

# RECENT EXPERIMENTS WITH NEW FUNGICIDES FOR THE CONTROL OF BLISTER BLIGHT (*EXOBASIDIUM VEXANS MASSEE*) ON TEA

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Blister Blight (*Exobasidium vexans* Massee) on tea has been successfully controlled by spraying copper-based fungicidal formulations containing 50% metallic copper. Formulations containing 20-25% copper, and, nickel chloride hexahydrate, containing 24% nickel, were tested for their efficacy in controlling Blister Blight at various rates of application. It was found that the rate of 4 oz per acre, of the test fungicides Perexin (25% copper, 30% zinc) Colloidox (20% copper) and nickel chloride gave adequate control of Blister Blight except under very severe monsoon conditions. Perenox (a standard formulation containing 50% metallic copper) was significantly superior to each test fungicide at equal rates of application. The significance of these results is discussed.

## Introduction

Since the time when copper-based fungicides were first recommended by the TRI for the control of Blister Blight (*Exobasidium vexans* Massee) on Ceylon tea, more information has accumulated about the causative fungus, its epidemiology and control with fungicides. The search for cheaper and/or more efficient methods of control still continues, and could result in considerable economy. The present article describes recent findings in experiments with new fungicides for blister blight control carried out in 1965. The significance of these results is discussed.

The fungicides used in these experiments are listed below :

<i>Fungicides</i>	<i>Active ingredients</i>	<i>Metal contents</i>
†Colloidox	cuprous oxychloride	20% copper
*Perenox	cuprous oxide	50% copper
*Perezin	cuprous oxide and zinc oxide	25% copper and 30% zinc
*Nickel chloride hexahydrate	nickel chloride	24% nickel

The literature on the fungicidal action of copper, zinc and nickel has been reviewed in an earlier article (de Silva 1965), where, also, experiments with Perenox, Perezin and nickel chloride were described. Each of these fungicides, at the rate of 4 oz per acre per spraying round, gave adequate control of Blister Blight on St Coombs Estate, during the monsoons of 1964, which, however, were rather mild. Further testing in 1965 was, therefore, necessary.

Colloidox is a suspension where the active ingredient, cuprous oxychloride, is suspended in a liquid. It contains 20% W/W of metallic copper, and it was decided to include this compound in certain experiments in order to test the performance of low-copper-content fungicides.

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† Obtained from The Shell Company of Ceylon Ltd.

\* Obtained from Chemical Industries (Colombo) Ltd.

## Field Experiments

### Experiment P 15a

The experiment was carried out at No 10 Field at St Coombs Estate (elevation 4500 ft). Each of the four fungicides (Colloidox, Perenox, Perezin, and nickel chloride) were tested at three rates of application—viz 4, 2 and 1 oz of the fungicide, in 15 gallons of water per acre. Together with the unsprayed controls, the number of treatments totalled 16. There were four replicates of each treatment. Knapsack sprayers were used. The experimental area was divided into four blocks, each block containing 32 plots, of 200 bushes each and covering 1/15 acre. The treatments were allocated to 16 plots in each block at random. These represented the 'white' squares on a chessboard. The 'black' squares were unsprayed controls. In this way, each treated plot was surrounded on all four sides by unsprayed plots, in order to eliminate edge effects resulting from one treated plot affecting the infection on neighbouring plots. In addition, guard rows of bushes were maintained. These were allowed to grow up to one foot above the level of the plucking table. Possible spray drifts were thereby completely eliminated. The shade was more or less uniform throughout the experimental area and was provided by *Grevillea robusta* spaced 20 ft × 30 ft and *Erythrina lithosperma* spaced 20 ft × 30 ft.

In the nickel chloride treatment, 0.01% 'Teepol' was used as a wetting agent. Low concentrations of fungicides were used deliberately to sharpen any possible differences. The spraying commenced at the beginning of May and was continued until the end of July 1965. Assessments of Blister Blight were made according to the method described earlier (de Silva 1965). During the period of the experiment, daily records were maintained for sunshine, rainfall, and the density of spores of *E. vexans* in the atmosphere using an Hirst spore trap.

