

ASSESSMENT OF THE INCIDENCE OF *OIDIUM* LEAF FALL AND ECONOMICS OF ITS CONTROL IN THE SMALLHOLDINGS

By

A. DE S. LIYANAGE, O. S. PERIES AND R. D. SEBASTIAN

INTRODUCTION

The rubber tree is deciduous and characteristically sheds its leaves, usually during the early months of the year. *Oidium heveae* Steinm. is a powdery mildew fungus which causes infection mainly to the immature leaflets, mature leaves being immune to the disease. Infection at the time of refoliation is of economic importance as a majority of young leaves can be infected under favourable climatic conditions, causing leaf fall. Repeated defoliation leads to depletion of food reserves in green twigs and can result in their dieback, often assisted by the attack of secondary parasites, chiefly *Botryodiplodia theobromae*.

The virulence of the causal organism increases directly with the increase in elevation, so much so that, the Rubber Research Institute of Ceylon does not advocate the planting of the currently recommended *Hevea* clones, at elevations higher than 800 ft above mean sea level. Extensive research work has been directed towards obtaining high-yielding clones, which are also resistant to *Oidium* leaf disease. If these clones are promising, there is every possibility of, at least part of the 100,000 acres, presently classified as marginal areas in the mid-country high elevations, being successfully replanted with rubber in the near future.

Oidium was first reported in Ceylon in 1925 (Stoughton-Harris, 1925). The disease spread with alarming rapidity, specially at higher elevations in the mid-country rubber growing areas. Field experiments were carried out on *Oidium* control, for six successive years commencing from 1930, in the Matale District. Sulphur dusting proved to be the most effective and economical method of combating the disease (Murray, 1930—1935). In Ceylon Murray (1930, 1931) obtained a 16% yield increase in the dusted plots over the control and a 75% increase in the next season. Bark renewal on the dusted field was 39% better than in the undusted plots. Clone LCB 870 was noted by Cramer (Mass, 1934) to show resistance to mildew, and crown budding experiments were laid out in Ceylon in 1941 and 1942 (Young, 1951). Soon attempts were made to incorporate disease resistance to high-yielding planting material by cross breeding methods. This work was done by Dr. C. E. Ford, the Geneticist of the RRIC, during the period 1934—1937.

In the smallholdings, a Government subsidized co-operative sulphur dusting scheme was organised by the Rubber Research Institute of Ceylon in 1958. (Wijewantha, 1958) after a pilot dusting scheme carried out in Kegalle District (Pieris, 1955). PB 86, which exhibits a certain degree of tolerance to *Oidium* leaf disease, is one of the most popular and widely planted clones in Ceylon. In fact, it constitutes approximately 64% of the total acreage planted, which includes both new plantings and replantings upto 1968, in the smallholdings. Rubber is increasingly becoming a crop bringing marginal returns and there is an urgent necessity to economise on methods of disease control. Peries (1962) initiated detailed laboratory investigations on the biology of the fungus and host-parasite relationship to provide a firm basis for economic control of diseases.

The main purpose of this survey was to assess the degree, and distribution of the incidence of *Oidium* in the smallholdings, the efficacy of control measures currently adopted, and determine whether routine control of the disease in all rubber growing districts of Ceylon is warranted, with due emphasis placed on economic considerations, especially in view of the fact that the *Oidium*-tolerant clone PB 86 is widely planted by the smallholders.

MATERIALS AND METHODS

Forty three co-operative sulphur dusting groups which functioned under the state-aided sulphur dusting scheme, organised by the Institute were selected in Colombo, Galle, Kalutara, Kegalle, Matale and Matara Districts for the survey. Each group was responsible for dusting a number of smallholdings and was supervised by a Rubber Instructor. In order to make the survey as representative as possible a minimum 20% sample chosen at random covering a wide variety of holdings in relation to size, situation, elevation, age and terrain was selected, from each of the dusted groups, for assessments. The survey covered 25 Tjir 1 clonal seedlings and 220 PB 86 holdings. For each of the treated holdings, another undusted holding of the same clone, age and similar in all other respects was selected in close proximity, to serve as a control plot. In effect, the experiment was a randomized block design with 220 blocks, each block having a control and a treated plot of clone PB 86.

