

OBSERVATIONS ON *PHYTOPHTHORA* DISEASES OF *HEVEA*

BY

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INTRODUCTION

Phytophthora palmivora causes pod rot, leaf-fall, dieback of twigs, rotting of tender shoots, black stripe and bark rot of tapping panels in *Hevea brasiliensis*. One or more of these diseases have been reported to occur at varying intensities in all the *Hevea* growing countries. Of these diseases, abnormal leaf-fall and black stripe or bark rot are of prime importance. In South India abnormal leaf-fall is recorded as the most destructive disease of *Hevea* because of the heavy South West monsoon rains, (Ramakrishnan & Radhakrishnapillai, 1961) but black stripe or bark rot has not been reported as a serious problem. This is attributed to cessation of tapping during the monsoon rains.

In Sri Lanka, leaf-fall is not as severe as in South India and Lloyd (1963) considered it uneconomical to employ control measures against it. Our studies have shown that this disease precedes the panel disease and is a visual guide to the probable infection sites of black stripe disease. Black stripe and the subsequent bark rot stage has always been considered to be of importance in Sri Lanka and large sums of money had been spent on tapping panel fungicides to protect the panels right through the year, even though Petch (1918) had pointed out that fungicide application during wet weather should suffice. Satchuthananthavale (1971) stressed the same, as inoculum for infection of panels is present only during this period.

The recommended period for application of tapping panel fungicides by the Institute is from mid-June to early September. New infections of black stripe disease follow leaf-fall. The incidence of black stripe is connected with pod rot and mature leaf-fall. To prevent the incidence of black stripe, it is essential to know the factors that play an important role in the abnormal leaf-fall of *Hevea*. These factors are (i) intensity of *Oidium* leaf-fall (ii) intensity of pod set (iii) intensity of rainfall. Time and again the importance of the one or the other of these three factors has been stressed by almost all the workers in this field.

MATERIALS AND METHODS

We made observations on rainfall in relation to disease incidence, and on the availability of pods during the season, to determine how helpful these factors would be in following the course of disease development for the season, and whether the period for application of fungicides recommended by the Institute holds good for all years, and also whether the application is necessary during the wet season in all years. In addition, we are screening clones for disease reaction to black stripe disease which information would be useful in selecting planting material for the wet zone.

The fields in each Estate and the years in which observations were made are given below:

Dartonfield Estate—PB 86, Nab 12 fields in 1970, 1971 and 1972. RRIM 513 in 1972; Frocester Estate—PB 86 and RRIC 36 fields in 1971 and 1972; Mirishena Estate—MK 3/2 and PB 86 field in 1971; Yatadola & Eladuwa Estates—PB 86 fields in 1970.

In Dartonfield Estate, leaf-fall due to *Phytophthora* had always occurred in known pockets in certain fields, year after year. Disease incidence had been severe in these areas in certain years, and in some years either mild, very mild or completely absent. These pockets may consist of a few trees or a number of trees, and again those which are affected most are those close to roads or open areas where pod set is heavy, and those which are in areas where high humidity prevails during the monsoons.

Assessment of the disease was visual and rated as follows :

Very mild—very few diseased leaves, one has to search for these leaves

Mild—few scart red diseased leaves, easily seen on the ground

Moderate—many diseased leaves on the ground

Heavy—ground covered with diseased leaves to form a carpet

Disease rating between Mild and Moderate and between Moderate and Heavy is described as 'Fairly Moderate' and 'Fairly Heavy'.

RESULTS

The interesting facts that emerged from these observations are: (i) factors affecting pod set influence the duration and intensity of leaf-fall, (ii) rainfall coinciding with the presence of mature pods in the field is the major climatic factor which affects the onset and severity of the disease, (iii) pod set and rainfall are both essential for disease incidence—in the absence of either one of these factors leaf-fall does not occur on an appreciable scale.

