic aspect, the manufacture of this type of rubber for export is not suitable but it certainly offers many advantages to the local manufacturers of rubber goods by increasing considerably the output of their compounding machinery.

6. MISCELLANEOUS.

6.1. Copper Content of Ceylon Rubber.—The previous experiments on copper contamination are being continued in order to collect more representative data on the extent of the contamination under different conditions, to ascertain the suitability of rainguards as a means of reducing the copper contamination in the latex and in the scraps and to investigate the effect of a controlled blending system, as described in Information Leaflet C/58/2.

The experiments were laid out at Dartonfield on two fields of $13\frac{1}{2}$ and $6\frac{1}{2}$ acres respectively. Dusting was started on these fields in March and was carried out with Blendox 4% at weekly intervals in the $13\frac{1}{2}$ acres area and at fortnightly intervals in the $6\frac{1}{2}$ acres area.

These experiments have been extended to a 1% copper dust with sticker which has been found to be phytopathologically as effective as the 4% dust without sticker.

The major sources of copper contamination in the field as a result of copper dusting may be due to:

Rain washing the copper dust off the leaves and the trunk of the rubber tree into the scraps or the latex, and wind, with or without rain, blowing copper dust into the scraps or the latex.

On the assumption that the washing down of the copper dust is the more important factor, we have, for over two years in one area, tested the C.I.S.I.R. rainguard, with a view of reducing if not eliminating the risk of copper contamination. Our results show that the use of these rainguards did not reduce the risk of copper contamination. It appeared that wind-borne contamination is equally important

and that both of the suspected causes of copper contamination could be overcome by the use of an effective protective cover over the tapping panel and the cup. Hence experiments were carried out using polythene rainguards, gauge 300 and 1,000, to cover both the panel and the cup and forming a type of skirt around the tree. Polythene sheet gauge 300 was found to be the most suitable.

There are not yet enough data for conclusions to be drawn regarding the effect of these rainguards but it would appear that there might be a certain protection against contamination.

Analysis of scraps, whole latex rubber and latex crepe of areas dusted with copper dust, but protected with polythene rainguards, gave rather high values for copper. Since the area of the preliminary experiments is an area which had been heavily dusted with copper fungicide for experimental purposes during the past two years, the experiments have been repeated in an area not previously dusted and the results will be published in due course.

The sticking power of commercial copper dusts on the leaves has been investigated in laboratory experiments by treating dusted leaves several times with water under standardized conditions. The figures are given in Table 5.

TABLE 5

| Treatment | 1% CIBA with sticker % Cu remaining on leaf | 6% Blendox. % Cu remaining on leaf |
|------------------------|---|--|
| After dusting | 100.0 | 100.0 |
| „ 1st soaking in water | 66.7 | 45.1 |
| „ 2nd „ „ | 64.7 | 33.5 |
| „ 3rd „ „ | 63.7 | 29.7 |
| „ 4th „ „ | 63.0 | 28.3 |
| „ 5th „ „ | 62.3 | 27.9 |

It is seen that the copper dust with incorporated sticker is more effectively retained on the leaves than the copper dust without sticker.

6.2. Dirt Content of Ceylon Rubber.—Examination of the dirt content of Ceylon rubber, from the viewpoint of conformity to a possible future specification, has been started. In total 817 samples have been analysed, 440 of which have been received from two Packing Houses in Colombo and Galle. From September 1959 three estates are sending weekly samples regularly for evaluation of the variation in dirt content during a period of at least one year. More estates will be included in this scheme during 1960.

Results of our preliminary experiments, expressed as percentage dirt content, are given in Table 6.

TABLE 6

| Grade | No. of Samples | Arithmetic Mean | Highest Value | Lowest Value | Standard Deviation | Variability % |
|-----------------|----------------|-----------------|---------------|--------------|--------------------|---------------|
| R.S.S. I | 74 | .048 | .159 | .008 | .0183 | 38.2 |
| R.S.S. II | 50 | .045 | .108 | .026 | .0145 | 32.2 |
| R.S.S. III | 44 | .057 | .111 | .003 | .0190 | 33.2 |
| R.S.S. IV | 32 | .065 | .142 | .034 | .0246 | 37.7 |
| R.S.S. V | 8 | .075 | .102 | .051 | .0188 | 25.1 |
| Latex Crepe I | 87 | .042 | .117 | .003 | .0276 | 66.5 |
| Latex Crepe IX | 22 | .025 | .067 | .007 | .0154 | 62.2 |
| Latex Crepe IA | 19 | .021 | .060 | .011 | .0128 | 60.4 |
| Latex Crepe II | 75 | .036 | .082 | .013 | .0131 | 36.7 |
| Latex Crepe III | 70 | .071 | .329 | .012 | .0625 | 87.7 |
| Latex Crepe IV | 20 | .061 | .130 | .021 | .0290 | 47.4 |
| Latex Crepe V | 28 | .091 | .238 | .017 | .0565 | 62.2 |
| Scrap Crepe I | 69 | .323 | .731 | .072 | .1719 | 53.2 |
| Scrap Crepe IX | 7 | .417 | .890 | .301 | .1806 | 43.3 |
| Scrap Crepe 2X | 7 | .499 | .802 | .396 | .1380 | 27.6 |
| Scrap Crepe II | 54 | .343 | 1.346 | .043 | .2676 | 78.1 |
| Scrap Crepe III | 81 | .588 | 3.898 | .048 | .5599 | 95.2 |
| Scrap Crepe IV | 13 | .534 | 1.295 | .119 | .3938 | 73.8 |
| Scrap Crepe V | 8 | .562 | 1.464 | .121 | .4255 | 75.7 |

Scrap crepes seem to be very highly contaminated, mainly with bark, due to careless collection of the panel scraps. It has been observed that, as a general practice on some estates, the panel scraps are not pulled off from the tapping cuts before tapping is carried out, so that the bark scrap is delivered to the factory with the adhering bark. Strict measures should be taken to discourage this practice as it is then difficult to separate bark from scrap.

6.3. Factory Water.—It has been observed that in general the influence of the quality of water used in rubber factories is under-estimated. Some features of the water such as pH, content of calcium, bicarbonates, iron and floating dirt would appear to be of great importance for the quality of the final product. It has been shown that an iron content of 1 mg. iron per litre of water can markedly affect the discolouration of bleached crepe. To draw attention to the importance of water supply an article on this subject has been published in the Institute's Quarterly Journal, 35 (1959) 32-37.

6.4. Factory Effluents.—Attention has been drawn to the problem of the discharge of acidic effluents from rubber factories causing damage to cash crops and polluting the streams. It has not yet been possible to find an economic and practicable solution to this problem. Effective treatment of the effluents from rubber factories is technically possible but the capital expenditure and running costs involved would make it prohibitive and it is unlikely that estates would be prepared to accept recommendations involving high costs.

As the discharge of the daily relatively small quantity of effluents (in the order of about 500-5,000 gls) does not occur continuously throughout the day, but is restricted only to a few hours, the degraded streams should revert to their original state in more or less a short time. The time of reversion will be dependent on the quantity of water in the stream and its rate of flow but in most cases it should take a relatively short time, provided the water is not stagnant. Complaints from one village on the pollution of a stream used for bathing have been found to be groundless. During an inspection it was observed that the stream in question carried a

relatively large amount of water with a satisfactory rate of flow, even during the dry season. The milky effluents, containing a small amount of rubber, were fairly quickly dispersed in the water and about 200 yards below the point of discharge the stream water had already reverted back to normal.

In co-operation with another estate, some experimental work has been carried out in connexion with the disposal of the effluents into the plantation as it was not possible to discharge them into a stream. A 500-gallon settling tank, consisting of 2 inter-communicating compartments in which the effluents are neutralized by means of limestone mixed with a small amount of quick lime has been constructed. The neutralized effluents are now discharged into the rubber plantation. The experiments will be continued with an altered design of the settling tank.

REPORT OF THE SMALLHOLDINGS DEPARTMENT

By

R. T. WIJEWANTHA

SUMMARY

Further extents planted by smallholders, either State aided or on their own, have resulted in an increase in the amount of work undertaken by this Department. Assistance to smallholders in the form of advisory visits as well as assistance in contour lining of their holdings for planting was continued. A new section to deal with publicity and audio-visual education was started during the year under review. A much enlarged Sulphur Dusting Scheme was organized and, with suitable supervision, many smallholdings of high-yielding rubber were successfully dusted.

The Chief Advisory Officer of the Department, his Senior Assistant Advisory Officer as well as the two sectional Assistant Advisory Officers were on duty throughout the year.

Five Temporary Rubber Instructors and one Artist/Clerk were recruited during the year. Several posts of Rubber Instructor, however, remained vacant at the end of the year due to a dearth of suitably qualified applicants to fill these posts.

Six New Ranges were carved out from the larger ranges, which had become unwieldy. In all there are now 47 ranges.

The Director, the Smallholders' Representative on the Rubber Research Board and the writer inspected smallholdings, particularly those which had been sulphur dusted under the Smallholdings Department Co-operative Dusting Scheme, in Matugama division on 16th March 1959.

The writer visited the Rubber Research Institute of Malaya and made a tour of inspection of Malayan smallholdings during the period 11th to 18th December.

Loans for the purchase of vehicles were granted to 10 officers during the year.

A substantial increase in the volume of correspondence was recorded during the year.

The number of field demonstrations to permit-holders on the proper method of making sheet of an improved quality, was stepped up. In order to improve the smoking of sheet, Rubber Instructors persuaded smallholders to build 28 demonstration and 14 ordinary smokehouses. These smokehouses were completed satisfactorily by the end of the year.

The sixth Smallholdings Folder, on "Tapping", was published in both Sinhalese and English. A short leaflet in Sinhala on the identification of secondary leaf fall, caused by *Phytophthora palmivora*, was prepared and distributed at short notice, in view of the unexpected heavy incidence of *Phytophthora* which followed in the wake of the South-west monsoon.

A successful Field Day was held on 20th June at Kalutara North. The Chairman Rubber Research Board and the Acting Director attended it this year. The guest lecturer was the Assistant Soils Chemist. The main item of field work was a lecture demonstration on a simple method of calculating the acreage of a given land with the use of a road tracer and a circular measuring tape.

All 6,620 holdings for which replanting permits had been issued were visited by Rubber Instructors. 24,323 visits were paid during the year to smallholdings, including 15,611 visits in respect of holdings planted in previous years.

During the year Rubber Instructors and Assistants lined 2692 permit areas totalling 3,650 Ac. 1R. 17P. for soil conservation works and 3,490 permit areas of 4439 Ac. 0R. 06P. for planting holes in 1959 permit areas. These Officers have lined a further 262 permit areas totalling 389Ac. 3R. 02P. in extent, for soil conservation works, and 212 permit areas comprising 311 Ac. 1R. 33P. in extent for planting holes in permit areas of previous years. 239 special reports on subsidy replanted areas were furnished to the Rubber Controller.

A total of 1, 885 tappable trees have been marked for tapping by Rubber Instructors, by way of demonstrations in 56 replanted holdings.

Officers of this Department continued to carry out random checks on the planting material issued at the Commodity Purchase Depots by the Rubber Controller to the subsidy replanting permit-holders.

Apart from replanting work, Rubber Instructors devoted part of their time in visiting, advising and assisting smallholders newly planting rubber. 4,654 such preliminary reports were sent to the Rubber Controller during the year. 16,597 visits were made by the field staff to new-planting permit areas and new-planted permit areas of this and previous years for advice and lining. Rubber Instructors also marked 2,089 tappable trees in 98 new-planted holdings, as demonstration marking, before loaning Departmental templates to the permit holders. Rs. 6082/40 were paid as Soil Conservation grants to 102 peasant class permit holders, on the advice of Rubber Instructors after counter checking by Divisional Advisory Officers.

A total of 9,099 special inspections were undertaken at the request of the Rubber Controller.

The survey of the incidence of White Root disease in smallholdings, which was concluded in 1959, showed that a further 329 holdings in this group have been infected. This raised the total percentage infection to 35.6%. As smallholders were not adopting proper treatment and control methods, it was decided to set down "Fomes Control Demonstration Plots" in the various ranges. Up to the time of writing 36 such plots have been laid down.

The State-aided Sulphur Dusting Scheme organized by this Department a few years back was further extended during the 1958/59 season. In all a total of 6,247 acres (1,884 holdings) were successfully dusted, as against 1,471 holdings covering 4,782 acres in 1957/58. It is pleasing to record that more genuine smallholders are now taking part in the Scheme. Arrangements have been made for the dusting of 8,170 acres of rubber in 2,509 holdings during the forthcoming season.

A publicity unit to provide audio-visual instructions to smallholders and to assist in propaganda work was added on to the Department in the latter part of the year. Thanks to the financial assistance provided by the Rubber Controller, it

became possible to organize a fully equipped mobile unit which commenced to function in the field from 26th October. By the end of the year a total of 34 propaganda meetings cum-exhibitions had been held in various parts of the Island.