Four, permanent sampling or leaf count beds, each measuring 6 ft × 6 ft covering a total of sixteen square yards, were laid out on cleared ground free of weeds, in two rows, placed in between nine rubber trees, in the centre of each of the selected holdings. The beds were numbered and the boundaries clearly demarcated. When steep terrain or contour drains interfered with the construction of leaf count beds, the layout of beds was shifted slightly, so as to keep them as close as possible to the desired area.

Dusting commenced when approximately 20% of the trees in the holdings began to show signs of bud break, after wintering. Four weekly rounds of dusting at the rate of 8 lb per acre were carried out using 'Kestrel', 'Mistral' or 'Noidium' portable dusting machines. This schedule was strictly maintained, unless inclement weather interrupted the scheduled operations. Dusting was carried out according to the Institute's recommendations (Anon, 1962).

The leaf beds were cleaned immediately after the initial round of dusting and leaf fall assessments were taken by counting the number of *Oidium*-infected leaves, and separating them from leaves shed due to other causes, like wind damage. A total of twelve leaf counts were taken from each holding, the first count taken three days after dusting, the second three days later and the third count made on the day of the subsequent round of dusting. The last count of the final round of dusting was always taken three days after the preceding count.

The leaf counts of the dusted and undusted holdings were taken on the same day, when both holdings wintered evenly. When wintering in the selected control holding was late, leaf fall assessments were made in the control plots maintaining the same interval of time, as was maintained in the case of dusted plots. In instances where the selected control holding wintered early, leaf fall assessments followed the normal schedule of a dusted holding, as applicable to those that wintered evenly.

Information was collected on the age, elevation, plant density, aspect, terrain and dates of commencement and completion of defoliation and refoliation, in respect of each of the holdings selected for the survey.

The leaf fall due to disease were transformed to logarithms prior to any statistical evaluation. The mean incidence of leaf fall due to disease based on logarithmic transformation gives a meaningful average of the incidence of the disease. The analyses of variance are not reproduced in this paper. However, the variance ratios are given in the bottom row of each table. Significant differences in the analyses of variance are denoted with an asterisk.

RESULTS

Incidence of leaf fall due to Oidium: When the overall incidence of leaf fall due to *Oidium* was considered (Table 1) it is apparent that Tjir 1 clonal seedlings are more susceptible to *Oidium* infection than PB 86, throughout the rubber growing districts of Ceylon.

TABLE 1
OVERALL INCIDENCE OF LEAF FALL DUE TO *OIDIUM*

Leaf fall	PB 86		Tjir 1 clonal seedlings	
	Mean leaf fall per acre	Range per acre	Mean leaf fall per acre	Range per acre
Leaf fall due to <i>Oidium</i>				
(i) Observed	130,075	0-2,134,440	204,792	4,840-961,648
(ii) Log basis	33,578		76,835	

The distribution of leaf fall due to *Oidium* is highly skewed (Table 2) and is characteristic of the distribution of most disease-causing organisms or their damage. When conditions that are conducive to the propagation of the causal agent improve in linear progression, the causal organism itself or the incidence of the disease increases in multiplicative progression.

TABLE 2
THE DISTRIBUTION OF LEAF FALL DUE TO *OIDIUM*

Level of leaf fall due to <i>Oidium</i> per acre	No. of holdings	Percentage holdings
Less than 30,250	100	46.5
30,250 — less than 75,625	47	21.8
75,625 — „ „ 151,250	38	17.7
151,250 — „ „ 302,500	12	5.5
302,500 — „ „ 605,000	7	3.3
605,000 — „ „ 907,500	4	1.9
907,500 — „ „ 1,210,000	1	0.5
1,210,000 — „ „ 1,512,500	2	0.9
1,512,500 and above	4	1.9
Total	215	100.0

The incidence of leaf fall due to *Oidium* infection varies significantly between districts, being highest in Matale District; Kegalle, Galle and Ratnapura Districts coming next in that order (Table 3). The incidence of the disease was lower in Colombo and Kalutara Districts, being lowest in the Matara District.