Pod set in relation to incidence and duration of leaf-fall

Incidence of *Oidium* is an important factor that affects pod set and indirectly leaf-fall due to *Phytophthora*. *Oidium heveae* affects the flowers and in years when incidence of *Oidium* is severe there is a marked reduction in the number of pods for that season. In Dartonfield, in 1970, due to the absence of *Oidium* leaf-fall, pod set was heavy in the 'susceptible areas' resulting in heavy leaf-fall caused by *Phytophthora* which lasted for 5 weeks. In 1971 the situation was reversed, *Oidium* incidence was severe, pod set was poor or absent in most areas, and as a result abnormal leaf-fall was not recorded in any of the 'susceptible areas' except one, which was protected by sulphur dust during the *Oidium* season (Table 1). The same was observed in Mirishena Estate in 1971. Pod set was poor due to the severe incidence of *Oidium* and *Phytophthora* leaf-fall was not recorded in that year.

TABLE 1

DISEASE INCIDENCE AND DURATION OF LEAF-FALL IN DARTONFIELD
IN RELATION TO POD SET

Year	<i>Oidium</i> incidence	Pod set	<i>Phytophthora</i> leaf-fall	Duration of leaf-fall
1970	Very mild	Heavy	Heavy	5 weeks 21.6.70—1st week of August
1971	Severe	Absent	Absent	
	Except for* a small area	Except for* a small area	Heavy in* this Area	5 weeks 26.7.71—1st week of September
1972	Mild	Protracted flowering and pod set though light	+PB 86 mild Nab—mild RRIM 513 heavy	12 weeks 14 weeks 4 weeks

* This area was protected by sulphur dust for experimental purposes.

+ Dates of leaf-fall.

PB 86 3rd week of June to 3rd week of August and first to third week in October.

Nab 4th week of June to 3rd week of August and first week of September to 1st week of November.

RRIM 513 4th week of September—4th week of October.

In 1972, at Dartonfield, abnormal leaf-fall was spread over 12 to 14 weeks. This year, due to protracted flowering, pod set was not even. Availability of mature pods over a number of weeks resulted in prolonged leaf-fall in the 'susceptible areas'.

Mature pods were seen in the Nab field as late as early October. A few trees of clone RRIM 513 suffered heavy leaf-fall in October although infected pods were not available on trees of this clone, but it was found that the inoculum for infection had come from infected pods of clone RRIC 52 trees close to RRIM 513 trees. In spite of the presence of infected pods on the upper branches of clone RRIC 52, the canopy below remained unaffected by *Phytophthora* infection.

The pattern of disease incidence at Frocester Estate in 1971 and 1972 was similar to the one seen at Dartonfield Estate for the same years. In 1971, in the RRIC 36 field, the disease was mild, infection occurring only in two sites which lasted for 5 weeks at each site. Here too the mature pods available at one time had provided inoculum for defoliation only for 5 to 6 weeks.

In 1972 leaf-fall lasted for 14 weeks. Depending on the time of flowering and pod set, leaf-fall commenced as early as mid-May as seen in Table 2.

TABLE 2

DISEASE INCIDENCE AND DURATION OF LEAF-FALL AT FROCESTER ESTATE

Year	Field	Leaf-fall	Duration
1971	PB 86 field	Absent	—
	RRIC 36 field	*Mild	5 weeks } 2 Infection 5 weeks } points
1972	PB 86 field	*Mild to moderate	†13 weeks
	RRIC 36 field	Mild to moderate	††14 weeks

*Confined to a few trees only.

†13 weeks, 3rd week of May to 3rd week of August.

††14 weeks, 3rd week of May to end of August.

In a normal year when pods mature at one time within a short period, leaf-fall due to *Phytophthora* is seen to last for 5 to 6 weeks. Availability of mature pods at one time will depend on the 'wintering' of a clone, time of flowering and its susceptibility to *Oidium*. Depending on these factors, mature pods may be present either in May, June or July and periods of heavy leaf-fall, depending on rainfall, could be expected to occur in June, July or August.

