

LOSSES OF CROP CAUSED BY *EXOBASIDIUM VEXANS* MASSEE

2—LOSSES ON UNSHADED HIGH-YIELDING CLONAL TEA

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It was reported that loss of crop caused by *Exobasidium vexans* Massee on seedling tea was not quantitatively related to the degree of control of the disease (de Silva, Murugiah & Saravanapavan 1972). High-yielding tea clones may behave differently from seedling tea and % loss of crop due to disease may be of a different order, and total losses possibly more. In order to investigate this, crops were measured over a five-year pruning cycle from high-yielding clonal tea with different degrees of disease incidence obtained by spraying different doses of fungicide. It was found that crop loss caused by *E. vexans* on clone TRI 2024 was negligible over each year and over the pruning cycle. It is possible that high-yielding clones may suffer more loss per unit area in an individual harvest because there are more potential infection sites, but the ability of clones to grow more rapidly compared with average seedling tea seems to suggest that losses in individual harvests may be made up for more quickly, resulting in no significant differences in crops over long periods, regardless of whether infection by *E. vexans* is controlled or not. This finding could lead to large savings in the cost of control of *E. vexans* in Sri Lanka.

INTRODUCTION

It was reported in the previous paper in this series (de Silva, Murugiah & Saravanapavan 1972) that infection of unshaded *seedling tea plants by *Exobasidium vexans* Massee was dependent on the dose of copper-based fungicide applied. Different doses of fungicide ranging from 0 to 560 g/ha brought about different levels of infection, but crops harvested from the sprayed plots were not quantitatively related to the degree of disease control obtained by applying the fungicidal treatments.

Clonal tea is generally high yielding compared with seedling tea. Clones were originally selected for their capacity to yield well and for other desirable properties such as their ability to produce tea with good manufacturing properties. Poor clones may be comparable with average seedling tea but a specially-selected, high-yielding clone may respond differently to disease infection than does average seedling tea.

This paper describes the results of experiments on loss of crop attributable to Blister Blight Leaf Disease on high-yielding unshaded clonal tea.

EXPERIMENTAL

The high-yielding tea clone TRI 2024 spaced 0.6 m within rows and 1.2 m between rows planted in 1961 as far as possible with rows on the contour, was used for these experiments which were conducted at the Tea Research Institute of Sri Lanka, St

* 'Seedling' tea refers to tea plants grown from seed as opposed to 'clonal' tea grown from cuttings of selected mother bushes.

Coombs Talawakelle (elevation 1200 m amsl). The experimental area was demarcated into 24 plots of 100 plants each. There were no interspersed shade trees. There were eight fungicidal treatments which were allocated at random to plots in each of three blocks. The plots and the blocks fitted into a contiguous area. Each plot was bordered with guard rows maintained at a height of 0.15 m above the level of the plucking table of the plot, in order to minimize the possibility of spray drifts from one plot to the next. Eight doses of fungicide, zero, 4.375, 8.75, 17.5, 35.0, 70.0, 140.0 and 560.0 g/ha Perenox† dispensed in 170 l/ha water, were applied using knapsack-type sprayers with standard nozzles. The spray treatments were applied the day following each harvesting round and spraying was done throughout the year irrespective of weather conditions.

Samples of flush (young shoots) consisting of the leaf bud and three successive leaves were collected from each plot for the purpose of assessing the degree of disease infection immediately before collecting the harvest from each plot. Each sample consisted of not less than one hundred shoots. The weight of the sample was added to the weight of crop harvested. Shoot infection was assessed by obtaining the % of shoots showing young or mature lesions on the third leaf of each shoot. This method is standard for the measurement of shoot infection at the Tea Research Institute of Sri Lanka and at other tea research stations. The standard of plucking was assessed at about 60% 'two leaves and a bud'. Harvesting was generally done every 6 to 9 days, depending on the quantity of flush available for harvest.

The following quantities of fertilizer were applied uniformly to all plots each year:

N (as calcium ammonium nitrate)	336 Kg/ha given in 6 doses	
K ₂ O (as muriate of potash)	100 Kg/ha	} given in a single dose
P ₂ O ₅ (as saphosphosphate)	22 Kg/ha	
Dolomite	250 Kg/ha	
Boron (as Borax)	2.1 Kg/ha	

The experiment continued for an entire pruning cycle of five years duration. Pruning was carried out according to standard estate practice in the high-country of Sri Lanka, leaving one or two rim lungs which were removed at bud break. Herbicides were not used for weed control which was carried out manually. The fungicidal treatments in the year of pruning commenced at the time new buds appeared after pruning.