TABLE 3
DISTRIBUTION OF INCIDENCE OF LEAF FALL DUE TO *OIDIUM*
WITH REFERENCE TO DISTRICTS

District	Leaf fall due to <i>Oidium</i> per acre (log basis)
Matale	1,788,985
Kegalle	69,575
Galle	53,542
Ratnapura	33,275
Colombo	19,965
Kalutara	19,965
Matara	13,915
Variance ratio $n_1 = 5 ; n_2 = 141$	4.57*

Elevation has a marked influence on the incidence of leaf fall due to *Oidium*, the incidence of the disease increasing significantly with increase in elevation (Table 4). The amount of leaf fall due to *Oidium* is approximately three times greater at elevations between 300—500 ft and about five times greater at elevations above 500 ft, when compared to the incidence below 100 ft.

TABLE 4
DISTRIBUTION OF INCIDENCE OF LEAF FALL DUE TO
OIDIUM WITH REFERENCE TO ELEVATION

Elevation (feet)	Leaf fall due to <i>Oidium</i> per acre (log basis)
Less than 100	23,898
100 — less than 300	17,545
300 — less than 500	70,482
500 and over	114,042
Variance ratio $n_1 = 3 ; n_2 = 144$	12.93*

Influence of various factors on the incidence of leaf fall: In order to assess the influence of age, a more homogenous sub-sample was selected. This assessment was confined to holdings from Colombo and Kalutara Districts, where the rainfall patterns are similar and elevation is below 300 ft. Leaf fall due to the disease is not significantly influenced by the age of the tree, at the ages considered (Table 5). However, there is a possibility that trees lose vigour as they get older, and the resistance of older trees to the disease should be further investigated.

TABLE 5

INFLUENCE OF AGE ON LEAF FALL DUE TO *OIDIUM*

Age (years)	Leaf fall due to <i>Oidium</i> per acre (log basis)
Less than 10	26,015
10 - 11	40,232
12 - 13	17,242
14 - 15	22,385
16 and above	22,082
Variance ratio $n_1 = 4 ; n_2 = 84$	1.36

The relationship between planting density and incidence of *Oidium* is shown in Table 6. Leaf fall due to *Oidium* is not significantly influenced by plant density, but it seems likely that leaf fall due to the disease is high at higher densities.

TABLE 6

INFLUENCE OF PLANT DENSITY ON LEAF FALL DUE TO *OIDIUM*

Plant density (per acre)	Leaf fall due to <i>Oidium</i> per acre (log basis)
Less than 170	9,680
170 - 189	24,200
190 - 209	18,755
210 and over	38,720
Variance ratio $n_1 = 3 ; n_2 = 80$	1.99

There is no relationship between aspect of land and leaf fall due to incidence of the disease (Table 7).

TABLE 7
INFLUENCE OF ASPECT OF LAND ON THE INCIDENCE OF *OIDIUM*

Aspect	Leaf fall due to <i>Oidium</i> per acre (log basis)
Eastern	22,688
Western	18,452
Variance ratio $n_1 = 1 ; n_2 = 182$	< 1.00

The terrain of land has no bearing on leaf fall due to the disease; this was evident at both elevations from sea level, up to 300 ft and from 300 to 700 ft (Table 8).

TABLE 8
INFLUENCE OF TERRAIN ON LEAF FALL DUE TO *OIDIUM*

(a) Less than 300 ft elevation

Terrain	Leaf fall due to <i>Oidium</i> per acre (log basis)
Flat	22,385
Gentle slope	18,150
Steep	27,225
Variance ratio $n_1 = 2 ; n_2 = 31$	< 1.00

(b) 300 — Less than 700 ft elevation

Terrain	Leaf fall due to <i>Oidium</i> per acre (log basis)
Flat	84,398
Gentle slope	100,732
Steep	84,398
Variance ratio $n_1 = 2 ; n_2 = 31$	< 1.00

Efficacy of sulphur dusting in controlling leaf fall due to Oidium: The overall effect of the treatment, in the entire rubber growing area, shown in Table 9, indicates that dusting is significantly ($F_{1,219} = 41.56^{***}$) better than the control.

There is an absolute reduction in leaf fall of 13,915 per acre, and a relative reduction of 41% in PB 86, while a 58% relative reduction and 44,770 leaves per acre absolute reduction, is achieved in Tjir 1 clonal seedlings.