In an abnormal year, when pod set is spread over months due to protracted flowering, pod set may not be heavy and mature pods would be present over a number of months. In such years, leaf-fall may be rarely heavy but continued over a longer period as seen in Tables 1 and 2.

Rainfall in relation to onset and severity of Phytophthora leaf-fall

Rainfall appears to be the chief climatic factor governing the onset and severity of the disease.

Onset of the disease

It was observed in all three years, that the first visible occurrence of leaf-fall followed a rainfall of 1 in. or more for 2 or more days. Any light showers preceding these days may have some effect on the intensity of the leaf-fall that follows the heavy rainfall. Visible leaf-fall followed rainfall of over 1 in. on 20th and 21st June 1970, 23rd and 24th July 1971 and 16th, 17th, and 18th June 1972 (Table 3).

TABLE 3
RAINFALL AND ONSET OF *PHYTOPHTHORA* LEAF-FALL IN DARTONFIELD
RAINFALL PRIOR TO ONSET OF LEAF-FALL

1970	1971	1972
17th June 0.40*	21st July 0.23*	14th June 0.05*
18th June 0.70	22nd July 0.27	15th June 0.21
19th June 0.08	23rd July 1.38	16th June 1.80
20th June 3.06	24th July 2.38	17th June 1.60
21st June 1.28	25th July 0.53	18th June 3.00
22nd Onset—1st leaf-fall	26th Observation date—mild	19th Onset—1st leaf-fall
*Rainfall in inches		22nd Observation date—mild

Severity of the disease

After the onset of the disease, the subsequent rainfall will be the deciding factor for the severity of the disease. In 1970 and 1971 at Dartonfield the weeks following the onset were dry, and leaf-fall was either absent or mild. Heavy leaf-fall occurred in the 3rd and 4th week after onset during which period heavy rainfall too was recorded. Thereafter the disease declined with the advent of the dry weather. Tables 4a and 4b.

TABLE 4A
LEAF-FALL IN RELATION TO RAINFALL, DARTONFIELD, 1970

Weeks	Period	Rainfall (in.)	Incidence
	17th—23rd June	5.56	Onset—22.6.70
1	24th—30th June	3.48*	Very mild
2	1st—7th July	0.08	Mild
3	8th—14th July	5.18	Mild—heavy
4	15th—21st July	8.59	Heavy
5	22nd—28th July	1.60	Decline