DETAILED REPORT

Introduction.—Subsidized replanting of smallholdings which was commenced in 1953, when 661 acres were replanted, has increased from year to year and, by the end of 1959, a total of 45,654 acres planted under the Rubber Replanting Subsidy Scheme came under the purview of this Department. This, with a further increase in unsubsidised new plantings, has resulted in a considerable increase in the work of this Department of the Rubber Research Institute. Assistance to smallholders in the form of advisory visits as well as assistance in contour lining of their holdings for planting was continued. A new section to deal with publicity and audio-visual education was started during the year under review. A much enlarged Sulphur Dusting Scheme was organized and, with suitable supervision, successfully dusted many smallholdings of high-yielding rubber.

1. GENERAL.

1.1. Staff.—The Head of the Department whose designation was changed during the year from “Smallholdings Advisory Officer” to “Chief Advisory Officer Smallholdings”, the Senior Assistant Advisory Officer and the two Assistant Advisory Officers were on duty throughout the year.

Appointments.—The following appointments were made during the year:—

| | |
|--|-------------------|
| Mr. W. W. Gunasekera, as Temporary Rubber Instructor w.e.f. | 1-8-59. |
| Mr. D. Palihakkara, ” ” ” ” ” | 1-8-59. |
| Mr. T. W. Jayalath, ” ” ” ” ” | 1-8-59. |
| Mr. R. K. Gunatillake, ” ” ” ” ” | 1-8-59. |
| Mr. T. B. Herath, ” ” ” ” ” | 1-8-59. |
| Mr. M. J. P. Lusena was appointed Artist/Clerk w.e.f. | 17th August 1959. |

Mr. W. D. Banda, Rubber Instructor, was appointed Rubber Instructor Publicity, with effect from 15-9-59 and Mr. S. D. Athukorale, Replanting Assistant, was attached to the Publicity Unit with effect from the same date.

One Rubber Instructor resigned from the Department for personal reasons at the end of the year.

Several posts of Rubber Instructor remained vacant at the end of the year due to a dearth of suitably qualified applicants to fill these posts.

1.2. New Ranges.—The following 6 new ranges were carved out from the larger ranges which had become unwieldy:—

Aranayake
Narammala
Homagama
Millewa
Agalawatta
Welipenna

With the establishment of these new ranges and, in order to balance each of the six divisions, Undugoda range and Pitigala range were transferred to Avissawella and Galle divisions respectively. There are now altogether 47 ranges.

1.3. Visits.—Dr. E. D. C. Baptiste, Director, R.R.I.C., Mr. W. P. H. Dias, J.P., Smallholders' Representative on the Rubber Research Board, and the writer inspected smallholdings, particularly those which had been sulphur dusted under the Smallholdings Department Co-operative Dusting Scheme, in Matugama division, on 16th March 1959.

The above three Officials also made an extensive tour of inspection of smallholdings in the Northern Sector between 8th and 10th September.

1.4. Special Activities.—The Chief Advisory Officer Smallholdings represented the Director at committee meetings of the Ceylon Association for the Advancement of Science in connexion with the Science Exhibition held in September 1959.

He was invited to attend the Smallholdings Committee meetings in March and July, the Administrative Committee Meeting at Dartonfield on 8th October and also served on the Smallholdings Selection Committee, which held several meetings during the year.

1.5. Visit to Malaya.—The Chief Advisory Officer Smallholdings visited the Rubber Research Institute of Malaya and made an official tour of inspection of Malayan smallholdings during the period 11th to 18th December. An illustrated report on his impressions and observations was submitted to the Director.

1.6. Loans.—Loans for the purchase of vehicles were granted to 10 officers during the year. The total sum loaned was Rs. 17,870/-.

1.7. Correspondence.—A substantial increase in the volume of correspondence, which passed through this office, was recorded during the year.

General:

| | |
|---------|--------|
| Inward | 5,313 |
| Outward | 11,499 |

With Rubber Controller:

| | |
|---------|--|
| Inward | 645 (from Rubber Controller with new planting applications, etc.). |
| Outward | 8,596 (including 4,721 preliminary reports, 2,821 final inspection reports and 1,054 special reports, etc.). |

In addition to the above, 5,765 letters were addressed by field staff to permit holders.

1.8. Demonstrations.—The number of demonstrations to permit holders, on the correct method of making sheet of an improved quality, was stepped up to 738. 490 sq. ft. of mesh for strainers and 560 aluminium pans were sold at concession rates to smallholders. Rubber Instructors paid 1,076 visits to demonstration smokehouses and 1,667 visits to ordinary smokehouses to advise on methods of sheet improvements.

With this object in view, Rubber Instructors have persuaded smallholders to commence building 53 demonstration and 33 ordinary smokehouses. Twenty eight of the demonstration and 14 of the ordinary smokehouses were completed satisfactorily by the end of the year.

In addition to the sheet-making demonstrations 257 tapping, 696 disease-control and 430 miscellaneous demonstrations were given by the field staff.

1.9. Publications.—The sixth Smallholdings Folder, on “Tapping” was published in both Sinhalese and English. A short leaflet in Sinhala on the identification of secondary leaf fall caused by *Phytophthora palmivora* was prepared and distributed at short notice, in view of the unexpected heavy incidence of *Phytophthora* which followed in the wake of the South-West monsoon.

2. ASSISTANCE TO CO-OPERATIVE SOCIETIES & SMALLHOLDERS.

A pair of Walker’s “Melius” rubber rollers was purchased, at a discount rate, through this Department by the Holombuwa Multi-purpose Co-operative Society. 150 Aluminium coagulating pans were also sold to this Society at concession rates. Two pairs of Hunter’s “Pluto” rubber rollers were purchased by two smallholders through this Department, also at concession rates.

The Department exchanged some correspondence with the Assistant Commissioner for Co-operative Development, Kegalla, for the registration of a proposed Rubber Co-operative Society at Uruledeniya in Kegalla range. 224 advisory visits were made by the field staff to existing Rubber Co-operative Societies during the year.

Four tons of manure were purchased through this Department by a Rubber Co-operative Society and by one smallholder.

3. ANNUAL FIELD DAY.

The Annual Field Day was held on 20th June at Kalutara North. The Chairman of the Rubber Research Board and the Acting Director attended it this year. The guest lecturer was the Assistant Soils Chemist who spoke on composting. The main item of field work was the lecture demonstration on a simple method of calculating the acreage of a given land with the use of a road-tracer and a circular measuring tape. This was given by a retired Government Surveyor. The full programme for the day was as follows:—

- 8-00 a.m. Opening address by the Smallholdings Advisory Officer.
- 8-15-9-45 a.m. Lecture by Licensed Surveyor on method of working out acreages of permit areas by use of road-tracer and measuring tape.
- 9-45-10 a.m. Tea Interval.
- 10-00 a.m. Welcome of Chairman, Director, etc.
 5 minute talk by the Chairman.
 5 minute talk by the Acting Director.
- 10-15 a.m. Lecture on composting by the Acting Soils Chemist.
- 11-00 a.m. Lectures by the Smallholdings Advisory Officer on:
 - 1. Tapping in Subsidy Replanting areas.
 - 2. Audio-visual Village Propaganda (using colour slides with synchronised taped commentary).
- 12-30 p.m. Conclusion of Field Day.

4. REPLANTING.

Considerable attention was paid by the field staff in assisting smallholders and small estate owners to replant their permit-areas in accordance with the requirements of the Rubber Replanting Subsidy Scheme. The following replanting permits, issued in respect of the year 1959, were in force at the end of the year:—

| | No. of Permits | Acres | Roods | Perches |
|----------------------------------|-------------------|--------------|---------|----------|
| Estates over 100 acres ... | 369 | 9,005 | 3 | 38 |
| Estates between 10 and 100 acres | 1,063 | 8,429 | 2 | 00 |
| Smallholdings under 10 acres ... | 6,620 | 9,773 | 0 | 10 |
| | <hr/> 8,052 | <hr/> 27,208 | <hr/> 2 | <hr/> 08 |

All 6,620 of the above smallholdings were visited by Rubber Instructors. 24,323 visits were paid during the year to smallholdings, including 15,611 visits in respect of holdings planted in previous years.

During the year Rubber Instructors and Assistants lined 2,692 permit areas totalling Ac. 3,650 1R. 17P. for soil conservation works and 3,490 permit areas of Ac. 4,439 0R. 06P. for planting holes, in 1959 permit areas. These officers have also lined 262 permit areas of previous years totalling Ac. 389 3R. 02P. for soil conservation works and 212 permit areas of Ac. 311 1R. 33P. for planting holes. 239 special reports on subsidy replanted areas were furnished to the Rubber Controller.

A total of 1,885 tappable trees have been marked for tapping by Rubber Instructors by way of demonstrations in 56 replanted holdings.

Officers of this Department continued to carry out random checks on the planting material issued from the Commodity Purchase Depots by the Rubber Controller to the subsidy replanting permit holders. 187 inspections were carried out by the field staff and a total of 20,314 plants examined.

5. NEW PLANTING.

Apart from replanting work, Rubber Instructors devoted part of their time in visiting, advising and generally assisting smallholders newly planting rubber. Each new land for which rubber new-planting rights were being asked, was visited and reported on by a Rubber Instructor before a permit was issued. 4,654 such preliminary reports were sent to the Rubber Controller during the year. 3,276 new-planting permits, covering 5,213 acres, were issued during the year. 16,597 visits were made by the field staff to new-planting and new-planted permit areas of this year and previous years for advice and lining. A new record sheet (yellow form) was entered up for each of the 1959 new-planting permit areas visited. The condition in which the previous years' new-planted areas were found, and work recommended to be done, were entered in the relevant form of each permit area visited. 3,204 Final Inspections reports and 844 Special reports were sent to the Rubber Controller.

Rubber Instructors and Assistants lined 479 permit areas of Ac. 596 2R. 02P. in extent for soil conservation works and 507 permit areas of Ac. 682 0R. 00P. in extent for planting holes in 1,959 permit areas.

Similarly, 150 permit areas of Ac. 231 1R. 11P. in extent were lined by Rubber Instructors and Assistants for soil conservation works and also 142 permit areas Ac. 235 0R. 13P. in extent for planting holes in 1958 new planting permit areas.

Rubber Instructors marked 2,089 tappable trees in 98 new-planted holdings, as demonstration marking, before loaning Departmental templates to the permit holders.

5.1. Soil Conservation.—The sum of Rs. 6,082/40 was paid as Soil Conservation grants to 102 peasant class permit holders, on the advice of Rubber Instructors, after counter checking by Divisional Advisory Officers.

6. SPECIAL INSPECTIONS FOR RUBBER CONTROL DEPARTMENT.

Several special inspections were undertaken at the request of the Rubber Controller, in addition to the normal advisory visits, mentioned previously.

| | | | |
|---------------------------------------|-----|-----|-------|
| Visits for Preliminary Reports | ... | ... | 4,654 |
| Visits for Final Inspection Reports | ... | ... | 3,204 |
| Visits for Special Reports | ... | ... | 1,054 |
| Visits for Checking Planting Material | ... | ... | 187 |

7. WHITE ROOT DISEASE.

The Fomes survey, commenced in 1956/57, revealed that 19.7% of all smallholdings replanted between 1953 and 1955 were infected to some degree or other by White Root disease.

In the follow-up survey in 1957/58, it was found that a further 701 of the holdings, planted during the period referred to, had now been infected (Table I) raising the percentage infection to 30.3%. The subsequent survey, which was concluded during 1959, showed that a further 329 holdings in this group have been infected. This raises the total percentage infection to 35.6%.

TABLE I

| D.A.O's Division | SMALLHOLDINGS PLANTED 1953-55 | | |
|---------------------|---|--|--|
| | Holdings found infected at 1st survey 1956/57 | Additional holdings found to be infected at 2nd survey 1957/58 | Further holdings found to be infected at 3rd survey 1958/59 |
| Kegalla | 75 | 110 | 60 |
| Avissawella | 209 | 127 | 82 |
| Colombo | 27 | 17 | 11 |
| Ratnapura | 291 | 186 | 73 |
| Matugama | 505 | 198 | 75 |
| Galle | 94 | 63 | 28 |
| | 1,201 | 701 | 329 |

This same survey revealed that a further 545 smallholdings planted in 1956 now show infection, raising the percentage infection of holdings planted in 1956 to 20.8% (Table II):

TABLE II

| D.A.O's Division | No. of holdings planted in 1956 showing infection at 1957/58 survey | No. of holdings planted in 1956 showing infection at 1958/59 survey |
|------------------|---|---|
| Kegalla ... | 20 | 46 |
| Avissawella ... | 42 | 86 |
| Colombo ... | 9 | 10 |
| Ratnapura ... | 115 | 168 |
| Matugama ... | 141 | 202 |
| Galle ... | 14 | 33 |
| | 341 | 545 |

In addition to the survey on holdings planted during the period 1953-56, investigations have shown that of 5,389 holdings planted in 1957, 433 acres (8%) are already infected (Table III).