TABLE 9
OVERALL EFFICIENCY OF DUSTING

Treatment	PB 86			Tjir 1 clonal seedlings		
	Mean leaf fall per acre (log basis)	Absolute control leaves per acre	Relative control percentage	Mean leaf fall per acre (log basis)	Absolute control leaves per acre	Relative control percentage
Dusted	19,965	13,915	41	32,065	44,770	58
Control	33,880			76,835		

It is evident from Table 10 that dusting is significantly more effective, when the level of leaf fall due to *Oidium* is high, both from the point of view of the extent of absolute control and also relative control. In fact, when the level of leaf fall due to *Oidium* is less than 15,125 the amount of control achieved is only 20%. Though dusting was significantly better, only 34% control is effected when the leaf fall is in the region of 15,125 to 30,250 leaves per acre. The amount of absolute control and percentage relative control achieved increased significantly, as the level of leaf fall increased, so much so that, when the level of leaf fall per acre is over 151,250, the efficiency of dusting increased remarkably to effect a 78% control.

TABLE 10
EFFICACY OF DUSTING AT DIFFERENT LEVELS OF INCIDENCE OF LEAF FALL DUE TO *OIDIUM*

Level of leaf fall per acre	Treatment	Significance	Mean leaf fall per acre	Absolute control per acre	Relative control percentage
Less than 15,125	Dusted	$F_{1,57} = 1.59$	4,840	1,210	20
	Control		6,050		
15,125 — less than 30,250	Dusted	$F_{1,45} = 10.26^*$	13,915	7,260	34
	Control		21,175		
30,250 — less than 75,625	Dusted	$F_{1,47} = 13.21^*$	26,015	23,898	48
	Control		49,913		
75,625 — less than 151,250	Dusted	$F_{1,39} = 22.87^*$	42,350	65,642	61
	Control		107,992		
151,250 and over	Dusted	$F_{1,27} = 35.64^*$	89,540	313,088	78
	Control		402,628		

It is observed in Table 11, that in Galle, Colombo and Matara Districts the effect of dusting is not statistically significant. From the point of view of absolute reduction in leaf fall control, no useful purpose would be served, in dusting Colombo, Kalutara and Matara Districts. In these areas, even without dusting, the incidence is lower than in Kegalle and in certain high elevation areas in Galle District even after dusting.

TABLE 11
EFFICACY OF SULPHUR DUSTING IN DIFFERENT DISTRICTS

District	Treatment	Significance	Mean leaf fall per acre	Absolute control per acre	Relative control percentage
Kegalle	Dusted	$F_{1,38} = 5.74^*$	43,252	26,317	38
	Control		69,575		
Galle	Dusted	$F_{1,19} = 3.16$	29,645	24,197	45
	Control		53,842		
Ratnapura	Dusted	$F_{1,18} = 6.47^*$	16,335	16,940	51
	Control		33,275		
Colombo	Dusted	$F_{1,25} = 3.65$	10,285	9,680	48
	Control		19,665		
Kalutara	Dusted	$F_{1,44} = 8.33^*$	13,612	6,050	31
	Control		19,662		
Matara	Dusted	$F_{1,6} = 5.72$	3,932	9,983	72
	Control		13,915		

The results shown in Table 12 indicate that sulphur dusting can reduce *Oidium* leaf disease significantly, specially at higher elevations. It is observed that the amount of leaf fall due to *Oidium* increased remarkably with increase in elevation and absolute control achieved is much greater at higher altitudes. At lower elevations, incidence even without dusting is lower than the levels achieved at higher elevations, even after dusting. Accordingly sulphur dusting may not be economic at lower elevations.

TABLE 12
EFFICACY OF SULPHUR DUSTING AT DIFFERENT ELEVATIONS

Elevation (feet)	Treatment	Significance	Mean leaf fall per acre	Absolute control per acre	Relative control percentage
Less than 100	Dusted	F _{1,53} = 4.62*	16,335	7,563	31
	Control		23,898		
100—less than 300	Dusted	F _{1,42} = 10.27*	8,772	8,773	50
	Control		17,545		
300—less than 500	Dusted	F _{1,26} = 4.99*	43,560	26,922	38
	Control		70,482		
500 and over	Dusted	F _{1,22} = 18.30*	47,190	54,148	53
	Control		101,338		

Economics of Oidium control: The economic importance of *Oidium* leaf disease of *Hevea* must ultimately be judged by the loss in yield due to the disease. Peries (1963) initiated an experiment at Eladuwa Estate, Matugama, on clone PB 86, to assess the cumulative effect of recurrent defoliation due to *Oidium* and *Phytophthora* leaf diseases on the yield. The yield records of the individual areas were maintained since 1963 August in order to assess the effect of each disease separately and the combined effect of both on the yield of *Hevea*. The results given in Table 13 show the influence of *Oidium* control on the yield. However, this experiment has not been in progress for a sufficiently long period, for any definite conclusions to be made. But these results illustrate the general trend.