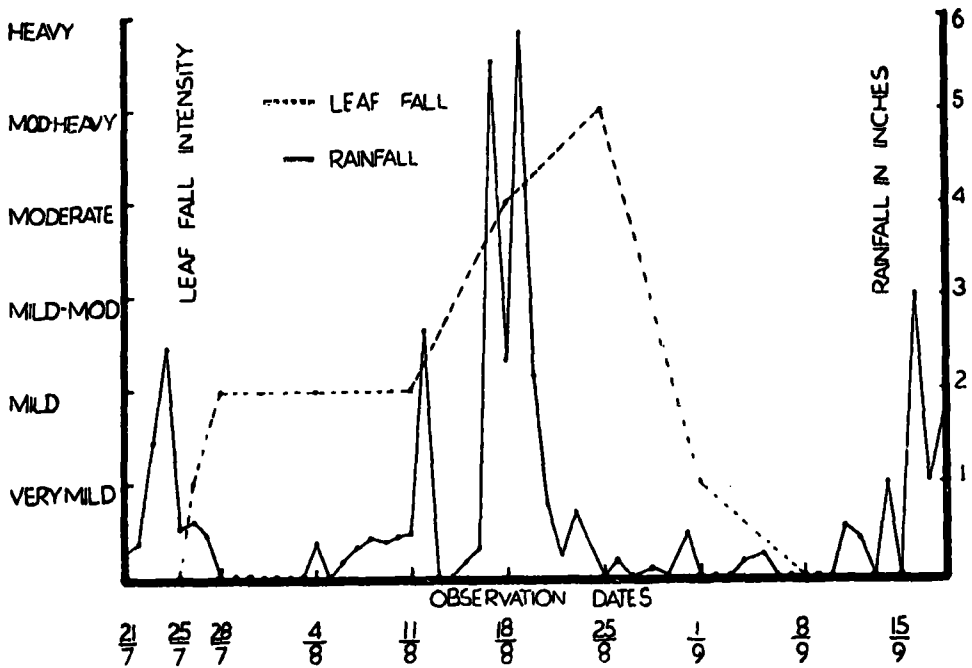
* 30th June 2.58" rain

TABLE 4B
LEAF-FALL IN RELATION TO RAINFALL, DARTONFIELD, 1971

Weeks	Period	Rainfall (in.)	Incidence
	21st—27th July	5.92	Onset—26.7.71
1	28th—4th Aug.	0.30	Very mild
2	5th—11th Aug.	1.20	Mild
3	12th—18th Aug.	10.08	Moderate
4	19th—27th Aug.	9.82	Heavy
5	28th—4th Sept.	0.51	Sharp decline

FIG. 1

PHYTOPHTHORA LEAF-FALL PATTERN IN RELATION TO RAINFALL DARTONFIELD



DISEASE RATING INDEX:—

- VERY MILD — very few scattered diseased leaves
- MILD — few scattered diseased leaves
- MILD-MOD — fairly moderate
- MODERATE — diseased leaves freely seen
- MOD-HEAVY — fairly heavy
- HEAVY — diseased leaves forming carpet on ground.



Plate 1 Clone R.R.I.M. 513

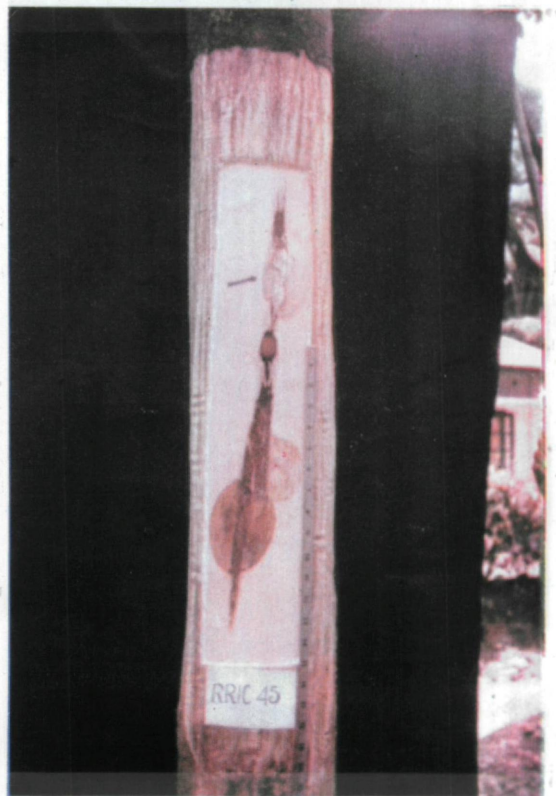


Plate 2 Clone R.R.I.C. 45

Plates 1 & 2. Clones showing susceptible reaction to artificial inoculation with zoospore suspension of *Phytophthora palmivora*. The bark has been removed to show infection. (Note: spread of lesion from the point of inoculation.)



Plate 3 Clone PB 86 showing natural infection by Black Stripe Disease



Plate 4 Clone PB 86 showing susceptible reaction to artificial inoculation with zoospore suspension of *P. palmivora*. (Note : spread of lesion from the point of inoculation.)