### Results

Statistical analysis of the data obtained from the experiment gave the following information :

- 1 — The unsprayed controls had significantly higher ( $P < 0.01$ ) blister blight infection than the fungicide-treated plots.
- 2 — For each fungicide, there was a clear dosage response—less infection being observed on plots sprayed with higher fungicide concentrations.
- 3 — Colloidox, Perezin and nickel chloride hexahydrate each at the rate of 4 oz per acre, and Perenox at the rates of 4 oz and 2 oz per acre controlled Blister Blight appreciably during the period of the experiment, but Perenox at the rate of 4 oz per acre gave significantly better control ( $P < 0.05$ ) than any of the other three fungicides at the same rate of application.
- 4 — There was no significant difference between the degree of control obtained with nickel chloride, Colloidox and Perezin each at the rate of 4 oz/acre and Perenox at the rate of 2 oz per acre.
- 5 — There was no significant difference between the degree of control obtained with nickel chloride, Colloidox and Perezin at the rate of 2 oz per acre and Perenox at the rate of 1 oz per acre.
- 6 — There was no significant difference between the degree of control obtained with nickel chloride, Colloidox and Perezin at the rate of 1 oz per acre.

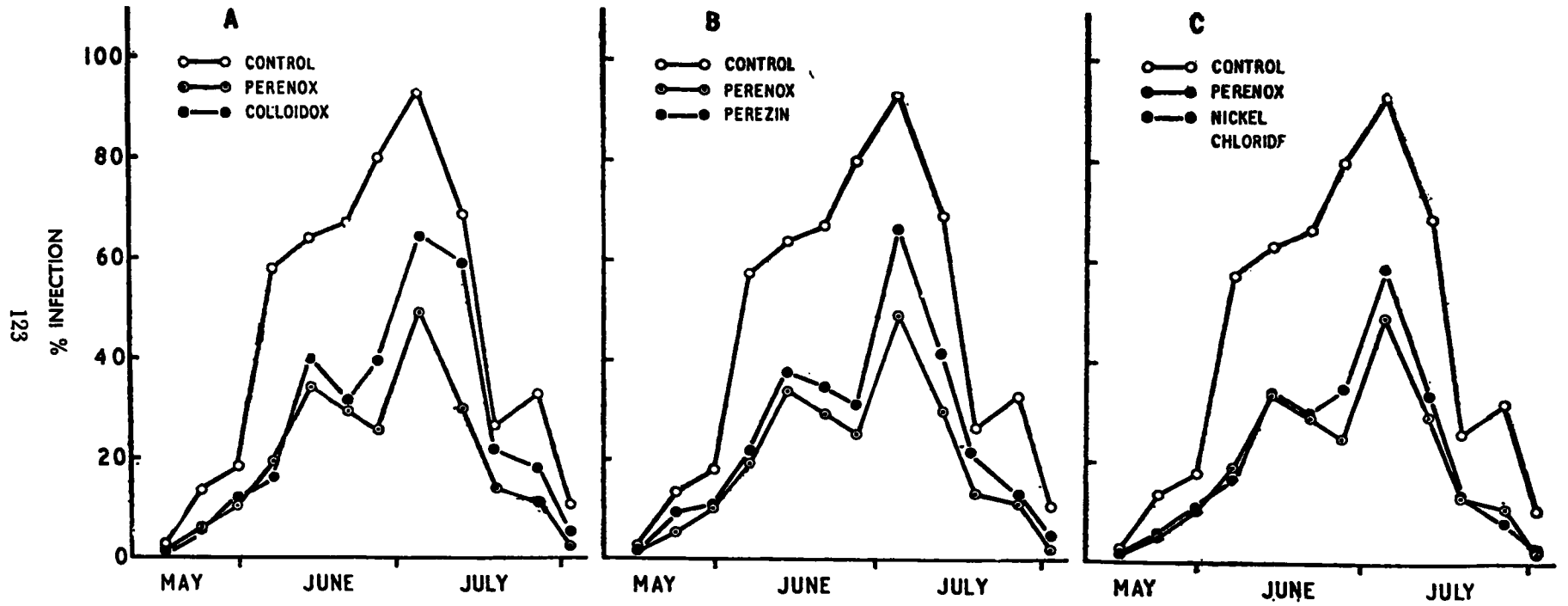


FIGURE 1—Percentage infection of shoots by *E. vexans* in plots sprayed with test fungicides