TABLE III

| D.A.O's Division | No. of holdings planted in 1957 showing infection at 3rd survey 1958/59 | |
|------------------|---|----------|
| | Planted | Infected |
| Kegalla ... | 923 | 39 |
| Avissawella ... | 1,151 | 96 |
| Colombo ... | 749 | 11 |
| Ratnapura ... | 804 | 131 |
| Matugama ... | 1,338 | 141 |
| Galle ... | 424 | 15 |
| | 5,389 | 433 |

This would mean that altogether 3,549 permit-areas of the 15,906 smallholdings planted during the 5-year period 1953-57 are affected by White Root disease. The percentage infection now stands at 22.2%.

TABLE IV

| Year | No. of holdings planted | No. of holdings infected up to and including 3rd survey |
|----------|-------------------------|---|
| 1953 ... | 243 | 86 |
| 1954 ... | 2,300 | 889 |
| 1955 ... | 3,724 | 1,255 |
| 1956 ... | 4,250 | 886 |
| 1957 ... | 5,389 | 433 |
| | 15,906 | 3,549 |

Every one of these holdings has been visited by the field staff of this Department and suitable advice given to the smallholders.

As smallholders were not adopting proper treatment and control methods, it was decided to set down "Fomes Control Demonstration Plots" in the various ranges. Up to the time of writing 36 of such plots have been laid down.

8. SULPHUR DUSTING.

The State-aided Sulphur Dusting Scheme organized by this Department some years ago was further extended during the 1958/59 season. Dusting machines were loaned to 66 Co-operative Groups and the free services of Rubber Instructors were available to smallholders, as in previous years. This year, too, Government allocated funds for issue of sulphur dust to smallholders at subsidized rates.

Several modifications and alterations to the Dusting Scheme were made in 1957/58. These had resulted in a streamlining of dusting procedure and technique, so that throughout the dusting season the scheme had worked smoothly and according to plan. In 1958/59, therefore, no further major changes were considered necessary. The formation of tentative groups, however, was initiated about one month earlier than in the previous years.

The Sulphur Dusting Scheme was advertised in the Press by the usual notification in both Sinhala and English on 10th and 12th September 1958. An attractive leaflet on dusting and application forms were issued to field staff about the same time for distribution among the smallholders.

The response from the public, except in the Kalutara District, was poor. Only intensive and local propaganda by the field staff enabled the formation of the required number of groups. Although applications were received from 69 groups at the start, only 67 finally participated (Table V). One group in the Kegalla District defaulted in making payments. In the Matara District several smallholders in 2 groups at Imaduwa and Ibbawala cried off. The remaining smallholdings in the 2 groups were then amalgamated to form the combined Imaduwa/Ibbawala group.

TABLE V

| DISTRIBUTION OF DUSTING GROUPS | | |
|--------------------------------|--------------------------|--------------------------|
| District | No. of Groups 1957/58 | No. of Groups 1958/59 |
| Kalutara ... | 15 | 17 |
| Colombo ... | 12 | 14 |
| Kegalla ... | 9 | 15 |
| Ratnapura ... | 6 | 9 |
| Galle ... | 6 | 8 |
| Matara ... | 3 | 3 |
| Kandy ... | — | 1 |
| Total ... | 51 | 67 |

Even in those groups which were accepted, considerable difficulty was experienced in the collection of money for sulphur dust and other expenses. In

many instances the writer or the Divisional Advisory Officer had to personally intervene and persuade the smallholders, including in some cases the Group Organizers, not to withdraw from the Scheme. As in the previous year it was the 50% subsidy on dusting sulphur that served as the biggest attraction in persuading smallholders to join the Scheme.

In all 1,884 holdings were dusted, as against 1,471 holdings in 1957/58. It is pleasing to record that more genuine smallholders are now taking part in the Scheme.

The largest acreage to be dusted in a district was, as in previous years, at Kalutara (1,669½ acres), and the smallest in the Kandy district which was a newcomer to the scheme. The single dusting group there was organized with the greatest difficulty, as the Kandyan peasants were rather reluctant to join a scheme which, in their view, had so far not proved itself. The smallholders of Hataraliyadda in Galagedera range who had already formed themselves into a Rubber Producers' Society were finally with much persuasion made to participate. It speaks much for the working of the Scheme that half-way through the dusting season, many neighbouring smallholders wished to get their holdings, too, included for dusting even at this late stage.

As in 1958, wintering during the dusting season of 1959 was later than usual. The earliest holding to be dusted was in the Undugoda dusting group, Kegalla District, where dusting was commenced on 13.1.59. Dusting was completed first in the Malwana Group on 6th March 1959. The last to complete dusting was the one at Rathmale (Kalutara District), where dusting was finally concluded on 10th April 1959.

The average cost of dusting an acre (excluding cost of sulphur) showed a very slight decrease, Rs. 4/94 against Rs. 5/06 last year. This was mainly due to the fact that Group Organizers in several cases had helped to transport the dusting machines in their own vehicles at a nominal rate.

The Machine Operators continued to function satisfactorily and, in most cases, helped the Rubber Instructors materially.

The attitude of smallholders has not changed much from that reported in previous years. A contributory factor has been the fact that the incidence of Oidium in recent years has been comparatively mild.

Although in the districts where weather conditions did not favour Oidium much difference could not be seen between dusted and undusted holdings, the opposite was the case in the other areas, notably along the coastal belt. In this sector, the dusted holdings were successfully protected, showing, at the most, only a negligible leaf fall or only slight spotting, whereas the non-dusted ones were much more severely affected and showed considerable leaf fall.

Summary:

| | | | | |
|---------------------------------------|-----|-----|-----|----------|
| Number of holdings dusted | ... | ... | ... | 1,884 |
| Acreage dusted | ... | ... | ... | 6,246¾ |
| Number of dusting groups | ... | ... | ... | 67 |
| Number of acres per machine (average) | ... | ... | ... | 93 |
| Size of the smallest holding | ... | ... | ... | ¼ acre |
| Size of the largest holding | ... | ... | ... | 31 acres |
| Average number of holdings in a group | ... | ... | ... | 28 |
| Average size of a holding | ... | ... | ... | 3¼ acres |

• A total of 6,246 $\frac{3}{4}$ acres in 1,884 holdings were dusted successfully in the 1958/59 season. This constitutes the largest acreage of smallholdings to be dusted in one season. Nearly 70% of these holdings were below 10 acres each in extent and therefore qualified for receipt of sulphur dust at the subsidised rate.

8.1. Sulphur dusting during the 1959/60 Season.—Arrangements have been made for the dusting, during the forthcoming season, of 8,170 acres of rubber in 2,509 holdings. The 82 sulphur dusting groups, which have been formed, will be distributed accordingly to revenue districts as follows:—

| | | | |
|------------------|-----|-----|----|
| Colombo District | ... | ... | 15 |
| Kalutara | „ | ... | 20 |
| Kegalla | „ | ... | 20 |
| Ratnapura | „ | ... | 13 |
| Galle | „ | ... | 8 |
| Matara | „ | ... | 5 |
| Kandy | „ | ... | 1 |
| | | | 82 |

Sulphur dust at subsidized rate will be issued for dusting in 2,342 holdings, which are each below 10 acres in extent. Sulphur dust of an approved quality has been purchased and distribution of this dust among individual smallholders was completed by the end of the year.

Detailed instructions were given to the field staff on dusting methods and maintenance and care of the machine by the writer in early December, and a confirmatory instructional leaflet was issued on 8-12-59.

By the end of December all preparations were completed and everything was in readiness for commencement of dusting.

9. PUBLICITY UNIT.

A publicity unit to provide audio-visual instructions to smallholders and to also assist in propaganda work was added on to the Department in the latter part of the year.

Thanks to the financial assistance provided by the Rubber Controller, it became possible to organize a fully equipped mobile unit which commenced to function in the field from 26th October. By the end of the year a total of 34 propaganda meetings-cum-exhibitions had been held in various parts of the Island. These proved to be a great success and on an average 300 people had attended each meeting. This meant that in nearly every case the entire adult population of the village, in which the meeting was held, turned up. An evening's programme normally commenced at about 6-30 p.m. with a few lectures on some useful topics. This would be followed by a colour-slide show synchronized with a taped commentary. An exhibition of posters, specimens, etc. would follow and the day's programme would be concluded by about 9-30 p.m.

9.1. Poster Competition.—Professionals and Amateur Artists were invited to participate in a Poster Competition organized by this Department in collaboration with the Rubber Control Department. The subject matter was "the advisability of commencing tapping in rubber trees of only a suitable girth". A panel of judges, consisting of the Chairman, Director, Rubber Controller and the Chief Advisory Officer Smallholdings, selected the prize-winning entries at a meeting held on 2.9.59. Representatives of the press who were invited to be present at this adjudication were kind enough to give it wide publicity. Copies of the first of the prize-winning entries were printed and distributed widely throughout the rubber-growing districts of the Island by the end of the year.

REPORT OF THE ESTATE DEPARTMENT

By

L. WIJYEGUNAWARDENA

SUMMARY

The Institute's stations of Dartonfield, Nivitigalakele and Hedigalla, in extent 1,491 acres, 0 rood and 30 perches, bear a planted acreage of 1,011 of which 467 acres, 2 roods and 11 perches were tapped during the year. 57 acres at Hedigalla were under nursery for the Rubber Replanting Subsidy Scheme.

Weather conditions were not conducive to the harvesting of crop. The South-West monsoon rains were protracted, causing extensive wind damage in the outlying divisions, and finally merged with the North-East monsoonal rains.

A crop of 271,074 lb., representing an average of 631.9 lb. per acre, was obtained. The price differentials obtaining for crepe and sheet determined the type of manufacture.

The immature rubber acreage was reduced from 620 acres, 2 roods, 3 perches in 1958 to 523 acres, 3 roods, 12 perches in 1959, the difference representing the acreage brought into bearing.

The dry weather experienced during the first quarter of the year impeded the activity of *Oidium heveae*. Sulphur dusting very successfully controlled the mild attack of this leaf disease.

A fairly high incidence of *Phytophthora* leaf fall was recorded during the year. The weather conditions that prevailed during the second and third quarters of the year were very favourable for the build up of inoculum and the spread of *Phytophthora*. Good results were, however, obtained with the dusting technique employed using copper-based fungicides.

With the use of the organo-mercuric fungicides, Antimucin and Kankerdood, the incidence of Bark Rot was considerably reduced compared with previous years. A complete control has, however, not been achieved.

Budwood of the RRIC series of clones continued to be in demand and issues to 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.

A record of work during the year in connexion with maintenance of buildings, new buildings, power and water supply is given in the body of the report.

An agreement was entered into with the Department of Government Electrical Undertakings to obtain A.C. supply for the Institute.

The Rubber Replanting Subsidy Scheme nursery at Hedigalla continued to be supervised throughout 1959. The Nursery was in full production.

Estimates for 1960 connected with the working of the Group, maintenance works of the Institute, field and factory experiments, etc. were prepared by the writer and approved by the Rubber Research Board.

DETAILED REPORT

1. GENERAL.

1.1. Staff.—The Superintendent was on duty during the year except for the period 17th March to 1st June which included a part of his end-of-contract leave. The Assistant Superintendent acted for him during this period.

The Assistant Superintendent, Mr. D.de S.de Fonseka was on duty throughout the year.

Mr. D. H. Abeywickrema was appointed Works Inspector on the Intermediate Staff Grade and assumed duties on 16-1-1959.

The following officers in the Assistant Staff resigned on the dates mentioned:—

- 30-5-59 — Mr. D. A. Jayasinghe, Accounts Clerk.
- 5-7-59 — „ S. D. Jayaweera, Field Assistant attached to Soils Department.

Mr C. Jeyaraj was appointed Accounts Clerk on 17th September 1959 in place of Mr. Jayasinghe.

The following Minor Staff appointments were made:—

- 1-1-59 — Mr. J. D. Sirisena, Electrical Attendant.
- 1-1-59 — „ K. A. Sadiris, Estate Office Peon.
- 1-4-59 — „ W. D. Armon, Field Attendant, for Plant Breeding work in Botany Department.
- 1-7-59 — „ D. S. Dedduwakumara, Field Attendant, for Botany Department work.

The Estate Department cadre stood at 58 at the close of the year, made up as follows:—

| | | | | |
|--------------------|-----|-----|-----|----|
| Senior Staff | ... | ... | ... | 1 |
| Intermediate Staff | ... | ... | ... | 2 |
| Assistant Staff | ... | ... | ... | 24 |
| Minor Staff | ... | ... | ... | 31 |

1.2. Visiting Agent.—Mr. C. A. C. Bowen paid two visits to the Institute's properties during the year. Reports on these visits were submitted to the Rubber Research Board.

Mr. Bowen intimated at the last visit that he would be retiring shortly. The writer records with deep appreciation the solicitous manner in which problems connected with the estate were dealt with by Mr. Bowen.