Plate 5 Clone R.R.I.C. 100
 Plate 5 Clone R.R.I.C. 100

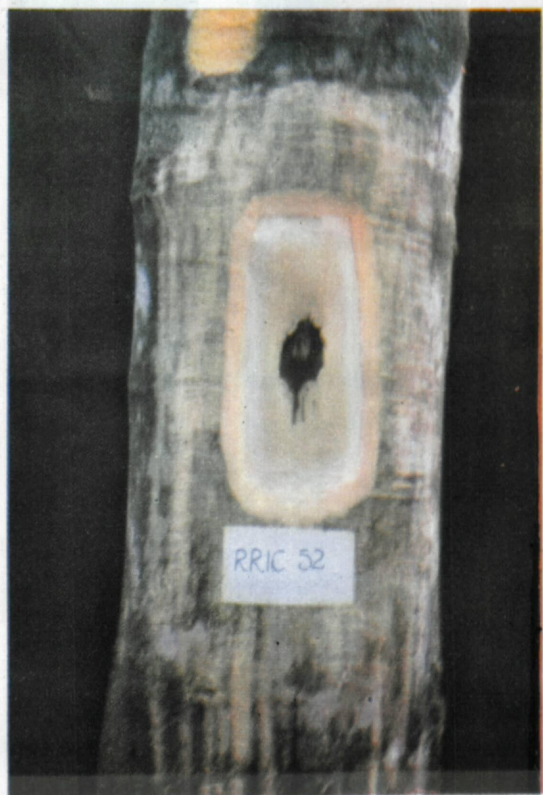


Plate 6 Clone R.R.I.C. 52
 Plate 6 Clone R.R.I.C. 52

Plates 5 & 6. Clones showing resistant reaction to artificial inoculation with zoospore suspension of *P. palmivora*. (Note: restricted dark lesion which is the characteristic reaction of clones resistant to Black Stripe Disease.)

Phytophthora leaf-fall pattern in relation to rainfall in Dartonfield in 1971 is clearly seen in Fig. 1. The rainfall over 1 in. or more for 2 days brought down the first set of infected leaves. With the absence of rain the week after, and slight showers in the 2nd week, leaf-fall remained mild. The subsequent heavy rainfall increased the intensity to heavy leaf-fall. Slight showers in the 5th week caused a sharp decline in the disease and it ceased by the 6th week. Heavy rainfall after the 6th week had no bearing on the disease, as pods, the most suitable *Hevea* plant tissue for multiplication of the fungus, was not available in the site. This again shows that a set of pods which mature at about the same time will influence the disease only for about 5 to 6 weeks.

Importance of intensity of rainfall to abnormal leaf-fall

In 1965 and 1966 *Oidium* incidence had been very mild or absent with fairly moderate to heavy pod set in some Estates but as rainfall for June and July had been low defoliation of mature leaves by *Phytophthora* had been either absent or very mild (Table 5).

TABLE 5

IMPORTANCE OF RAINFALL TO ABNORMAL LEAF-FALL

ESTATE	Rainfall (in.)			Podset	Leaf-fall
	June	July	August		
1965					
Culloden-Kalutara	4.66	9.26	16.62	Medium	Nil
Edurugalla „	5.97	4.78	26.93	Heavy	Nil
Dewalakanda-KV	7.73	4.53	25.70	Medium	Very mild*
Kiriporuwa „	7.72	6.56	25.17	Medium	Mild*
1966					
Culloden-Kalutara	8.18	8.36	8.61	Medium	Very mild
Rayigam „	10.90	7.58	7.07	Medium	Very mild
Ambatenne „	8.91	8.87	6.88	Heavy	Very mild
Galboda-Ratnapura	9.88	8.68	13.72	Medium	Very mild
Poronuwa „	9.44	8.15	11.32	Heavy	Nil
Katandola-Galle	9.65	8.07	13.35	Heavy	Nil
Baddegama „	5.90	2.30	11.55	Medium	Nil

*Leaf-fall occurred in August

Data presented in this Table were taken from the *Phytophthora* and *Oidium* questionnaires for the years 1965 and 1966.