TABLE 13
EFFECT OF SULPHUR DUSTING ON YIELD

Treatment	Yield (grams)	Pre-treatment	Post-treatment					
		1963 Aug.—Dec.	1964 Jan.—Dec.	1965	1966	1967	1968	1969
Only <i>Phytophthora</i> controlled	Observed	2782	3270	3594	3574	3398	3842	3590
	Relative	100	118	129	128	122	138	129
<i>Oidium</i> and <i>Phytophthora</i> both controlled	Observed	2926	3357	3741	3825	3787	3763	3834
	Relative	100	115	128	131	129	129	131
Percentage	Increase	—	—	—	2	6	—	2

It appears from Table 13, that the influence of *Oidium* control on yield is low and variable. In three out of six years for which records are available, *Oidium* control showed no improvement in yield (unpublished 1963—1969). In other words, the amount of leaf fall due to *Oidium* had not been serious enough to cause a depression in the yield during that period. In other years which apparently followed periods of high incidence, the yield increase ranged from only 2% to 6%. This yield increase was achieved with a 62% reduction in leaf fall through dusting and when the incidence of leaf fall was high. Therefore one is justified in assuming that generally the yield increase is much less.

In Table 14 it is shown that when the pre-treatment mean yields are compared with post-treatment mean yields of six years (1964—1969 both inclusive) of two treatments, the relative yield increase obtained through dusting over the years is zero.

TABLE 14

OVERALL EFFECT OF SULPHUR DUSTING ON THE YIELD
OF *HEVEA* OVER A PERIOD OF SIX YEARS (1964—1969)

Treatment	Yield (grams)	Pre-treatment yield (grams)	Post-treatment mean yield over six-year period (grams)
Only <i>Phytophthora</i> controlled	Observed	2782	3545
	Relative	100	127
<i>Oidium</i> and <i>Phytophthora</i> both controlled	Observed	2929	3718
	Relative	100	127

DISCUSSION

One of the factors which contribute to tolerance of PB 86 to *Oidium* at low elevations is the thickness of the leaf cuticle. A number of workers have shown that the leaf cuticle of PB 86 matures rapidly. In this regard it may be interesting to note that nearly 64% of the smallholdings planted upto 1968 consists of PB 86, and the acreage covered by the other tolerant clones, which includes RRIC 45, RRIC 52, PR 107 and LCB 870, is approximately 5%, making a total of 69% of the entire extent of the smallholdings. Tjir 1 clonal seedlings, on the other hand, are highly susceptible to *Oidium* infection, because of their uneven wintering habit, and slow maturity of the leaf cuticle. No useful purpose would be served in attempting to adopt control measures in general in Tjir 1 clonal seedlings, which constitutes approximately 23% of the smallholdings planted upto 1968, because it is being fast replaced with improved high-yielding clones. However, the high-yielding isolation gardens of Tjir 1 seedlings should continue to be protected, as their yields are comparable to those from the recent selections of clonal material.

In the mid-country high elevations the fungus caused severe defoliation and a considerable yield decline was observed, and sulphur dusting achieved economically beneficial effects with ensuing improvements in foliage, bark renewal and yield specially in the susceptible clones at higher elevations. The present studies revealed that, there is a direct correlation between elevation and virulence of the pathogen at higher elevations, and this effect is definitely marked at elevations higher than

300 ft above mean sea level. This is presumably due to the fact that, there is a rapid build-up of inoculum due to the existence of more conducive conditions. Peries (1964) propounded that *Oidium* leaf disease is likely to assume epidemic proportions during periods when cool, dull, humid weather with mist in the nights and early mornings together with light showers of short duration prevailed. These environmental conditions usually occur at higher elevations during the period of refoliation. It is observed that refoliation is irregular and protracted, and delays the maturity of leaf cuticle at higher altitudes; consequently the susceptible period is of far longer duration. These factors probably account for the greater incidence of *Oidium* in Matale, Kegalle, Ratnapura and Galle Districts.