1.3. Correspondence.

| | | | | |
|---------|-----|-----|-----|-------|
| Inward | ... | ... | ... | 401 |
| Outward | ... | ... | ... | 1,145 |

1.4. Weather (Estate Gauge).—Comparative rainfall figures (inches) for 1958 and 1959 are shown below:

| Month | Dartonfield | | Nivitigalakele | | Hedigalla | |
|-------------------------|---------------|---------------|----------------|---------------|---------------|---------------|
| | 1959 | 1958 | 1959 | 1958 | 1959 | 1958 |
| January | 3.15 | 8.64 | 3.04 | 10.80 | 8.01 | 10.25 |
| February | 3.23 | 5.10 | 3.61 | 7.70 | 9.89 | 10.11 |
| March | 2.01 | 13.05 | 2.95 | 15.30 | 11.55 | 19.25 |
| April | 18.28 | 12.49 | 19.06 | 11.55 | 18.73 | 15.88 |
| May | 16.08 | 23.28 | 18.53 | 22.30 | 18.22 | 26.34 |
| June | 28.30 | 18.33 | 32.71 | 19.50 | 32.40 | 25.51 |
| July | 12.79 | 4.96 | 15.52 | 6.25 | 14.90 | 7.04 |
| August | 14.59 | 8.43 | 16.93 | 8.35 | 16.75 | 13.44 |
| September | 19.16 | 6.46 | 18.10 | 5.95 | 22.07 | 7.19 |
| October | 12.16 | 23.52 | 14.55 | 23.85 | 27.60 | 27.28 |
| November | 15.61 | 10.46 | 16.02 | 14.87 | 23.28 | 16.70 |
| December | 6.37 | 14.91 | 6.69 | 9.89 | 17.40 | 22.78 |
| Total | 151.73 | 149.63 | 167.71 | 156.31 | 220.80 | 201.77 |
| Average (5 year period) | 157.9" | | 159.2" | | 195.5" | |
| Total No. of Wet Days | 223 | 207 | 162 | 149 | 255 | 242 |

The rainfall for the year at Dartonfield, Nivitigalakele and Hedigalla Divisions amounted to 151.7", 167.7" and 220.8" respectively. The first quarter was particularly dry, bordering on conditions of drought. With the breaking in of the South-West monsoon which gained in intensity reaching its peak with a rainfall of 30 inches in June; extensive wind damage was caused on the outlying divisions of Nivitigalakele and Hedigalla. This wet spell continued throughout the third quarter recording a fall of approximately 50 inches, an intensity which was last experienced in 1953.

The rainfall trends at Hedigalla have shown a steady increase of 20 inches per year since 1957.

1.5. Acreage Summary—Dartonfield Group.

| Rubber | Dartonfield | | | Nivitigalakele | | | Hedigalla | | | Total | | |
|------------------------------------|-------------|----------|-----------|----------------|----------|-----------|--------------|----------|-----------|--------------|----------|-----------|
| | A. | R. | P. | A. | R. | P. | A. | R. | P. | A. | R. | P. |
| Mature | 104 | 3 | 08 | 126 | 2 | 11 | 236 | 0 | 32 | 467 | 2 | 11 |
| Immature | 28 | 3 | 29 | 20 | 0 | 08 | 474 | 3 | 15 | 523 | 3 | 12 |
| Nurseries | 5 | 2 | 00 | 14 | 1 | 07 | — | — | — | 19 | 3 | 07 |
| Total Rubber | 139 | 0 | 37 | 160 | 3 | 26 | 711 | 0 | 07 | 1,011 | 0 | 30 |
| Abandoned due to wind damage, etc. | — | — | — | 2 | 0 | 04 | — | — | — | 2 | 0 | 04 |
| Building sites | 32 | 1 | 18* | 7 | 3 | 29* | 8 | 1 | 18* | 48 | 2 | 25* |
| Pinewood plantation | — | — | — | — | — | — | 1 | 0 | 34 | 1 | 0 | 34 |
| Roads | 6 | 2 | 22 | 0 | 3 | 27 | 9 | 0 | 04 | 16 | 2 | 13 |
| Swampy areas | — | — | — | 0 | 2 | 08 | 0 | 2 | 20 | 1 | 0 | 28 |
| Streams and reservations | 0 | 0 | 29 | — | — | — | 13 | 0 | 29 | 13 | 1 | 18 |
| Jungles, etc. | — | — | — | 1 | 3 | 38 | 393 | 0 | 00 | 396 | 3 | 38 |
| Grand Total | 178 | 1 | 26 | 174 | 1 | 12 | 1,138 | 1 | 32 | 1,491 | 0 | 30 |

*Acreage figures were adjusted due to felling of rubber trees in certain areas for a large building project.

The total cultivated acreage of the Group was 1,011 acres by the end of the year. The acreage in full bearing increased from 384 acres, 2 roods, 36 perches in 1958 to 467 acres, 2 roods, 11 perches in 1959.

1.6. Crop.—Weather conditions were not conducive to the harvesting of crop, particularly on Hedigalla Division. Dartonfield and Nivitigalakele exceeded the estimated crop by 5,706 lb. and 2,593 lb. respectively, whilst Hedigalla fell short of the estimate by 12,225 lb. The total crop harvested was 98.5% of the Group estimate.

| | | | | |
|-----------|-----|---------|--------|---------|
| | | 1959 | | 1958 |
| Estimated | ... | 275,000 | | 250,000 |
| Harvested | ... | 271,074 | | 269,399 |
| | | <hr/> | | <hr/> |
| Deficit | ... | 3,926 | Excess | 19,399 |

Test tapping biscuits received from experimental areas on other estates, being 5,737 lb., resulted in a total manufacture of 276,811 lb. for the season at Dartonfield factory.

Comparative Yield Records of Individual Fields

| Dartonfield | | Acreage in Tapping | Total Yield in lb. | | Yield per acre | |
|-------------|----------------|--------------------|--------------------|--------|----------------|--------|
| | | | 1959 | 1958 | 1959 | 1958 |
| 1934 | Replanted Area | 7½ | 7,146 | 8,119 | 952.8 | 1082.5 |
| 1936 | " " | 9½ | 6,133 | 6,562 | 645.6 | 690.7 |
| 1938 | " " | *16 | 14,963 | 15,986 | 935.2 | 888.1 |
| 1939 | " " | 2 | 1,475 | 1,654 | 737.5 | 827.0 |
| 1941 | " " | 6½ | 5,032 | 4,898 | 774.2 | 753.5 |
| 1947 | " " | †8¼ | 8,239 | 8,670 | 998.7 | 845.8 |
| 1950/51 | " " | 25¾ | 14,000 | 11,713 | 543.7 | 454.8 |
| 1952 | " " | 30¼ | 11,418 | 4,109 | 377.5 | 241.7 |
| | | <hr/> | <hr/> | <hr/> | <hr/> | <hr/> |
| | | 105¾ | 68,406 | 61,711 | 646.9 | 639.5 |

| Nivitigalakele | | Acreage in Tapping | Total Yield in lb. | | Yield per acre | |
|----------------|----------------|--------------------|--------------------|---------|----------------|---------|
| | | | 1959 | 1958 | 1959 | 1958 |
| 1926 | Replanted Area | 10½ | 6,910 | 8,226 | 658.1 | 632.7 |
| 1927 | " " | 9¾ | 6,257 | 7,992 | 641.7 | 819.6 |
| 1928 | " " | 10½ | 6,482 | 7,486 | 617.3 | 712.9 |
| 1935 | " " | 28½ | 20,816 | 23,619 | 730.4 | 774.4 |
| 1939 | " " | 10¼ | 9,519 | 9,986 | 928.7 | 974.2 |
| 1940 | " " | 9¾ | 8,146 | 9,484 | 835.5 | 972.7 |
| 1940 | Swamp Area | 3¼ | 4,436 | 4,444 | 1,364.9 | 1,367.4 |
| 1941 | Clearing | 7 | 7,798 | 8,283 | 1,114.0 | 1,183.3 |
| 1942 | " " | 4½ | 5,249 | 5,516 | 1,166.4 | 1,225.7 |
| 1943 | " " | 7 | 4,977 | 4,852 | 711.0 | 693.1 |
| 1944 | " " | 4½ | 4,858 | 5,027 | 1,079.6 | 1,117.1 |
| 1946 | Replanted Area | 21 | 27,345 | 26,816 | 1,302.2 | 1,276.9 |
| | | <hr/> | <hr/> | <hr/> | <hr/> | <hr/> |
| | | 126½ | 112,793 | 121,731 | 891.6 | 929.2 |

* 18 acres in 1958

† 10¼ acres in 1958

Hedigalla

| | | | | | |
|------------------------------------|-------------------------------|---------------------|---------------------|-------------------|-------------------|
| 1943 Clearing | 10 $\frac{1}{4}$ | 7,612 | 8,146 | 742.6 | 794.7 |
| 1944 " | 11 $\frac{3}{4}$ | 7,507 | 8,417 | 638.9 | 716.3 |
| 1945 " | 22 $\frac{1}{4}$ | 12,982 | 13,191 | 583.5 | 592.8 |
| 1946 " | 12 $\frac{3}{4}$ | 8,580 | 9,476 | 672.9 | 743.2 |
| 1947 " | 45 | 24,948 | 26,013 | 554.4 | 578.1 |
| 1949 " | 34 $\frac{3}{4}$ | 16,758 | 11,795 | 482.3 | 339.4 |
| 1950/51 " | 20 | 4,091 | 3,544 | 204.5 | 177.2 |
| 1952 Clearing (Part) | 40 | 7,397 | — | 184.9 | — |
| | <hr/> 196 $\frac{3}{4}$ <hr/> | <hr/> 89,875 <hr/> | <hr/> 80,582 <hr/> | <hr/> 456.8 <hr/> | <hr/> 514.1 <hr/> |
| Total for the Group | 429 | 271,074 | 264,024 | 631.9 | 687.1 |
| T.T. biscuits from outside estates | — | 5,737 | 5,375 | | |
| | <hr/> 429 <hr/> | <hr/> 276,811 <hr/> | <hr/> 269,399 <hr/> | | |

1.7. Tapping.—(a) Tapping was resumed after the usual wintering rest, on 16th, 9th and 17th March at Dartonfield, Nivitigalakele and Hedigalla respectively. The uneven wintering of trees was most noticeable due to the numerous clones planted in close proximity to one another.

During the resting period, tapping panels were marked with the appropriate bark consumption in keeping with the systems of tapping adopted in the various experimental clearings.

(b) Yields of fields are, in general, of the expected order, except in fields which are under various tapping systems for experimental purposes.

1.7.1. Dartonfield Division.

(a) The decrease in yield in the 7 $\frac{1}{2}$ acre area replanted in 1934 with clones Gl 1, AVROS 256 and PB 25, tapped on V/2 d/2 (ladder tapping), is due to the tapping cuts in virgin bark approaching the bark of second renewal on the old tapping panels.

(b) The decrease in yield in the 2-acre block of 1939 replanting is mainly due to the obsolete experimental clones, such as TK 12, TK 26 and AVROS 163, which are susceptible to bark diseases.

(c) The increase in yield per acre in the 1938 and 1947 replantings is due to reduction in the acreage for building purposes during 1959.

1.7.2. Nivitigalakele Division.

(a) The decrease in yield in the 1927 replanted area of 9 $\frac{3}{4}$ acres is due to cessation of the Yield Stimulation Experiment.

(b) The decrease in yield in the 1928 replanted area of 10 $\frac{1}{2}$ acres is due to V/2 S/2 cuts (ladder tapping) on virgin bark approaching bark of second renewal on the normal tapping panels.

(c) The decrease in yield in the 1935 replanting of 28½ acres is due to stoppage of tapping in part of the field in connexion with plant breeding work.

(d) The decrease in yield in the 1940 clearing of 9¼ acres is due to the unprecedented *Phytophthora* leaf fall this year. This was the worst affected area in the Group. The adjoining fields planted in 1939 and 1941 were also adversely affected.

1.7.3. Hedigalla Division.

The yields from most fields in 1959 were far below the estimate and much higher yields were expected from the young rubber in tapping. The adverse effect of a heavy rainfall of 220.8 inches, resulting in a further reduction of the number of tapping days from 242 days in 1958 to 218 days in 1959, was undoubtedly responsible for the loss of crop. A loss of over 60 days of tapping was noted in relation to the other Divisions.