The influence of rainfall on the incidence of leaf-fall is also shown in Table 6. In 1970 in both Eladuwa and Yatadola Estates, rainfall was low in the weeks following the onset, the leaf-fall remained mild and ceased by the 4th week. In both estates pod set had been moderate to good.

TABLE 6

LEAF-FALL IN RELATION TO RAINFALL ELADUWA AND YATADOLA ESTATES 1970

Period	ELADUWA		YATADOLA	
	Rainfall (in.)	Incidence	Rainfall (in.)	Incidence
July/Aug. 39—3	4.63	First observed	3.44	First observed
July 15—21	0.96	Nil	0.60	Nil
July 22—28	2.97	Mild	3.48	Very mild
August 4—10	3.71	Leaf-fall on the decline	0.94	Leaf-fall on the decline

These observations show the importance of rainfall to the incidence of *Phytophthora* leaf-fall. Ramakrishnan & Radhakrishnapillai (1961) too have shown rainfall as being the most important factor which influences the onset and determines the severity of the disease.

From the observations made on the disease incidence, it is clear that:—
(i) *Phytophthora* leaf-fall in a normal year would last for about 5 to 6 weeks from onset starting either in May, June or July, depending on the period during which mature pods are present. In an abnormal year defoliation of mature leaves would last for 10 to 14 weeks or more.

(ii) Onset and severity of the disease could be followed from the daily rainfall figures for a particular division of an estate where *Phytophthora* disease is known to occur when mature infected pods are present in these fields.

(iii) Incidence of *Oidium* for a particular year and rainfall from May onwards will be the key factors in the occurrence of *Phytophthora* leaf-fall for that particular year. Combinations of these factors that result in incidence of *Phytophthora* leaf-fall are given in Table 7.

TABLE 7

KEY FACTORS INFLUENCING THE INCIDENCE OF *PHYTOPHTHORA* LEAF-FALL

<i>Oidium</i> incidence	Pod set	Rainfall	Leaf-fall	Example
Absent	Good	Heavy in June/July	Heavy	Dartonfield 1970
Light & late	Moderate to good	Heavy in July/August	Heavy	Dartonfield 1971 (Experimental area protected)
Severe	Poor	Heavy	Absent	Dartonfield 1971 Mirishena
Absent	Good	Low in June/July	Absent or very mild	1965—1966 (Table 5)
Light & late	Moderate to good	Low in July/August	Absent or mild	1970 Eladuwa Yatadola (Table 6)
Light and protracted	Protracted flowering and protracted pod set	Moderate or heavy over months from May to Nov.	Mild prolonged	Dartonfield 1972 Frocester

When *Oidium* leaf disease is absent, pod set is heavy and with heavy rains in June and July *Phytophthora* leaf-fall too would be heavy as seen in Dartonfield and in many other estates in 1970. If *Oidium* incidence is late and light, pod set may be late, and if it is heavy, heavy rainfall in July and August would influence *Phytophthora* leaf-fall which again would be heavy as seen in Dartonfield experimental area in 1971.

In years when incidence of *Oidium* is severe (as seen in 1971 in most estates) pod set would be poor. Even if heavy rains occur during the monsoon months they would be of no consequence.

If rainfall is low during June, July, August, as seen in 1965, 1966 (Table 5), or as was recorded at Eladuwa and Yatadola Estates in 1970 (Table 6), then, even if pod set is heavy, disease would remain low or absent for that season.

In an year when protracted flowering and pod set occur as seen in 1972 at Dartonfield and Frocester Estates (Table 1 and 3), then the disease would be spread over a number of months, though not severe.