The extent of defoliation caused by *Oidium* varies greatly in different districts. The incidence of *Oidium* was extremely low in the main low country districts of Colombo, Kalutara and Matara. It seems probable that climatic conditions in the wet low country districts are unfavourable for prolonged activity of the pathogen to cause extensive damage and routine dusting as a prophylactic measure is scarcely justifiable in these districts. Sulphur dusting as a protective measure is likely to be useful in Matale, Kegalle and in certain areas of Ratnapura and Galle Districts, particularly at elevations above 300 ft. In view of these findings it can be concluded that the extensive control measures undertaken annually, as a routine practice in the estates, particularly in the districts with low incidence enumerated earlier, is not warranted.

It is now abundantly clear that economics of disease control is of vital importance for the survival of the industry. Comparative yields must constitute the ultimate criterion of the value of sulphur dusting. If the comparative increase in yield of the treated rubber more than adequately compensates for the expenditure incurred, then it can reasonably be argued that sulphur dusting is beneficial. Peries (1963) initiated long-term experiments to establish the economic significance of *Oidium* and *Phytophthora* leaf diseases. The results so far collected indicate that, there had been a yield decline of 6% and this decrease occurred only once in six years for which records are available. In other words, severe epidemics are not likely to occur every year. Therefore the additional yield improvement of 39 lb per acre per annum obtained through a 6% increase due to dusting cannot be expected annually.

If the view is accepted that the severity of secondary leaf fall due to *Oidium* is associated with annual fluctuations of weather conditions at the time of refoliation, then the need for an integrated approach to studies on *Oidium* control is urgently felt. Considerable saving can be effected by the development of varieties highly resistant to the disease and also attempting to study the environmental factors, mainly the seasonal rainfall distribution, using long-term records which would be helpful to predict with a certain degree of accuracy the onset and severity of the disease.

The total acreage of smallholdings dusted in 1970 under the state-aided sulphur dusting scheme was approximately 5%. According to the reports submitted by the Rubber Instructors there are numerous practical difficulties in the organisation and execution of the so-called co-operative sulphur dusting scheme. Smallholders in the low country have expressed quite firmly that sulphur dusting at low elevations is a wasteful operation; instead they feel that a subsidized manuring scheme might prove beneficial. In the event of a heavy outbreak of *Oidium* leaf disease occurring due to conducive weather conditions, it is suggested that the Rubber Research Institute should afford the facility of a mobile sulphur dusting unit for the use of the smallholders to combat the disease.

CONCLUSIONS

1. Tjir 1 clonal seedlings succumb to *Oidium* infection more readily than PB 86 in the entire rubber growing area.
2. *Oidium* control can be dispensed with, in all the smallholdings and estates situated below 300 ft above mean sea level, in Colombo, Galle, Kalutara, Kegalle, Matara and Ratnapura Districts.
3. The virulence of the fungus increases at higher altitudes causing, greater leaf fall and the efficacy of sulphur dusting is highest in these areas.
4. *Oidium* is unlikely to cause appreciable economic losses, through yield depression, to warrant routine control on the more popular rubber clones planted recently.

ACKNOWLEDGEMENTS

We gratefully acknowledge the whole-hearted co-operation and assistance extended by all the Rubber Instructors, Divisional Advisory Officers and the Chief Advisory Officer of the Smallholdings Department. Our thanks are also due to Mr. V. Abeywardena, Consultant Biometrician, C.R.I., and his staff and Mr. G. A. J. P. R. Gunasekara for statistical evaluation. We are indebted to Mr. B. Hettiarachchi of the C.R.I. for preparation of all the slides for this paper, and to Mr. Z. E. Irugalbandara for helping to sort out the yield records, which he has maintained since 1963.