1.7.4. Analysis of tapping rounds on Dartonfield Group for 1959 (1958 figures in brackets.)

Dartonfield Division:

| | Early tapping | Late tapping | No tapping | | | |
|-----------------|---------------|--------------|-------------|---------|----------|--|
| | | | Winter rest | Rain | Holidays | |
| 1st Quarter ... | 61 (61) | 3 (1) | 23 (23) | — (1) | 3 (4) | |
| 2nd Quarter ... | 34 (33) | 32 (23) | — | 20 (31) | 5 (4) | |
| 3rd Quarter ... | 37 (69) | 30 (14) | — | 25 (9) | — (—) | |
| 4th Quarter ... | 59 (54) | 23 (26) | — | 8 (10) | 2 (2) | |
| | 191 (217) | 88 (64) | 23 (23) | 53 (51) | 10 (10) | |

Nivitigalakele Division:

| | | | | | | |
|-----------------|-----------|---------|---------|---------|-------|--|
| 1st Quarter ... | 66 (59) | 2 (8) | 22 (22) | — (1) | — (—) | |
| 2nd Quarter ... | 39 (28) | 27 (27) | — (—) | 19 (31) | 6 (5) | |
| 3rd Quarter ... | 46 (68) | 25 (14) | — (—) | 21 (10) | — (—) | |
| 4th Quarter ... | 61 (50) | 20 (31) | — (—) | 10 (11) | 1 (—) | |
| | 212 (205) | 74 (80) | 22 (22) | 50 (53) | 7 (5) | |

Hedigalla Division:

| | | | | | | |
|-----------------|-----------|---------|---------|----------|-------|--|
| 1st Quarter ... | 52 (60) | 16 (5) | 19 (15) | 2 (7) | 1 (3) | |
| 2nd Quarter ... | 20 (38) | 19 (5) | — (—) | 44 (43) | 8 (5) | |
| 3rd Quarter ... | 34 (56) | 14 (18) | — (—) | 44 (18) | — (—) | |
| 4th Quarter ... | 51 (23) | 12 (37) | — (—) | 29 (22) | — (—) | |
| | 157 (177) | 61 (65) | 19 (15) | 119 (90) | 9 (8) | |

1.8. **Manufacture.**—A summary of the various forms of manufacture during the year is given overleaf:—

| Latex Grades | | Total in lb. | Percentage |
|-----------------------|---------|--------------|------------|
| Smoked Sheet | No. 1 | 15,284 | 5.52 |
| " | " No. 2 | 1,960 | .71 |
| " | " No. 3 | 280 | .10 |
| Pale Crepe | No. 1 | 146,331 | 52.86 |
| " | " No. 2 | 23,062 | 8.33 |
| " | " No. 3 | 36,892 | 13.33 |
| Latex for Experiments | | 5,854 | 2.12 |
| | | <hr/> | <hr/> |
| | | 229,663 | 82.97 |
| | | <hr/> | <hr/> |
| Scrap Grades | | | |
| Scrap Crepe | No. 1 | 37,625 | 13.59 |
| " | " No. 2 | 8,200 | 2.96 |
| " | " No. 3 | 471 | .17 |
| Scrap for Experiments | | 852 | .31 |
| | | <hr/> | <hr/> |
| | | 47,148 | 17.03 |
| | | <hr/> | <hr/> |
| Grand Total | | 276,811 | 100.00 |
| | | <hr/> | <hr/> |

With the increased acreages of experimental areas of numerous clones with diverse latices coming into bearing in the near future at Hedigalla, the production of a uniform No. 1 Crepe seems pregnant with difficulties.

1.9. Miscellaneous.

Field and Factory Experiments.—The Chemistry, Botany, Plant Pathology and Soils Departments were given assistance in carrying out their field and factory experiments.

Estimates.—Estimates for 1960 Capital and Revenue Expenditure 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 condition.

Manuring.—Mature areas of the Group received their quota of fertilisers in keeping with the R.R.I. programme.

Weeding.—Fields were well weeded and maintained clean and tidy.

2. PESTS AND DISEASES.

2.1. Oidium heveae.—The dry weather conditions, with the absence of a morning mist, appreciably reduced the activity of Oidium. A complete control of the spread of a mild attack was achieved by dusting with sulphur. The mature areas of the Group carried an exceptionally fine canopy of leaves after the 'winter rest'.

2.2. Phytophthora palmivora.—The waning of the South-West monsoon in July, and the low temperatures obtaining, afforded very favourable conditions

for the build up of inoculum and the spread of Phytophthora. A fairly high incidence of Phytophthora leaf fall was a notable feature this year. In July the leaf fall at Dartonfield and Hedigalla Divisions was confined to scattered trees in the fields which bore a heavy pod set.

At Nivitigalakele Division despite well spaced rounds of copper dusting, a sudden outbreak of leaf fall in mid-July caused some concern, the affected areas being confined to 1935, 1940, 1941 and 1942 plantings. The leaf fall was, however, controlled by concentrated spot dusting of copper fungicide at the higher poundage rate. Excellent results were obtained with the dusting technique employed.

2.3. Bark Rot.—The incidence of Bark Rot was considerably reduced compared with that of previous years, particularly at Hedigalla.

With the use of the organo-mercuric fungicides, Antimucin and Kankerdood, there was a marked reduction in the spread of bark rot on trees which had previously been affected. A complete control has, however, not yet been achieved.

2.4. Root Diseases.—A few scattered cases of *Fomes lignosus* and *Ustulina zonata* were found in the mature areas of the Group. Routine measures of control were adopted. Details of loss of trees were given in the monthly reports of this Department.

3. CAPITAL ACCOUNT—AGRICULTURAL DEVELOPMENT.

Dartonfield Division—Immature Replanted Areas

| | | | | |
|---------------------|-----|-----|-----|---------------------|
| 1953 Replanted Area | ... | ... | ... | 11½ |
| 1953 | „ | „ | ... | 5 (Planted in 1956) |
| 1954 | „ | „ | ... | 7¾ |
| 1955/56 | „ | „ | ... | 4¾ |
| | | | | <hr/> 29 <hr/> |

Nivitigalakele Division—Immature Areas

| | | | | |
|---------------|-----|-----|-----|----------------|
| 1953 Clearing | ... | ... | ... | 10 |
| 1954 | „ | ... | ... | 10 |
| | | | | <hr/> 20 <hr/> |

Hedigalla Division—Immature Areas

| | | | | |
|---------------|-----|-----|-----|------------------|
| 1952 Clearing | ... | ... | ... | 39½ |
| 1953 | „ | ... | ... | 142 |
| 1954 | „ | ... | ... | 177½ |
| 1955 | „ | ... | ... | 78 |
| 1956 | „ | ... | ... | 60 |
| 1957 | „ | ... | ... | 17¼ |
| | | | | <hr/> 514¼ <hr/> |

3.1. 1955 Clearing, Hedigalla.—(a) Twenty acres of nursery beds lined along the avenues between two rows of plants spaced 30 feet apart, leaving a distance

of seven feet on either side of the plants, originally prepared for the Rubber Replanting Subsidy Scheme, were removed in the course of the year. It is interesting to note that there was no noticeable adverse effect on the growth of the rubber plants in this clearing due to the presence of nursery plants for a period of 2½ to 3 years.

(b) Two acres were planted with budded stumps of clones PB 86 and CH 26 for the North-East planting in the low-lying areas of this clearing.

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.

3.2. Trees Uprooted—Mature and Immature Areas.

| Dartonfield | | Mature Areas | 1953 | 1954 | 1955/56 |
|--------------------|-----|--------------|-------|-------|---------|
| Wind damaged | ... | 89 | 1 | — | 2 |
| Building sites | ... | 117 | 40 | — | — |
| Fomes lignosus | ... | 6 | 2 | 2 | — |
| Thinning out | ... | 1 | — | — | — |
| | | <hr/> | <hr/> | <hr/> | <hr/> |
| | | 213 | 43 | 2 | 2 |
| | | <hr/> | <hr/> | <hr/> | <hr/> |

| Nivitigalakele | | Mature Areas | 1953 | 1954 |
|-----------------------|-----|--------------|-------|-------|
| Wind damaged | ... | 80 | 1 | 1 |
| Building sites | ... | 13 | — | — |
| Fomes lignosus | ... | 10 | 1 | 6 |
| Ustulina zonata | ... | 17 | — | 2 |
| Brown Bast Nodules | ... | 8 | — | — |
| Bleeding Canker | ... | 3 | — | — |
| | | <hr/> | <hr/> | <hr/> |
| | | 131 | 2 | 9 |
| | | <hr/> | <hr/> | <hr/> |

| Hedigalla | | Mature Areas | 1952 | 1953 | 1954 | 1955 | 1956 |
|--------------------|-----|--------------|-------|-------|-------|-------|-------|
| Wind damaged | ... | 560 | 72 | 64 | 64 | 5 | 1 |
| Thinning out | ... | 181 | 9 | 739 | 22 | — | — |
| Fomes lignosus | ... | 6 | — | 18 | 83 | 7 | 3 |
| Ustulina zonata | ... | 11 | — | — | — | 1 | — |
| Fomes noxius | ... | 13 | — | 10 | 10 | 6 | 1 |
| Brown Bast Nodules | ... | 2 | — | — | — | — | — |
| Bleeding Canker | ... | 2 | — | — | — | — | — |
| | | <hr/> | <hr/> | <hr/> | <hr/> | <hr/> | <hr/> |
| | | 775 | 81 | 831 | 179 | 19 | 5 |
| | | <hr/> | <hr/> | <hr/> | <hr/> | <hr/> | <hr/> |

4. NURSERIES.

4.1. Dartonfield Seedling and Budwood Nurseries.

Routine weeding and clearing of drains were carried out in all the nurseries. Plants were manured in accordance with the Institute's recommendations.

4.2. Nivitigalakele—(a) Seedling Nurseries.

(i) Overgrown plants in these nurseries were discarded. 7,000 Tjir 1 seedlings were planted in the 1 acre nursery during September.

(ii) The vigorous growing stocks in these nurseries were budded to meet the following requirements:—

| | | |
|-------|---------------|--|
| 1,100 | budded stumps | for commercial estates. |
| 200 | „ „ „ | Plant Pathology Department. |
| 447 | „ „ „ | Eladuwa Estate (supplies for Clone Trial). |
| 500 | „ „ „ | Hedigalla Division. |
| 2,925 | „ „ „ | Kepitigalla (Oidium Testing Station). |

(b) **Twinned Seedling Nurseries.**—The Plant Breeding Section utilised the good growers in the 1947 nursery as stocks for their requirements of budded stumps.

(c) **Budwood Nursery.**—(i) Overgrown plants were cut back for obtaining fresh budwood.

(ii) 758 yards of budwood of various clones were sold to estates and small-holdings and 244 yards were used at the Nivitigalakele nurseries for multiplication.

5. BUDWOOD OF EXCHANGE CLONES.

(i) Consignments of budwood were received from the following sources and were budded in the Nivitigalakele nurseries:—

| | | | | |
|---------|--------------|-------------|----------|----------|
| Liberia | 〔 | 6 clones on | ... | 5- 6-59 |
| | | 5 „ „ | ... | 5-12-59 |
| Miami | 15 clones on | ... | 25- 6-59 | |
| Miami | 〔 | 5 „ „ | ... | 14-10-59 |
| | | 10 „ „ | ... | 19- 8-59 |

(ii) Consignments of budwood were despatched to the following destinations:—

| | | | |
|---------------|-----|--------------|------------------------------|
| Liberia | ... | 12 clones on | 15- 4-59 |
| Miami | ... | 6 „ „ | 20- 4-59 |
| Malaya | ... | 52 „ „ | 21-10-59, 28-10-59 & 5-11-59 |
| South Vietnam | ... | 20 „ „ | 10-11-59 |

6. LABOUR AND HEALTH.

Labour was settled and adequate for work done this year. Line room accommodation was satisfactory. Wages were paid during the year in accordance with the Wages Boards Ordinance in force.

Dartonfield Group

| <i>Working Ceylonese</i> | Resident | Non-resident | Total |
|--------------------------|----------|--------------|-------|
| Men | 99 | 153 | 252 |
| Women | 83 | 63 | 146 |
| Children | — | — | — |

| | | | | |
|---------------------------|-----|-----|-----|-----|
| <i>Working Immigrants</i> | | | | |
| Men | ... | 33 | — | 33 |
| Women | ... | 28 | — | 28 |
| Children | ... | — | — | — |
| | | — | — | — |
| Total | ... | 243 | 216 | 459 |

Annual Holidays.—Annual holidays with pay were given to all labourers who were entitled to these in accordance with the Ordinance.

Maternity Benefits.—Eighteen full maternity benefits and 3 medical wants benefits payments were made.

Feeding Children and Milk Foods.—Free rations and $\frac{1}{4}$ lb. of bread were issued to each non-working child. Milk foods were issued to all infants whose mothers were incapable of nursing them.

Health.—The health of the members of the Institute's staff and of the estate labourers was satisfactory during the year.

Anti-Mosquito Measures.—DDT/Gammexane spraying was carried out throughout the year, at regular intervals, in and around the bungalows and lines under the supervision of the Apothecary.

Births.—Eleven children were born during the year on the Group.

Deaths.—There were no deaths on the Group this year.

