Control of Black Stripe Disease of Rubber

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ABSTRACT

Black Stripe disease, caused in Thailand by the fungus *Phytophthora botryosa*, is a serious and common infection of the tapping panels of rubber trees during the wet season.

Recent experiments have studied the degree of disease control in relation to different frequencies of application, using four fungicides, with daily and alternate daily systems.

It was found that for both tapping systems, treatment should be at least on every second tapping day when using Difolatan or Drazoxolon. With mild infections a longer interval of up to one week is satisfactory with Difolatan only. In the case of Antimucin, a slower acting chemical, use after every tapping was best with alternate daily tapping but the result was not clear with daily tapping. Actidione (cycloheximide) at 0.5% concentration failed in all treatments perhaps due to deterioration of prepared stock solutions, and cannot be recommended.

Black Stripe is a disease of the tapping panels of rubber trees caused by the fungus *Phytophtho ra palmivora* but *P. botryosa* seems to be the responsible pathogen in Thailand. The current state of knowledge of the disease in all its aspects including measures to control it has been reviewed by Schreurs (3).

The disease is characterised by black stripes of necrotic tissue in the cambium of recently tapped bark and also by bark lesions. In severe cases, wood is exposed thus ending the productive life of that part of the panel; in less severe cases the regeneration of the bark is uneven and future tapping is difficult. The fungus enters through wounds of the phloem; tapping itself is a wounding operation and the soft exposed tissues are very susceptible to invasion in the first 48 hours after tapping.

Black Stripe is a disease of the wet season when spores arriving on the bark are able to germinate easily. In Thailand the disease is most serious in the higher rainfall regions, especially in the changwats of the west coast of the peninsula.

Although there are differences in susceptibility, clones are resistant to the disease and all the high yielding clones used in Thailand suffer.

The disease can be controlled by the correct use of fungicides but little use is made of them here and too frequently the use is ineffective because of wrong times and frequency of application. Although recommendations for the control of the disease have been published in Malaysia (1), it is very necessary to appraise them for their relevancy to Thai conditions which differ in two important aspects, the widespread use of daily instead of alternate daily tapping and the much higher total rainfall (from 3000 to 5000 mm./annum). The experiments described in this paper studied the control of black stripe with various fungicides in relation to frequency of their application with both daily and alternate daily tapping.

Experimental Methods

The studies were carried out at Bang Po Rubber Station, Takuapa, on three clones; PB 5/51

and RRIM 605 with alternate daily tapping (d/2) and RRIM 623 with daily tapping (d/1). In the case of d/2, tapping was in fact less frequent because of rain interference but the regularity of d/1 was maintained as much as possible by late or afternoon tapping. All cuts were half spiral. Frequencies of application were for alternate daily tapping:

every tapping day, that is 1 day in 2
every second tapping day, that is 1 day in 4
every third tapping day, that is 1 day in 6

and for daily tapping:

every tapping day, that is 1 day in 1
every second tapping day, that is 1 day in 2
every fourth tapping day, that is 1 day in 4
every seventh tapping day, that is 1 day in 7

The fungicides used and their concentrations were:

Antimucin WBR,	organomercuric compound, 0.5%+1% Teepol	
Actidione,	cycloheximide,	0.5%
Difolatan 4 flowable,	captafol,	2.0%
-	drazoxolon,	1.0%

Chemicals were applied on a band of 5 cms above the tapping cut and 2 cms below the cut on each occasion immediately after tapping.

The experiments were arranged as incompletely randomised blocks in 4 replications with 3 or 4 trees per treatment plot. In all cases, tapping panels were first artificially inoculated with 10 ml. of fresh spore suspension on two occasions at an interval of 7 days, before fungicidal treatment was started.

Scoring of the incidence and severity of the disease lesions on a 0 to 4 scale was done each 15 days for 2-3 months according to the duration of the treatments.

Results

Alternate daily tapping: The mean scores for each treatment for all observations are given in two parts by clone, in Table 1. Lines have been added to delineate treatments where the incidence of disease fell notably below control level. Looking first at control, it is seen that the amount of infection was similar in both clones up to 60 days and then there was a major resurgence of the disease in clone PB 5/51 - this was influenced by the very humid conditions under a fairly complete canopy of leaves in that clone whereas in clone RRIM 605, defoliation due to Phytophthora leaf disease was very intense and so as the micro climate in that plantation was changed to less humid.