DISCUSSION AND CONCLUSIONS

Peries (1969) suggested a formula for forecasting *Phytophthora* leaf-fall epidemics based on temperature, relative humidity, sunshine and rainfall. Although no detailed data are given, it is stated that, if temperature below 29°C, relative humidity above 80%, at least 0.1" of rain per day and less than 3 h of sunshine per day prevailed for 4 consecutive days when infected fully mature green pods are present on the trees, leaf-fall epidemics can be expected to occur within the next fourteen days. In our observations, though heavy leaf-fall occurred in 1970 and in 1971, in areas where infected mature pods were present, some of these conditions did not prevail as suggested. Especially it was found that 0.1 in. rain per day for 4 consecutive days was not sufficient to keep the relative humidity constant above 80% for those days in the three years, in which the observations were made at Dartonfield. It was also noted that occurrence of a dry period soon after onset of leaf-fall resulted either in the absence of the disease or reduction in the intensity of leaf-fall as seen in Table 4a, 4b and 6.

Bourke (1970) in his review of plant disease prediction from weather data states that warnings based on observed weather data are not in the true sense forecasts. We do not aim here to forecast leaf-fall as we find that it is not practicable to predict such a disease on *Hevea* in Sri Lanka as done with late blight of potatoes; and even in the United Kingdom studies are being carried out to simplify the existing method with the use of a thermometer and a rain gauge which would be suitable for individual farmers (Smith & Walker, 1966). Our observations show that daily rainfall of an estate really governs the course of the disease when infected pods are present in the field and that daily rainfall intensity varies from estate to estate, and in some large estates from division to division within the estate. By observing the rainfall, the intensity of the disease in a particular estate could be followed up from onset to decline of leaf-fall. Rain gauges are available in estates which could serve the purpose.

It has been invariably noted that *Phytophthora* leaf-fall is followed by black stripe disease of the tapping panel in areas where leaf-fall prevails, and if proper precautions are not taken in time the disease is bound to occur.

We have shown that *Phytophthora* leaf-fall intensity follows the pattern of rainfall in a particular area. Hence the pattern of rainfall, if carefully followed during the monsoon months, could be a useful guide in determining the period during which precautions should be taken for the prevention of black stripe.

When viewed in the light of our observations on the incidence of disease and factors influencing the intensity of the disease it is clear that the present recommended period—mid-June to mid-September—for application of fungicides does not hold good for every year. This period will vary from year to year in any one estate. When leaf-fall commences in May as seen in Table 2 for Frocester Estate in 1971, it would be important to take the necessary precautionary measures from May onwards to prevent the incidence of black stripe. Therefore, the time to commence the application of fungicides or to adopt any other preventive measure should commence with the onset of leaf-fall. The length of time to adopt the preventive measure is again determined by the duration of leaf-fall. In a normal year leaf-fall would last for 6 to 8 weeks and in an abnormal year 10 to 14 weeks or even more.

Hence, precautionary measures should be taken as long as leaf-fall occurs in an area and for 2 to 4 weeks after it has completely stopped. In 1972 leaf-fall occurred as late as late September and early October in some estates. One estate reported severe incidence of black stripe in early October, and this estate had taken the necessary precautions for

black stripe till September as recommended but the leaf-fall that occurred after this period provided the inoculum for infection of bark which resulted in severe incidence of bark rot in the 'susceptible areas'.

When using rainfall data as a guide to follow the course of leaf-fall, firstly, areas where leaf-fall occur year after year, which are well known to the estate should be inspected for the presence of mature infected pods from the beginning of May, and secondly when infected pods are present, the daily rainfall figures should be observed. When heavy rainfall over 1 in. or more occurs for more than two days then it could be expected that appreciable leaf-fall would occur in the 'susceptible areas' where infected pods are present. The intensity of leaf-fall from then onwards will follow the pattern of rainfall. It would be best to cease tapping only in the 'susceptible areas', especially in those sections of the estates where black stripe is a perennial problem, from onset of leaf-fall until 2-4 weeks after the disease has ceased.

All estates can do away with the routine application of fungicides in wet weather too if they will strictly adhere to the recommendations to cease tapping in areas where leaf-fall occurs from onset to 2 to 4 weeks after leaf-fall has completely ceased. When trees are tapped in these areas only those in which the panel and the bark above the tapping cut are dry should be tapped.