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

| | | | | |
|-------------------------|-----|-----|-----|-------|
| Influenza | ... | ... | ... | 490 |
| Ulcers | ... | ... | ... | 74 |
| Ankylostomiasis | ... | ... | ... | 61 |
| Diarrhoea and Enteritis | ... | ... | ... | 103 |
| Ear diseases | ... | ... | ... | 84 |
| Other diseases | ... | ... | ... | 1,185 |
| | | | | — |
| Total | ... | ... | ... | 1,997 |

7. MAINTENANCE OF BUILDINGS, ETC.—REVENUE ACCOUNT.

7.1. General.

General Buildings.—Offices and laboratories were colour washed and all minor repairs found necessary were effected.

Bungalows.—All Senior, Intermediate and Assistant Staff Bungalows were maintained in good order. Some were completely colour washed and painted according to the programme of work for the year.

Cottages.—All cottages within the Group were maintained in good order and repairs were effected where necessary.

Water and Power Supply.—A very satisfactory standard was maintained throughout the year.

Bungalow Furniture.—Polishing of bungalow furniture was carried out according to the programme for the year. The unserviceable articles rejected by the Institute's Board of Survey were replaced during the year. Repairs to furniture were carried out where necessary.

Motor Vehicles.—A new Austin Truck was purchased in place of the Dodge Pick-up Truck which was sold. All vehicles were maintained satisfactorily throughout the year.

Machinery.—Messrs. H. W. Hammond & Co., Consulting Engineers, visited the Institute on 19th, 20th and 21st February 1959 and on 3rd March 1959 and inspected all the power plants and machinery. Their report, dated 4th March 1959, was submitted to the Rubber Research Board. The recommendations made by the Visiting Engineers were implemented.

7.2. Power Plant.—The Institute's Power Plant is comprised of the following:—

Dartonfield Division.

(a) 80/90 B.H.P. National Engine with a 'V' belt driven 55 K.W. D.C. 230 Volts Compound Wound Generator.

(b) 240 B.H.P. Blackstone Four Cylinder Vertical Diesel Engine direct coupled to a D.C. 180 K.W. 230 Volts D.C. Compound Wound Generator.

(c) 40 B.H.P. Lister Four Cylinder Diesel Oil Engine direct coupled to a 24 K.W. 230 Volts D.C. Compound Wound Generator.

Nivitigalakele Division.

(a) Two 12 B.H.P. two Cylinder Vertical Ruston Engine direct coupled to a 10 KVA 3 phase 4 wire 400/230 Volts Alternator.

(b) 5 B.H.P. Vertical Four Stroke National Oil Engine with a 'V' belt driven 2½ K.W. 230 Volts D.C. Generator. This unit was sold during the year.

Hedigalla Division.—20 B.H.P. Gardner Single Cylinder Horizontal Engine with a 'V' belt driven 12 K.W. 230 Volts D.C. Generator.

Maintenance of Power Plant.—Maintenance work was carried out at regular intervals according to the maker's recommendations and the plant was maintained in good order.

Fuel and Lubricating Oil consumption.

| | Liquid Fuel per hour in gallons | Lubricating oil per hour in pints |
|-------------------------------------|------------------------------------|--------------------------------------|
| 80/90 B.H.P. National Engine ... | 2.9 | 1.8 |
| 40 B.H.P. Lister Engine ... | 1.19 | 0.11 |
| 240 B.H.P. Blackstone Engine ... | 3.55 | 0.5 |
| 20 B.H.P. Gardner Engine ... | 0.56 | 0.44 |
| 12 B.H.P. Ruston Engine (No. 1) ... | 0.34 | 0.03 |
| 12 B.H.P. Ruston Engine (No. 2) ... | 0.32 | 0.03 |

7.3. Machinery.

Factory Machinery.—There were no additions to factory machinery. All machinery were maintained in good order.

6 N.H.P. Vertical Cross Tube Cradley Boiler.—This boiler worked satisfactorily throughout the year. Repairs to manholes were done on the recommendations of the Visiting Engineers.

Battery House.—The N.I.F.E. type battery of 200 cells which is now redundant was offered for sale.

Water Pumps.—(a) Three 4" × 5" double acting Horizontal Myres Bulldozer pump driven by 5 H.P. D.C. motors functioned satisfactorily.

(b) The 4" × 5" double acting Horizontal Lee Howel pump driven by a 5 H.P. 230 Volts D.C. motor worked satisfactorily.

(c) The double acting horizontal pump driven by 2 H.P. 220 Volts D.C. motor worked satisfactorily throughout the year.

Machinery in Laboratories.—All electrical machinery in the laboratories were tested by the Visiting Engineer. Any repairs found necessary were attended to. Several alterations and extensions of a minor nature were carried out.

Drying Rooms.—Two drying rooms fitted with hot water radiators and the Beeston Boiler worked satisfactorily throughout the year. A new cowl and chimney was fitted to the Boiler.

8. NEW BUILDINGS, ETC.—CAPITAL ACCOUNT.

8.1. Dartonfield Division.—The following buildings were completed and taken over:—

- (a) Four Intermediate Staff Bungalows.
- (b) Five Assistant Staff Bungalows Grade I.
- (c) Two Double Cottages for labourers.
- (d) Extension to Club House.
- (e) Sulphur and Manure Shed.
- (f) Two enclosed garages.
- (g) Enclosing of lorry garages.

The following buildings were under construction during the period under review:—

- (a) Extension to Assistant Staff Bungalows Nos. 16 and 17.
- (b) Extension to Intermediate Staff Bungalow No. 3.
- (c) Construction of Soils Laboratory (Preliminary Work).
- (d) One Double Cottage for Minor Staff.
- (e) Superintendent's Bungalow.

8.2. Nivitigalakele Division.—The following buildings were completed and taken over:—

- (a) Intermediate Staff Bungalow.
- (b) Single Cottage for Minor Staff.
- (c) Double Cottage for labourers.

Preliminary work in connexion with the extension to the field laboratory commenced late in December 1959.

8.3. Hedigalla Division.—The following buildings were under construction during the year:—

- (a) Estate Office and Visitors' Room.
- (b) One Assistant Staff Bungalow Grade II.
- (c) One Single Cottage for Minor Staff.

8.4. Water Supply at Dartonfield.—Arising from the recent increase in the resident population and housing accommodation, together with the envisaged laboratory buildings and extensions, it was found expedient to augment the water supply available for both laboratory and domestic use. A suitable modified scheme was drawn up. The implementation of this scheme is on hand and a new reinforced concrete tank of 12,000 gallons capacity was constructed to provide sufficient storage capacity for factory water supply. Improvements to the upper dam was also carried out.

8.5. Power Supply at Dartonfield.—An agreement was entered into with the Department of Government Electrical Undertakings to obtain a load of 250 K.V.A. to meet the power requirements of the factory, laboratories and for domestic use. Action was taken to prepare detail plans and specifications for switch gear, cables, motors, etc. necessary for the conversion from D.C. to A.C. supply.

9. RUBBER REPLANTING SUBSIDY SCHEME NURSERY AT HEDIGALLA.

9.1. Supervision.—The Estate Superintendent, R.R.I.C., paid supervisory visits to this nursery.

9.2. Staff.—Mr. D. D. Liyanearatchy, Nursery Manager, resigned with effect from 1st April 1959 and Mr. L. Samaranayake, Assistant Nursery Manager, has been in charge of the nursery under the supervision of the Assistant Superintendent stationed at Hedigalla Division.

9.3. Rainfall.—220.8 inches were recorded as against 201.8 inches in the previous year.

9.4. Seedling Nursery.—(a) A reduction of the nursery acreage from 77 acres to 57 acres was effected after the issues were made for the South-West planting season. The area abandoned was twenty acres of nursery beds lined along the avenues between two rows of plants spaced 30 feet apart, leaving a distance of seven feet on either side of the plants, which were prepared for the Rubber Replanting Subsidy Scheme in the 1955 clearing under rubber at Hedigalla.

(b) The Rubber Replanting Advisory Board's decision that a third of the total nursery acreage be allowed to lie fallow for one year on a three-year rotation scheme was implemented. The areas lying fallow were sown to three varieties of *Crotalaria*, namely, *anagyroides*, *juncea* and *striata*. Comparative growth characteristics and seeding qualities could be observed for future reference.

(c) Nineteen acres of nursery beds were ready to receive germinated rubber seedlings. The shortage of seed supply due to the severe *Phytophthora* season permitted the planting up of approximately 13 acres only.

9.5. Budwood Nursery.—(a) Budwood requirements for the South-West planting issues were obtained from this nursery, augmented by supplies from outside sources.

(b) The 3,100 planting points made up of buddings of clones LCB 1320 and PB 86 supplied the entire quantity of budwood from this nursery for the North-East planting material, required for issues by the Rubber Control Department.

9.6. Maintenance.—The Seedling and Budwood nurseries were maintained in good condition throughout the year. Routine weeding, manuring and attention to paths and drains were carried out.

9.7. Pests and Diseases.—A mild attack of Bird's Eye Leaf Spot (*Helminthosporium heveae*) was observed in January and control measures were adopted.

9.8. Planting Material.—75,114 budded stumps of clones PB 86 and LCB 1320, together with 128,440 Tjir 1 clonal seedlings, were issued from this nursery by the Rubber Control Department during the South-West and North-East planting seasons. The roots of all planting material were dipped in "Tillex" soon after up-rooting, prior to despatch.

9.9. Roads.—Tenders were invited for metalling and tarring one mile of road and for re-tarring of two miles of metalled road. The tender was awarded to the United Engineering & Construction Co. who carried out the work satisfactorily towards the end of the year.

REPORT OF THE CHAIRMAN, RUBBER RESEARCH BOARD

1. BOARD.

1.1. Membership.—The following changes in the membership of the Board occurred during the year:—

Mr. G. H. Dulling resigned and Mr. H. Creighton was nominated in his place by the Planters' Association of Ceylon with effect from 1st January.

Mr. H. E. Peries, Deputy Secretary to the Treasury, was away from the Island from 2nd April and Mr. D. G. L. Misso acted for him until his return on 28th June.

Mr. V. T. G. Karunaratne, M.P., was re-nominated by the Hon'ble Minister of Agriculture and Lands for a further period of three years with effect from 29th June.

Dr. E. D. C. Baptiste, Director, was away from the Island from 29th March and Mr. C. A. de Silva, Botanist, acted for him until his return on 20th July.

Mr. G. H. Carter resigned and Mr. C. R. Warren was nominated in his place by the Planters' Association of Ceylon with effect from 1st August.

Senator E. W. Kannangara's period of membership terminated on 30th October and Senator L. Jayasundera was nominated in his place by the Hon'ble Minister of Agriculture and Lands with effect from 17th November.

The personnel of the Board at the end of the year was as follows:—

Ex-Officio Members.

The Director, R.R.I.C.—Dr. E. D. C. Baptiste, Ph.D. (Lond.), M.Sc., A.R.C.S., D.I.C., F.I.R.I.

The Director of Agriculture—Dr. M. F. Chandraratne, M.B.E., Ph.D., B.Sc. (Lond.), D.I.C., F.A.Sc.

The Deputy Secretary to the Treasury—Mr. H. E. Peries, O.B.E., C.C.S.

The Rubber Controller—Mr. B. Mahadeva, M.A., C.C.S.

Nominated Members.

Representing the Senate—Senator L. Jayasundera.

Representing the House of Representatives—Mr. V. T. G. Karunaratne, M.P.

Representing the Smallholders—Mr. W. P. H. Dias, J.P.

Representing the Planters' Association of Ceylon—Mr. H. Creighton, and Mr. C. R. Warren.

Representing the Low-Country Products Association of Ceylon—Mr. L. C. de Mel and Mr. S. Pathmanathan (Chairman).

Mr. C. D. de Fonseka, Chief Administrative Officer, functioned as Secretary to the Board during the year.

Meetings of the Board were held on 27th February, 25th March, 23rd May, 24th July, 19th October and 7th November.

2. COMMITTEES.

2.1. Administrative Committee.—The following changes occurred in the membership of the Committee during the year:—

- Mr. G. H. Dulling resigned and Mr. H. Creighton was nominated to the Committee in his place with effect from 1st January.
- Mr. G. H. Carter resigned and Mr. C. R. Warren was nominated to the Committee in his place with effect from 1st August.
- Mr. C. A. de Silva served on the Committee during the absence of Dr. E. D. C. Baptiste, Director.

Meetings of the Administrative Committee were held on 13th February, 13th March, 13th May, 10th August and 8th October.

2.2. Experimental Committee.—An Experimental Committee consisting of the following members was appointed with effect from 7th November:—

1. The Chairman of the Board.
2. The Director, R.R.I.C.
3. The Director of Agriculture.
4. Mr. C. R. Warren.
5. Mr. H. Creighton.
6. Mr. W. P. H. Dias, J.P.

2.3. Smallholdings Committee.—The personnel of the Committee at the end of the year was as follows:—

- Mr. S. Pathmanathan (Chairman).
- Mr. W. P. H. Dias, J.P.
- Dr. E. D. C. Baptiste.

A meeting of this Committee was held on 17th July.