Results varies very much by chemical as well as by frequencies of treatment. No treatment was completely effective. Looking at the chemicals, Antimucin started to control the disease within one month but only after 2 months did the level of infection fall well below control. It is particularly important to note that the chemical prevented a major re-infection at 60 days in PB 5/51 and this emphasises its protective function.

Actidione which was without effect on PB 5/51 and showed on slight activity on RRIM 605, was clearly not fungitoxic under the conditions of the experiment.

Difolatan presented conflicting results. It showed strong fungitoxic activity on PB 5/51 where control of the disease was obvious within 30 days but for undetermined reasons its activity on RRIM 605 was erratic and rather weak.

For both Antimucin and Difolatan it is clear that application after every tapping was the best and further that they only exerted and sustained fungitoxic and protective action when applied at least after every alternate tapping day. The benefit of x 1 frequency of use was particulary strong for Antimucin although on the less infected panels of RRIM 605, its application on alternate tapping days was adequate after $1\frac{1}{2}$ months. In the case of Difolatan on PB 5/51, its use every second tapping day was almost equally successful as for use every tapping day and so apparently indicating longer fungitoxic persistence on the panel.

Table 1. Scores of the incidence of Black Stripe disease with alternate daily tapping.

Clone PB 5/51

Chemical	Frequency of application (in tapping days)	Days after treatment						
		0	15	30	45	60	75	90
Antimucin	x1	2.5	2.2	1.5	1.0	1.2	0.5	0.5
	x2	2.7	2.0	1.7	1.5	2.0	1.5	0.7
	x3	3.5	3.2	2.7	2.5	3.0	2.5	2.0
Actidione	x1	2.7	2.7	2.2	1.7	2.5	1.7	1.0
	x2	2.7	2.0	1.5	1.2	2.5	1.7	0.7
	x3	2.2	2.2	1.2	1.5	3.2	2.0	1.2
Difolatan	x1	3.0	2.0	1.2	1.0	1.2	0.7	0.2
	x2	3.0	2.0	1.5	1.2	1.2	0.7	0
	x3	2.5	2.2	1.7	1.2	1.7	1.5	0.7
Control		3.0	2.0	2.0	1.2	3.2	1.7	1.0

Clone RRIM 605

Fungicide	Frequency of application (in tapping days)	Days after treatment					
		0	15	30	45	60	75
Antimucin	x1	3.0	2.0	1.7	1.0	0.5	0
	x2	3.7	2.7	2.0	1.2	0.7	0.2
	x3	3.7	3.2	2.7	2.0	1.5	0.5
Actidione	x1	3.5	2.7	2.2	1.7	1.2	0.5
	x2	3.5	3.2	2.5	2.0	1.2	1.0
	x3	3.2	2.7	1.7	1.2	0.5	0.2
Difolatan	x1	3.5	2.7	2.2	1.7	1.2	0.7
	x2	3.5	2.5	1.7	1.5	1.2	0.5
	x3	3.2	2.5	1.7	1.5	1.2	1.0
Control		3.5	3.0	2.0	1.5	1.2	1.0

Daily tapping: The mean scores of each treatment over $2\frac{1}{2}$ months are given in Table 2. Again lines are drawn to mark out areas useful disease control.

By chemicals, Antimucin and Difolatan again gave clear evidence of suppressing the disease within 30 days. Drazoxolon also emerged with a high level of fungitoxic activity and it could that it is as effective as the first two. Actidione was again a failure and in fact it will be observed that the incidence of disease actually seems to have increased under the use of this chemical.

By frequency of application, the following three important results were obtained:

With Difolatan and drazoxolon, daily application was the best but the advantages over alternate daily use were small.

Table 2. Scores of the incidence of Black Stripe with daily tapping.

Clone RRIM 623

Chemical	Frequency of application (in tapping days)	Days after treatment					
		0	15	30	45	60	75
Antimucin	x1	1.6	1.0	0.4	0.4	0.7	0.2
	x2	1.6	1.2	0.3	0.3	0.1	0
	x4	1.5	0.2	0.2	0.2	0.2	0
	x7	2.0	0.6	0.3	0.3	0.3	0
Actidione	x1	1.5	1.4	0.7	0.7	1.2	0.3
	x2	1.7	2.0	1.3	1.3	2.0	0.3
	x4	1.8	1.8	1.0	1.5	1.8	0.5
	x7	1.8	1.8	1.1	1.2	2.1	0.8
Difolatan	x1	2.0	1.0	0	0	0	0
	x2	1.5	0.5	0.2	0	0	0
	x4	1.7	0.5	0.2	0.2	0	0
	x7	1.6	0.8	0.1	0	0.1	0
Drazoxolon	x1	2.0	1.0	0	0	0	0
	x2	1.9	0.7	0.4	0.2	0	0
	x4	1.9	0.9	0.4	0.7	0.4	0
Control		1.7	1.0	0.6	0.4	0.6	0

Application as infrequent as x7 was almost as effective as more frequent usage for Difolatan.