RESULTS AND DISCUSSION

Mean disease infection obtained with different doses of fungicide for each year of the pruning cycle are given in Table 1.

† Perenox is a cuprous oxide WP formulation containing 50% w/w metallic copper, manufactured by the Plant Protection Division, Haslemere, Surrey, U.K, of Imperial Chemical Industries, Ltd, UK and marketed by Chemical Industries (Colombo) Ltd.

TABLE 1 — *Blister blight infection on the third leaf of shoots of unshaded TRI 2024, obtained after spraying different doses of fungicide*

Year of pruning cycle	3rd yr	4th yr	5th yr	1st yr	2nd yr	3rd yr	Cycle total
No. of assessments	19	44	43	23	41	16	186
Dose of fungicide (g/ha)							
0	23.6a	35.3a	33.7a	17.8a	36.8a	52.8a	34.4a
4.375	20.9ab	33.9ab	31.2ab	14.9b	37.3a	49.0b	32.3b
8.75	19.8b	33.9ab	32.6ab	14.9b	36.5a	44.4c	32.2b
17.5	19.4b	32.9b	30.8ab	12.2c	33.5b	43.5c	30.4c
35.0	14.9c	33.0b	30.5b	10.8cd	31.0bc	43.4c	29.3cd
70.0	13.1cd	32.2b	29.9bc	12.3c	29.2c	43.7c	28.6d
140.0	10.9de	28.9c	27.4cd	9.4d	25.3d	37.7d	25.4e
560.0	9.6e	21.6d	24.4d	6.7e	16.1e	28.0e	19.6f
LSD ($P=0.05$)	3.2	1.8	3.0	2.0	2.8	3.7	1.6

(Symbols *a* to *f* are used to indicate significance at $P=0.05$ in vertical columns only. There is no significant difference between figures with the same symbol in vertical columns).

It is seen from Table 1 that the extent of disease control is proportional to the dose of fungicide applied. This confirms earlier observations on seedling tea (de Silva *et al.* 1972) that different levels of infection are obtained by applying varying doses of copper-based fungicide.

The crops from the plots with different levels of infection were not significantly different ($P < 0.05$) for any of the years of the pruning cycle. This result generally confirms the earlier conclusion that although infection levels may vary, crops harvested do not vary accordingly. Fig 1 shows the difference between % infection and also between crops harvested from plots sprayed with 280 g Cu/ha and from unsprayed plots for each year of the pruning cycle. It is evident that whereas infection levels between these two treatments were widely different, crops did not differ significantly.

These experiments were carried out on high-yielding clonal tea with a much larger number of plucking points per unit area than the seedling tea which was used in our earlier studies. There is the possibility that the infection of individual shoots by *E. vexans* could be affected by the number of shoots per unit area, but evidence is lacking on this point. If the disease was causing sufficient damage to the shoots to the extent that yield was likely to suffer, then we could expect losses from a high-yielding clone to be greater than that from seedling tea which has lower cropping potential. The fact that crop losses over each year of the pruning cycle did not differ significantly despite differences in infection levels, must mean that these levels are below a threshold value which appears to be higher for clonal tea than for seedling tea.

It is possible that at times when conditions for infection are most favourable, *ie* for some individual harvesting rounds particularly during monsoon conditions, the loss of young shoots caused by *E. vexans* could be considerable. The fact that such losses do not add up cumulatively over a year or over a pruning cycle to produce significant losses from plots with varying levels of infection could mean that such losses are being compensated for in subsequent harvests when conditions for infection are not as severe. This concept was suggested in our previous paper and it now appears to have more validity.