Routine application of fungicides right through the year only results in unnecessary expenses to the estate. For instance, in Dartonfield Group in 1969 waterproof and water-miscible fungicides were used right through the year for which the total expenses amounted to Rs. 10,110/-. In 1972 the amount estimated for the use of water-miscible fungicides during the wet weather was Rs. 4,836/- of this only Rs. 1,794/- was spent. This expenditure was incurred only for the application of fungicides once in three weeks in the experimental areas of the various departments. The interval of application, however, shows that this was not warranted because if the fungicide was performing a useful function it would have to be applied on every tapping day. Fungicides were not applied in the rest of the estate. It should be noted that no new infections of bark was reported this year and this is mainly because tapping was not carried out when the bark was wet.

It is observed that even now most estates apply fungicides before tapping, although Satchuthananthavale (1971) pointed out that this practice has no effect on the control of the disease.

If fungicides are to be used they should be applied only in areas where leaf-fall occurs in the estate, commencing from onset of leaf-fall to 2 to 4 weeks after leaf-fall has ceased. It should be applied at the time of collection of latex on every tapping day. If this is followed then large sums of money that is being spent by incorrect use of fungicides in disease free areas at times when they are not required could be saved.

Results of screening of clones for disease resistance

Preliminary trials were carried out to screen clones for disease resistance and susceptibility to *Phytophthora* black stripe disease. Trees were artificially inoculated using a zoospore suspension of the pathogen to induce infection.

In clones which were susceptible to the disease, the lesion was light brown in colour and was of a spreading type. Of the clones tested, clones RRIM 513, RRIC 45, PB 86 and RRIC 107 gave this susceptible reaction. Infection spread rapidly forming longer lesions on the first two clones compared to the other two. Clone PB 86 is known for its susceptibility to Bark Rot but clone RRIC 45 is not. Only two estates have reported black stripe incidence on clone RRIC 45 so far. From these results it would appear that both clone PB 86 and RRIC 45 are similar in their susceptibility to Bark Rot.

In clones in which disease was not established the lesion was restricted and dark brown in colour. Of the new clones of RRIC 100 series; clones RRIC 100, RRIC 102, RRIC 103 and RRIC 105 gave 100% resistant reaction in the first trial. Clones RRIC 102 and RRIC 103 were tested again at a different station and found to exhibit the same reaction.

TABLE 8
DISEASE REACTION TO ARTIFICIAL INOCULATION

Station	Clone	Number of trees inoculated	Year of planting	Trees group according to lesion length				
				20 cm & above	10-20 cm	3-10 cm	0-3 cm	
Kuruwita	RRIC 45*	9	1966	3	1	2	3	
	RRIC 52	9	1961	2	3	3	1	
	PB 86*	9	1964	—	2	7	—	
	RRIC 107*	9	1964	—	7	1	1	
	RRIC 110	9	1964	—	2	1	6	
	RRIC 109	6	1963	—	2	1	3	
	RRIC 104	3	1961	—	—	2	1	
	RRIC 108	7	1963	—	—	1	6+	
	RRIC 100	9	1961	—	—	1	8+	
	RRIC 105	5	1963	—	—	—	5+	
	RRIC 102	9	1964	—	—	—	9+	
	RRIC 103	9	1966	—	—	—	9+	
	Dartonfield	RRIM 513*	10	1961	10	—	—	—
		RRIC 45*	10	1961	9	—	—	1
PB 86*		10	1961	1	7	—	2	
RRIC 52		10	1961	—	—	10	—	
NAB 12		10	1952	—	—	10	—	

*Lesion light brown in colour and spreading type.
in the other clones lesion dark brown in colour and restricted type.
+ Clones in which disease was not established.

From these results of the preliminary trials we are of the opinion that clones could be tested at an early stage by this method for inherent resistance or susceptibility to black stripe disease.

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