REFERENCES

- ANON (1962). *Oidium* leaf disease. *Advis. Circ. Rubb. Res. Inst. Ceylon No. 70*.
- MAAS, J. E. J. A. (1934). The selection of *Hevea brasiliensis* at s' Lands Caoutchoucbedrijf. *Arch. v.d. Rubbercult. Ned.-Indie*, **18**, 81—86.
- MURRAY, R. K. S. (1930). Sulphur dusting as a means of controlling *Oidium*. *Q. Circ. Ceylon Rubb. Res. Scheme 7*, 28—30.
- MURRAY, R. K. S. (1931 a). Further sulphur dusting experiments against *Oidium*. *Q. Circ. Ceylon Rubb. Res. Scheme 8*, 17—23.
- MURRAY, R. K. S. (1931 b). The influence of *Oidium* and sulphur dusting on yield and bark renewal. *Q. Circ. Ceylon Rubb. Res. Scheme 8*, 42—51.
- MURRAY, R. K. S. (1933). Further yield records in connection with *Oidium heveae*. *Q. Circ. Ceylon Rubb. Res. Scheme 10*, 1—8.
- MURRAY, R. K. S. (1934). The sulphur dusting treatment for *Oidium*. *Q. Circ. Ceylon Rubb. Res. Scheme 11*, 43—53.
- MURRAY, R. K. S. (1935). The control of *Oidium*. *Q. Circ. Ceylon Rubb. Res. Scheme 12*, 10—17.
- PERIES, O. S. (1962). Review of the Plant Pathology Department. *A. Rev. Rubb. Res. Inst. Ceylon 1961*, 65.
- PERIES, O. S. (1963). Review of the Plant Pathology Department. *A. Rev. Rubb. Res. Inst. Ceylon 1962*, 58.

- PERIES, O. S. (1964). Review of the Plant Pathology Division. *A Rev. Rubb. Res. Inst. Ceylon* 1963, 62.
- PIERIS, W. I. (1955). Report on the trial sulphur dusting of rubber smallholdings in the Kegalle District in 1955. *Q. Circ. Rubb. Res. Inst. Ceylon* 31, 92—102.
- STOUGHTON-HARRIS, R. H. (1925). *Oidium* leaf fall of rubber. *Q. Circ. Ceylon Rubb. Res. Scheme*, 8—11.
- WIJEWANTHA, R. T. (1958). Report on the sulphur dusting of smallholdings in 1957/58. *Q. Circ. Rubb. Res. Inst. Ceylon* 34, 63—76.
- YOUNG, H. E. (1951). Leaf mildew of rubber — a review. *Q. Circ. Rubb. Res. Inst. Ceylon* 27, 3—15.

QUESTIONS AND ANSWERS

- Question: Does the susceptibility to *Oidium* increase with the ageing of the tree? (Anon).
- Answer: Not really, in fact, a young plant could be more susceptible to *Oidium* than a vigorous mature tree; but if our question implies senility — yes, a senile tree could be expected to be more susceptible than a tree 10—15 years old. However, susceptibility here could be related to so many other factors such as the application of fertilizers, intensity of tapping and weed control to mention a few. (Dr. O. S. Peries).
- Question: Unfortunately nothing has been mentioned about the desirability or otherwise of sulphur dusting in Moneragala area. Any comments please? (Mr. Ambrose Pereira).
- Answer: Unfortunately too, Moneragala is not considered to be a large rubber growing district at present, so we have not carried out experiments there. However, the remarks made about the other districts would be applicable to the Moneragala District too. (Dr. O. S. Peries).
- Question: You stated that sulphur dusting of rubber at elevations below 300 ft can be safely dispensed with. It is common practice now to watch the weather and sulphur dust only if it is humid, cloudy and cool. Do you advocate that estates need not be prepared in future for dusting areas below 300 ft even if the weather is favourable to *Oidium* infection? (Mr. W. W. J. Mendis).
- Answer: I was referring to generalities — however, *Oidium* infection depends entirely on weather and of conditions suitable for the fungus. Sulphur dusting can be undertaken at estate level on susceptible clones in areas where *Oidium* infection is known to recur every year. (Dr. O. S. Peries).
- Questions: On how many estates in the Kalutara District have you carried out experiments to say that sulphur dusting need not be done in this district? Please name them. (Anon).
- Answer: We carried out leaf counts on 45 holdings — these were all smallholdings and I am afraid I cannot name them. (Dr. O. S. Peries).