With drazoxolon, intervals wider than alternate daily were definitely disadvantageous.

Further and most surprisingly it would seem that with Antimucin use after every tapping was a disadvantage.

Discussion

Black Stripe is a difficult disease to eliminate and in these experiments it was not controlled as strongly as anticipated. A number of reasons for this could be offered including:

The influence of high rainfall causing loss of chemical from the trunks.

Inadequate concentration for local conditions.

Incomplete coverage of the newly tapped bark with fungicide.

The effect of rain could not be directly ascertained but rainwash of chemical was often observed in the case of drazoxolon - such a defect could be remedied by a change in formulation of product.

Possible inadequacy of concentration of chemical could be due to the rainfall effect or from other inherent factors in the host/parasite relationship including the fact that the fungus species involved in the disease in Thailand is not the same one as elsewhere. In the case of Difolatan our laboratory plate tests have indicated that a 2.5 percent concentration would be better than

the generally recommended 2 percent. A similar reason might also explain, in part, the failure of Actidione since there are indications from the laboratory that the fungitoxic concentration is nearer 1.5 percent and not the recommended 0.5 percent.

However, another reason for the poor results with Actidione could have been the deterioration of prepared solutions in storage (a colloidal suspension developed) - in which case the fungicide would not be very suitable for generalised use by small holders.

The illogical result with Antimucin, that is, less effective at the most frequent rates of application, might have been associated with the addition to the chemical of a 1 percent Teepol as spreader. Although Chee in Malaysia reported favorably on the combination, it has been the experience in Cambodia that the use of anionic Teepol impaired the efficiency of Antimucin and there, it is strongly recommended to use non-ionic adjuvants only (2).

The experiments have demonstrated the most important fact that the fungicidal value of the chemicals for Black Stripe control is closely linked with the frequency of their application. Clearly with alternate daily tapping, fungicide is ideally applied after every tapping and it must be applied not less frequently than every alternate tapping day if used less often than this, control is delayed or not possible, so giving rise to the risks of severe and permanent damage to the future tapping panels. The same basic fact holds for daily tapping.

One of the main uses of fungicide should be to protect the panel against invasion of spores. This aspect has already been remarked in the results for PB 5/51 where a secondary resurgence of disease was much suppressed through the regular use of Difolatan and Antimucin. It is a practical demonstration of the fact that the primary function of these fungicides should be to prevent rather than to control disease which has been allowed to develop. This means that the chemicals must be in place on the trunk when the spores start to invade, in other words, at the beginning of the wet season and, then, used regularly during the normal epidemic period.

A decision on the frequency of use of fungicide must take into account their cost of use and the relationship of this cost to total returns and labour required. As the disease is one of the wet season when tapping is less frequent, applications would not be required as often as the theoretical tapping schedule would indicate. It is estimated that for Difolatan and Antimucin, the cost of chemical and application is only about 5 satang per tree. About 150 trees can be treated per hour preferably by the tapper. Thus costs would be about 3 baht per rai per time not a large item and they are of lesser importance than the risks of damaging future tapping panels, a key to long term profitable exploitation through the failure to use fungicide correctly.

Literature Cited

1. CHEE, K.H. 1972. Recent investigations in the control of Black Stripe. Proc. R.R.I. M. Planters' Conf. 155 p.

2. RESING W.L. AND G. DECONINCK. 1966. Lutte contre la maladie des panneaux de saignee. Recommandations actuelles (Control of tapping panel diseases. Present recommendations). Circulaire aux Planteurs No. 05/66, Institute des Recherches sur le Caoutchouc au Cambodge.

3. SCHREURS, J. 1972. Black thread disease, control measures and yield stimulation in Hevea brasiliensis in Liberia. Mededelingen Landbouwhogeschool Wageningen, Nederland, 72-26.