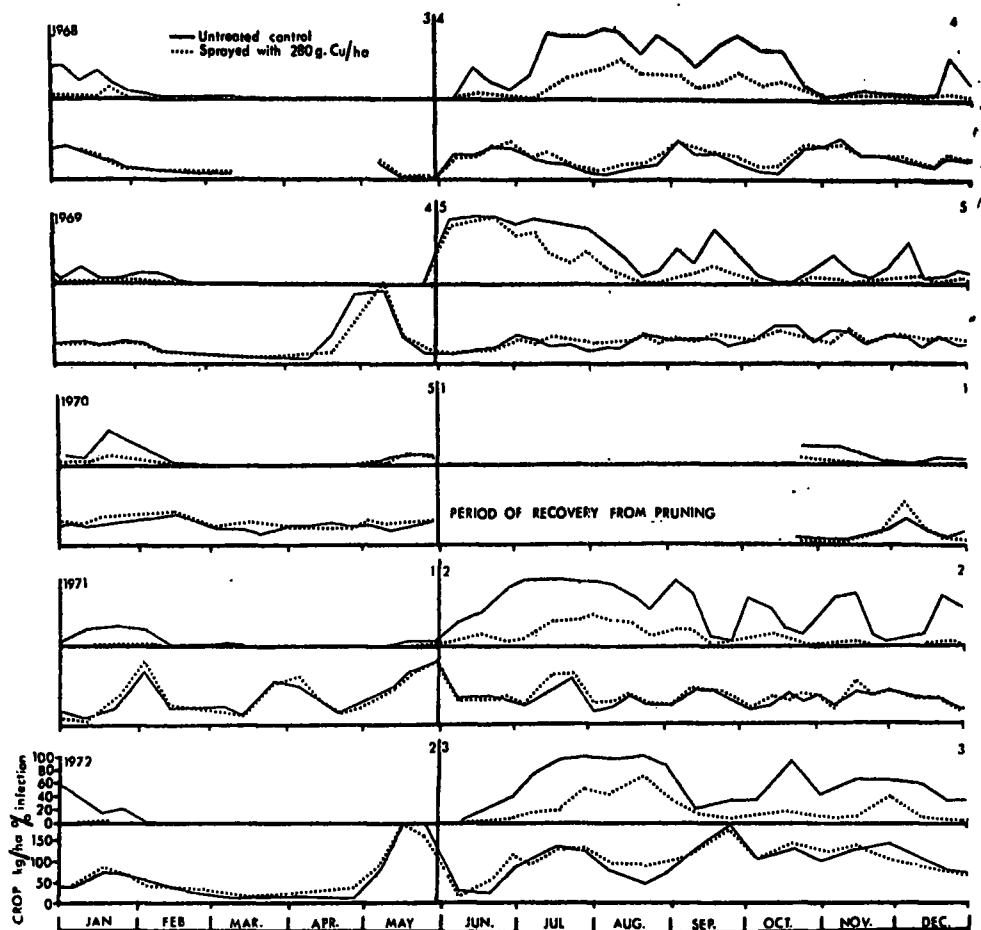


FIG. 1—Effect of copper fungicide on infection of tea (Clone TRI 2024) by *E. vexans* and on tea crop for the period 1968-1972—The year of the pruning cycle indicated.

The major difference in the results of our experiments on clonal tea and those on seedling tea relates to the fact that in the case of seedling tea in the early part of the cycle some significant crop loss was recorded, whereas for clonal tea, even in the early part of the cycle no significant losses were recorded. This difference could be explained by the hypothesis that losses in individual harvests, particularly during weather favourable for infection, are compensated for in subsequent rounds, when high yields are obtained from clonal tea compared with that from average seedling tea. This could mask the losses taking place in individual rounds more effectively in clonal tea than in seedling tea. More work needs to be done on this aspect of the problem.

Further, it is well known that tea responds to unfavourable conditions with unusually high shoot production subsequently. For example, after a prolonged dry period particularly in Uva (eastern tea districts of Sri Lanka) with the onset of the wet weather there is the annual 'rush' period when very large crops are harvested. Tea plantations in Uva are the most productive in Sri Lanka despite the fact that they undergo a dry period longer than that experienced in any other tea-growing area in Sri Lanka. It has also been pointed out (Calnaido 1973) that when tea plants are attacked by insect pests, the losses caused could be compensated for subsequently, resulting in unappreciable differences in crops over a year or a pruning cycle from pest-free and pest-attacked tea.

If *E. vexans* was able to infect mature leaves as well as young leaves, then perhaps significant crop losses might have been recorded, but it is well known that the fungus can infect only young succulent shoots and that it is not capable of penetrating mature shoots. The young shoots in a clonal tea plant may constitute a smaller proportion of the total shoot system than do the young shoots of a seedling tea plant. Loss of young shoots to a seedling tea plant may, therefore, be a more serious setback than it is to a clonal tea plant. This could explain why crop loss was recorded on seedling tea but not on clonal tea in the early stages of the pruning cycle.

The results presented in this paper are subject to three sources of possible error. Firstly, there is the possibility of phytotoxicity of fungicide which needs to be investigated. Secondly, it is well known that tea clones differ in their susceptibility to infection by *E. vexans*. Our experiments were carried out on clone TRI 2024. It is not impossible that other clones with varying susceptibility to *E. vexans* would behave differently. Thirdly, our experiments were carried out at one location, and even with the same clone, it is possible that results may differ at locations with different climatic conditions.

These results, however, are sufficiently encouraging for us to envisage great savings in the cost of control of *E. vexans* in Sri Lanka.

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