2.4. Smallholdings Department Selection Committee.—The personnel of the Committee at the end of the year was as follows:—

- Mr. W. P. H. Dias, J.P.
- Mr. B. Mahadeva.
- Dr. E. D. C. Baptiste.
- Mr. R. T. Wijewantha (C.A.O.S.).

Meetings of this Committee were held on 22nd June and 17th July.

2.5. Salaries Committee.—The personnel of the Committee at the end of the year was as follows:—

- Mr. S. Pathmanathan (Chairman).
- Mr. V. T. G. Karunaratne, M.P.
- Mr. B. Mahadeva.
- Mr. H. E. Peries.
- Dr. E. D. C. Baptiste.

Meetings of this Committee were held on 24th March, 2nd June and 12th October.

2.6. Building Committee.—The personnel of the Committee at the end of the year was as follows:—

Mr. S. Pathmanathan (Chairman).

Mr. W. P. H. Dias, J.P.

Mr. L. C. de Mel.

Mr. V. T. G. Karunaratne, M.P.

Mr. C. R. Warren.

Dr. E. D. C. Baptiste.

Meetings of this Committee were held on 13th March, 24th March, 29th June and 12th October.

2.7. Ad hoc Committees.

2.7.1. Committee appointed for the selection of Research Assistants.—A Committee consisting of the Chairman, the Director, Mr. B. Mahadeva and Mr. H. E. Peries was appointed to interview and select candidates for appointment as Research Assistants.

As Mr. Mahadeva was unable to attend meetings of this Committee Dr. M. F. Chandraratne, Director of Agriculture, was co-opted to the Committee.

The same Committee selected a candidate for the post of Librarian.

Meetings of this Committee were held on 2nd September and 12th October.

2.7.2. Committee consisting of the Directors and Chairmen of the Tea, Rubber and Coconut Research Institutes.—The Chairman and the Director served on this Committee, a meeting of which was held on 11th July.

3. LIAISON WITH OTHER ORGANIZATIONS.

3.1. London Advisory Committee for Rubber Research (Ceylon and Malaya).—The Board contributed jointly with the Rubber Research Institute of Malaya to the London Advisory Committee for the maintenance of the advisory services rendered by its Agricultural Sub-Committee.

4. FINANCE.

4.1. Income.—The Board's main income was derived from the cess on exports of rubber under Section 6 (1)a of the Rubber Research Ordinance (Cap. 302).

Income from this source exceeded the estimate for the year by Rs. 23,740/-.

Monthly cess collections were as follows:—

| | | | | | | | |
|-----------------|-----|-----|---------|-----------------|-----|-----|-----------|
| January | ... | Rs. | 167,350 | Brought Forward | ... | Rs. | 978,120 |
| February | ... | „ | 133,346 | July | ... | „ | 81,897 |
| March | ... | „ | 163,676 | August | ... | „ | 87,645 |
| April | ... | „ | 271,245 | September | ... | „ | 154,334 |
| May | ... | „ | 126,012 | October | ... | „ | 181,536 |
| June | ... | „ | 116,491 | November | ... | „ | 153,520 |
| | | | | December | ... | „ | 49,888 |
| Carried Forward | ... | Rs. | 978,120 | Total | ... | Rs. | 1,686,940 |

A profit of Rs. 141,792/- was derived from the normal working of Dartonfield Group, and a grant of Rs. 336,875/- was received from Government for Smallholdings work.

4.2. Expenditure.—Recurrent expenditure amounted to Rs. 1,795,758/-. Capital Expenditure amounting to Rs. 765,970/- was incurred during the year, the main items being:

| | | | | | |
|--------------------------|-----|-----|-----|-----|---------|
| Agricultural Development | ... | ... | ... | Rs. | 145,874 |
| Buildings | ... | ... | ... | „ | 374,961 |
| Laboratory Equipment | ... | ... | ... | „ | 80,024 |

4.3. Accounts.—The accounts for the year with a Balance Sheet showing the property and liabilities of the Board will be prepared and submitted to the Auditor-General for examination.

Sgd. S. PATHMANATHAN,
*Chairman of the Board,
 Rubber Research Institute of Ceylon.*

RUBBER RESEARCH INSTITUTE OF CEYLON.

BALANCE SHEET AS AT 31st DECEMBER, 1958

| | Rs. | Cts. | Rs. | Cts. | | Rs. | cts. | Rs. | cts. |
|--|--------------|------|--------------|------|--|--------------|------|-----|--------------|
| ACCUMULATED FUNDS: | | | | | | | | | |
| Expended on Fixed Assets | | | | | | | | | |
| Unexpended Funds | | | | | | | | | |
| | | | | | | | | | 5,326,793.38 |
| Balance as at 31st December, 1957 | 623,178.27 | | | | | | | | |
| Add: Excess of Income over Expenditure 1958 ... | 643,159.53 | | | | | | | | |
| Add: Refund of S.H. Department Grant for 1956 | 3,746.65 | | | | | | | | |
| Add: Depreciation written off and value of assets sold | 5,068.99 | | | | | | | | |
| | 1,275,153.44 | | | | | | | | |
| Less: Amount expended on fixed assets during 1958 | 607,481.09 | | | | | | | | |
| | | | 667,672.35 | | | | | | |
| Add: Reserve for Stabilisation of Income | | | 1,000,000.00 | | | | | | |
| | | | 1,667,672.35 | | | | | | |
| | | | | | | | | | 915,018.71 |
| DEPRECIATION RESERVE | | | | | | | | | |
| CURRENT LIABILITIES: | | | | | | | | | |
| Creditors | | | | | | | | | |
| Sundries | | | 98,117.37 | | | | | | |
| Receipts in Advance | | | 97,461.96 | | | | | | |
| Security Deposits | | | 4,000.00 | | | | | | |
| Govt. Loan for Establishment of Sub-Station | | | 500,000.00 | | | | | | |
| | | | 699,579.33 | | | | | | |
| | | | | | | | | | 5,326,793.38 |
| | | | | | | | | | |
| FIXED ASSETS:— | | | | | | | | | |
| At Cost | | | | | | 4,725,569.54 | | | |
| Additions during the year | | | | | | 607,481.09 | | | |
| | | | | | | 5,333,050.63 | | | |
| Less Items sold | | | | | | 6,257.25 | | | |
| | | | | | | 5,326,793.38 | | | |
| INVESTMENTS AT NOMINAL VALUE:— | | | | | | | | | |
| Ceylon Govt. Securities: | | | | | | | | | |
| General | | | | | | 2,018,200.00 | | | |
| Provident Fund | | | | | | 845,000.00 | | | |
| | | | | | | 2,863,200.00 | | | |
| (Approximate Market Value Rs. 2,835,583.88) | | | | | | | | | |
| CURRENT ASSETS:— | | | | | | | | | |
| Debtors | | | | | | | | | |
| Cess Collection for December | | | | | | 104,888.22 | | | |
| Accrued Interest | | | | | | 22,401.01 | | | |
| Sundries | | | | | | 131,921.52 | | | |
| | | | | | | 259,210.75 | | | |
| Payments in Advance | | | | | | | | | |
| Loans | | | | | | | | | |
| Purchase of Transport | | | | | | 53,727.44 | | | |
| Purchase of Cookers | | | | | | 5,144.49 | | | |
| | | | | | | 58,871.93 | | | |
| Stocks | | | | | | | | | |
| Rubber in Store and with Brokers at prices since sold | | | | | | 59,453.43 | | | |
| Other Stocks | | | | | | 11,007.80 | | | |
| | | | | | | 70,461.23 | | | |

RUBBER RESEARCH INSTITUTE OF CEYLON.

REVENUE ACCOUNT FOR THE YEAR ENDED 31st DECEMBER, 1958

| DR. | | Rs. cts. | Rs. cts. | | CR. |
|------------|--|------------|------------|------------------------|--|
| To | ADMINISTRATION OF THE BOARD: | | | By | Cess Collections |
| | Travelling Expenses of Board Members ... | 3,075.50 | | | Government Grant for Smallholdings |
| | Entertainment of Board Members ... | 192.83 | | | Work |
| | | | 3,268.33 | | Rs. 261,500.00 |
| | PERSONAL EMOLUMENTS: | | | | Soil Conservation Work |
| | Senior Scientific Staff | 162,800.31 | | | Rs. 15,000.00 |
| | Junior Scientific Staff | 68,827.06 | | | |
| | Office Staff | 54,010.73 | | | Payment by the Rubber Controller from Rubber Subsidy |
| | | | 285,638.10 | | Scheme Fund |
| | LIBRARY & PUBLICATIONS: | | | | Interest |
| | Library | 10,839.65 | | | Sale of Publications |
| | Publications | 6,263.61 | | | Profit from Dartonfield Group |
| | | | 17,103.26 | | Sundry Receipts |
| | SMALLHOLDINGS WORK: | | | | 3,629.85 |
| | Emoluments of Staff (S.H.) | 270,433.67 | | | |
| | Travelling and General Expenses (S.H.) ... | 109,286.63 | | | |
| | Smallholdings Soil Conservation Work ... | 7,216.79 | | | |
| | | | 386,937.09 | | |
| | LABORATORY: | | | | |
| | Equipment and Working Expenses | 48,270.96 | | | |
| | Furniture Replacements | 182.00 | | | |
| | | | 48,452.96 | | |
| | FIELD & FACTORY EXPERIMENTS: | | | | |
| | Field Experiments | 60,521.95 | | | |
| | Factory Experiments | 31,050.39 | | | |
| | | | 91,572.34 | | |
| | OFFICE: | | | | |
| | Stationery and Office Equipment | 7,433.36 | | | |
| | Postages and Telegrams | 4,550.74 | | | |
| | Advertising | 9,925.91 | | | |
| | Telephone | 1,480.00 | | | |
| | Audit Fees | 4,500.00 | | | |
| | | | 27,890.01 | | |
| | TRAVELLING: | | | | |
| | Travelling Expenses of Staff | | 45,895.72 | | |
| | | | 906,757.81 | | |
| | Carried Forward | | | Carried Forward | 2,107,964.19 |

REVENUE ACCOUNT FOR THE YEAR ENDED 31st DECEMBER, 1958—(contd.)

| DR. | | Rs. | cts. | | Rs. | cts. | CR. |
|------------|---|------------|------|--------------|------------|------|----------------------------------|
| | Brought Forward ... | | | | 906,757.81 | | Brought Forward ... 2,107,964.19 |
| To | MAINTENANCE OF BUILDINGS, POWER & WATER SUPPLY & MOTOR VEHICLES: | | | | | | |
| | Maintenance of General Buildings ... | 5,236.81 | | | | | |
| | " " Bungalows ... | 12,091.98 | | | | | |
| | " " Water & Power Supply ... | 49,767.99 | | | | | |
| | Bungalow Furniture Replacements ... | 2,717.28 | | | | | |
| | Maintenance of Motor Vehicles ... | 17,197.88 | | | | | |
| | | | | 87,011.94 | | | |
| | MISCELLANEOUS ITEMS SHARED WITH ESTATE: | | | | | | |
| | Dartonfield Group General Charges ... | 41,609.48 | | | | | |
| | Upkeep of Building Premises ... | 13,565.80 | | | | | |
| | Factory Upkeep ... | 4,629.68 | | | | | |
| | | | | 59,804.96 | | | |
| | OTHER CHARGES: | | | | | | |
| | Contribution to L.A.C. ... | 4,666.67 | | | | | |
| | Contingencies ... | 1,786.04 | | | | | |
| | Insurance Charges ... | 12,644.79 | | | | | |
| | Staff Provident Fund ... | 111,302.80 | | | | | |
| | Passages ... | 15,000.00 | | | | | |
| | Entertainment Allowance ... | 2,699.90 | | | | | |
| | Dearness Allowance to Staff ... | 124,873.99 | | | | | |
| | Contribution to Asst. Staff Medical Fund ... | 5,375.84 | | | | | |
| | Contribution to Senior Staff Medical Scheme ... | 3,095.28 | | | | | |
| | Social Services ... | 2,110.13 | | | | | |
| | Depreciation ... | 114,175.50 | | | | | |
| | Debits Tax ... | 2,827.79 | | | | | |
| | Renovations and Replacements ... | 10,671.22 | | | | | |
| | | | | 411,229.95 | | | |
| | Excess of Income over Expenditure carried to Balance Sheet ... | | | | 643,159.53 | | |
| | | | | 2,107,964.19 | | | 2,107,964.19 |

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Dartonfield,
Agalawatta.
30-3-1959.

Sgd. C. D. DE FONSEKA,
Administrative Secretary,
Rubber Research Institute of Ceylon.

RUBBER RESEARCH INSTITUTE OF CEYLON.

VALUATION OF INVESTMENTS AS AT 31st DECEMBER 1958

| | Rs. cts. | Nominal Value | | Rs. cts. | | Present Market Value |
|---|------------|----------------------|-------------|------------|--|-----------------------------|
| | | Rs. cts. | | Rs. cts. | | Rs. cts. |
| Ceylon Government 3 % Sri Lanka Loan 1969/74 ... | 869,500.00 | | @ 100 | 869,500.00 | | |
| Ceylon Government 3 % Loan 1973/78 ... | 600,000.00 | | @ 96 13/16 | 580,875.00 | | |
| Ceylon Government 3 % Loan 1972/77 ... | 500,000.00 | | @ 97 7/16 | 487,187.50 | | |
| Ceylon Government 3 1/4 % Loan 1973/77 ... | 48,700.00 | 2,018,200.00 | @ 101 | 49,187.00 | | 1,986,749.50 |
| <hr/> | | | | | | |
| Ceylon Government 3 1/2 % Loan 1957/62 ... | 25,000.00 | | @ 100 13/16 | 25,203.13 | | |
| Ceylon Government 3 1/2 % National Loan 1964/69 ... | 70,000.00 | | @ 105 3/16 | 73,631.25 | | |
| Ceylon Government 3 % Loan 1966/71 ... | 500,000.00 | | @ 100 | 500,000.00 | | |
| Ceylon Government 3 % Loan 1969/72 ... | 250,000.00 | 845,000.00 | @ 100 | 250,000.00 | | 848,834.38 |
| <hr/> | | | | | | |
| | | <u>2,863,200.00</u> | | | | <u>2,835,583.88</u> |

RUBBER RESEARCH INSTITUTE OF CEYLON.

SCHEDULE OF FIXED ASSETS

| | At 31st December, 1957 Rs. cts. | Assets Sold in 1958 Rs. cts. | Additions in 1958 Rs. cts. | Total at 31st December, 1958 Rs. cts. |
|---------------------------------------|---------------------------------------|------------------------------------|----------------------------------|---|
| LAND INCLUDING DEVELOPMENT: | | | | |
| Dartonfield | 408,669.58 | | 14,595.28 | 423,264.86 |
| Nivitigalakele | 208,829.50 | | 5,164.25 | 213,993.75 |
| Hedigalla | 1,282,191.19 | | 173,110.06 | 1,455,301.25 |
| BUILDINGS AND LINES: | | | | |
| Dartonfield | | | | |
| Estate | 224,171.03 | | 5,042.00 | 229,213.03 |
| Headquarters | 772,009.37 | | 66,206.49 | 838,215.86 |
| Nivitigalakele | | | | |
| Estate | 47,124.96 | | 7,561.53 | 54,686.49 |
| Headquarters | 25,112.33 | | 3,474.12 | 28,586.45 |
| Hedigalla | | | | |
| Estate | 272,796.51 | | — | 272,796.51 |
| Headquarters | 66,828.98 | | 44,634.00 | 111,462.98 |
| FURNITURE AND FIXED EQUIPMENT: | | | | |
| Dartonfield | 184,725.59 | 6,257.25 | 75,910.80 | 254,379.14 |
| Nivitigalakele | 7,838.20 | | 1,092.50 | 8,930.70 |
| Hedigalla | 7,355.33 | | 3,190.71 | 10,546.04 |
| POWER AND WATER SUPPLY: | | | | |
| Dartonfield | 187,994.53 | | 7,105.98 | 195,100.51 |
| Nivitigalakele | 8,155.87 | | 27,509.90 | 35,665.77 |
| Hedigalla | 30,501.16 | | 4,916.57 | 35,417.73 |
| MACHINERY AND TOOLS: | | | | |
| Dartonfield | 595,733.59 | | 49,973.18 | 645,706.77 |
| Nivitigalakele | 4,754.23 | | — | 4,754.23 |
| Hedigalla | 19,427.68 | | — | 19,427.68 |
| LABORATORY APPARATUS | | | | |
| | 308,238.60 | | 84,593.92 | 392,832.52 |
| MOTOR VEHICLES | | | | |
| | 63,111.31 | | 33,389.80 | 96,501.11 |
| LIBRARY | | | | |
| | — | | 10.00 | 10.00 |
| | <u>4,725,569.54</u> | <u>6,257.25</u> | <u>607,481.09</u> | <u>5,326,793.38</u> |

ASSISTANT STAFF MEDICAL FUND

WORKING ACCOUNT FOR THE YEAR ENDED 31st DECEMBER 1958

DR.

CR.

| | Rs. | cts. | | Rs. | cts. |
|--|---------|---------|---|---------|------|
| To Payment of medical claims | 12,618. | 73 | By Balance brought forward from 1957 | 39,336. | 83 |
| „ Refunds to Officers | 820. | 70 | „ Officers' contributions for 1958 | 7,314. | 50 |
| „ Loans to 5 Officers | 781. | 00 | „ Board's contribution for 1958 | 7,303. | 28 |
| „ Balance carried forward to 1959 | 40,082. | 23 | „ Loan instalments recovered | 348. | 05 |
| | | | | | |
| | | 54,302. | | 54,302. | 66 |

Dartonfield,
Agalawatta,
30th March, 1959.

*Administrative Secretary,
Rubber Research Institute of Ceylon.*

RUBBER RESEARCH INSTITUTE OF CEYLON.

DARTONFIELD GROUP

ESTATE WORKING ACCOUNT FOR THE YEAR ENDED 31st DECEMBER 1958

DR.

CR.

| | Rs. | cts. | | Rs. | cts. |
|--|-------------------|------|--|--------------|-------------------|
| To ESTATE EXPENDITURE: | | | By SALE OF RUBBER: | | |
| General Charges | Rs. 63,308. | 54 | Smoked Sheet & Crepe 268,398 lbs. | Rs. 247,647. | 49 |
| Upkeep | " 33,223. | 93 | Less: Brokerage and | | |
| Cultivation | " 20,153. | 93 | Lot Money | " 2,654. | 98 |
| Collection | " 76,533. | 49 | | Rs. 244,992. | 51 |
| Manufacture | " 22,117. | 97 | Rubber for experiments 1,003 " | " 814. | 41 |
| Distribution | " 1,694. | 51 | | 269,401 lbs. | |
| | 217,032. | 37 | | | 245,806.92 |
| „ Difference in value of 3,650 lbs. Sulphur ... | 1,518. | 49 | „ Sale of 180 lbs. Pueraria Seeds | | 450.00 |
| „ Loss on sale of firewood | 88. | 26 | | | |
| „ Balance carried forward to Income and Expenditure account | 27,617. | 80 | | | |
| | <u>246,256.92</u> | | | | <u>246,256.92</u> |

Dartonfield,
Agalawatta.
30th March, 1959.

*Administrative Secretary,
Rubber Research Institute of Ceylon.*

ESTIMATES FOR 1960

(Adopted by the Board, 7th November 1959)

Estimate of Income for 1960

| | | | |
|----|---|---|---------------|
| 1. | Cess Collections | | Rs. 1,718,640 |
| 2. | Government Grant for Smallholdings Work | " | 330,350 |
| 3. | Interest | " | 80,000 |
| 4. | Sale of Publications | " | 4,000 |
| 5. | Profit from Dartonfield Group Working | " | 90,154 |
| 6. | Sundry Receipts | " | 3,000 |
| | | | Rs. 2,226,144 |

Estimate of Expenditure for 1960

RECURRENT EXPENDITURE:—

1. Administration of the Board:

| | | | |
|-----|---------------------------------------|-----------|--|
| (a) | Travelling Expenses of Board Members | Rs. 5,000 | |
| (b) | Entertainment of Board Members | " 250 | |
| | | Rs. 5,250 | |

2. Personal Emoluments:

| | | | |
|-----|--|-------------|--|
| (a) | Senior Scientific Staff | Rs. 282,834 | |
| (b) | Junior Scientific Staff | " 110,455 | |
| (c) | Experimental Staff, Dartonfield Group | " 42,165 | |
| | | Rs. 435,454 | |

3. Library and Publications:

| | | | |
|-----|---------------------|------------|--|
| (a) | Library | Rs. 20,000 | |
| (b) | Publications | " 10,500 | |
| | | Rs. 30,500 | |

4. Smallholdings Department:

| | | | |
|-----|---|-------------|--|
| (a) | Salaries and Allowances | Rs. 396,094 | |
| (b) | Travelling and General Expenses | " 169,500 | |
| (c) | Sulphur Dusting Scheme 1960 | " 74,485 | |
| (d) | Phytophthora Dusting Scheme 1960 | " 100,000 | |
| | | Rs. 740,079 | |

5. **Laboratory:**

| | | | |
|------------------------------------|-----|-------------|-------------|
| (a) Equipment and Working Expenses | ... | Rs. 107,150 | |
| (b) Furniture Replacements | ... | 600 | |
| | | <hr/> | Rs. 107,750 |

6. **Field and Factory Experiments:**

| | | | |
|-------------------------|-----|------------|-------------|
| (a) Field Experiments | ... | Rs. 91,393 | |
| (b) Factory Experiments | ... | 46,080 | |
| | | <hr/> | Rs. 137,473 |

7. **Office:**

| | | | |
|-------------------------------------|-----|------------|------------|
| (a) Salaries of Office Staff | ... | Rs. 70,454 | |
| (b) Stationery and Office Equipment | ... | 9,000 | |
| (c) Postages and Telegrams | ... | 5,000 | |
| (d) Advertising | ... | 4,500 | |
| (e) Telephone | ... | 1,860 | |
| (f) Audit | ... | 4,500 | |
| | | <hr/> | Rs. 95,314 |

8. **Travelling Expenses of Staff:**

| | | | |
|--------------------|-----|-----|------------|
| Officers' Expenses | ... | ... | Rs. 76,000 |
|--------------------|-----|-----|------------|

9. **Maintenance Charges:**

| | | | |
|----------------------------|-----|-----------|-------------|
| (a) General Buildings | ... | Rs. 4,717 | |
| (b) Bungalows | ... | 14,336 | |
| (c) Water and Power Supply | ... | 61,660 | |
| (d) Furniture | ... | 6,188 | |
| (e) Motor Vehicles | ... | 27,759 | |
| | | <hr/> | Rs. 114,660 |

10. **Miscellaneous items shared with Estate:**

| | | | |
|---------------------------------------|-----|------------|------------|
| (a) Dartonfield Group General Charges | ... | Rs. 39,058 | |
| (b) Upkeep of Building Premises | ... | 17,052 | |
| (c) Factory Upkeep | ... | 6,150 | |
| (d) Dartonfield Normal Working | ... | 26,798 | |
| | | <hr/> | Rs. 89,058 |

11. **Other Charges:**

| | | | |
|---|-----|-----------|-------------|
| (a) Contribution to London Advisory Committee | ... | Rs. 6,900 | |
| (b) Contingencies | ... | 2,500 | |
| (c) Insurance Charges | ... | 17,500 | |
| (d) Staff Provident Fund | ... | 164,372 | |
| (e) Passages | ... | 15,000 | |
| (f) Entertainment Allowance | ... | 5,850 | |
| (g) Dearness Allowance to Staff | ... | 167,450 | |
| (h) Assistant Staff Medical Fund | ... | 13,868 | |
| (i) Senior Staff Medical Scheme | ... | 5,500 | |
| (j) Social Services | ... | 3,500 | |
| (k) Legal Expenses | ... | 1,000 | |
| | | <hr/> | Rs. 403,440 |

| | | | | |
|---|-----|-----|-----|----------------------|
| 12. Depreciation | ... | ... | ... | Rs. 140,000 |
| 13. Renovation and Replacements | ... | ... | ... | „ 5,000 |
| 14. Establishment and Upkeep of Nurseries | ... | ... | ... | „ 8,448 |
| | | | | <u>Rs. 2,388,426</u> |

CAPITAL EXPENDITURE:—

| | | | | |
|--|-----|-----|-----|--------------------|
| 1. Agricultural Development | ... | ... | ... | Rs. 98,858 |
| 2. Buildings | ... | ... | ... | „ 268,500 |
| 3. Equipment | ... | ... | ... | „ 163,278 |
| 4. Vehicles | ... | ... | ... | „ 27,520 |
| 5. Roads | ... | ... | ... | „ 15,148 |
| 6. Water and Power Supply | ... | ... | ... | „ 191,000 |
| | | | | <u>Rs. 764,104</u> |
| Less: Amount available from Depreciation Reserve | ... | ... | ... | „ 19,747 |
| | | | | <u>Rs. 744,357</u> |
| Capital Expenditure to be met from General Funds | | | | <u>Rs. 744,357</u> |

SUMMARY

| | | | | |
|-----------------------------------|-----|-----|-----|----------------------|
| Income | ... | ... | ... | Rs. 2,226,144 |
| Expenditure: | | | | |
| Recurrent | ... | ... | ... | Rs. 2,388,426 |
| Capital | ... | ... | ... | „ 744,357 |
| | | | | <u>Rs. 3,132,783</u> |
| Excess of Expenditure over Income | ... | ... | ... | <u>Rs. 906,639</u> |

Printed for the RUBBER RESEARCH INSTITUTE OF CEYLON, Dartonfield, Agalawatta,
by H. W. CAVE & CO., LTD., Fort, Colombo.