Figure 1 indicates the degree of control of Blister Blight obtained with Colloidox, Perezin and nickel chloride hexahydrate when compared with the unsprayed controls and the standard fungicide Perenox. Each fungicide was used at the rate of 4 oz per acre. The plots treated with each test fungicide showed less blister blight infection than the untreated plots, but had more infection than the plots treated with Perenox, the standard fungicide containing 50% W/W of copper.

#### *Experiment P 15b*

This experiment was similar in design and layout to experiment P 15a (described above), except that an extra treatment was added, where Perenox and nickel chloride hexahydrate each at the rate of 4 oz per acre were applied in alternate rounds.

#### *Results*

The results obtained from this experiment are shown in Table 1.

TABLE 1—Percentage infection of Blister Blight on plots sprayed with test fungicides

Fungicides	Rate of application per acre (oz)	Mean % infection
Nickel chloride	.. 4	18.98
	2	26.51
	1	31.42
Colloidox	.. 4	21.23
	2	25.66
	1	30.27
Perenox	.. 4	16.24
	2	19.27
	1	24.74
Perezin	.. 4	19.22
	2	24.63
	1	29.78
Perenox and nickel chloride in alternate rounds	.. 4 (each)	18.92

LSD at P = 0.05 — 2.67

LSD at P = 0.01 — 3.72

The results shown in Table 1 confirm the results obtained from the previous experiment (P 15a). The use of alternate rounds of nickel chloride and Perenox each at the rate of 4 oz per acre did not result in better control of Blister Blight, than that obtained with 4 oz per acre of nickel chloride alone.

#### **Extension Experiments**

##### *Field Trial 1 (XUP 1)*

A large scale field trial was carried out at Hopton Group, Lunugala (elevation 2500 ft) in order to investigate the efficacy of nickel chloride in controlling Blister Blight.

The following treatments were carried out :

- 1 — Nickel chloride hexahydrate at the rate of 4 oz in  $2\frac{1}{2}$  gallons of water per acre  $\pm$  zinc/magnesium sprays
- 2 — Shell colloidal copper (20% copper) at the rate of 4 oz in  $2\frac{1}{2}$  gallons of water per acre
- 3 — Perenox at the rate of 4 oz in  $2\frac{1}{2}$  gallons of water per acre
- 4 — Nickel chloride hexahydrate at the rate of 3 oz in  $2\frac{1}{2}$  gallons of water per acre
- 5 — Unsprayed controls

Plots were over ten acres in extent except for the unsprayed control plot which measure  $5\frac{1}{2}$  acres and were unreplicated. Mistblowers were used for the spraying and assessments of Blister Blight were carried out as described earlier (de Silva 1965).

#### *Results*

- 1 — Sprayed plots had significantly less Blister Blight than unsprayed plot ( $P < 0.01$ ).
- 2 — Nickel chloride at 4 oz per acre gave significantly better control of Blister Blight than when it was used at the rate of 3 oz per acre ( $P < 0.05$ ).
- 3 — Nickel chloride at the rate of 3 oz per acre gave poor control of Blister Blight in December and January.
- 4 — There is apparently no reduction in efficiency of Blister Blight control when zinc sulphate and magnesium sulphate were incorporated into the nickel chloride sprays.
- 5 — Nickel chloride, Shell colloidal copper and Perenox gave adequate control of Blister Blight at the rate of 4 oz per acre.
- 6 — Mistblowers are suitable for nickel chloride spray application.

Other treatments were also carried out but inconclusive results were obtained.

#### *Field Trial 2 (XP 6)*

A large scale field trial was conducted at Lindoola Estate in order to determine the efficacy of Perezin in controlling Blister Blight. Seven treatments were applied, and mistblowers were used for spraying.

- 1 — Perenox at the rate of 6 oz per acre
- 2 — Perenox at the rate of 4 oz per acre
- 3 — Perenox at the rate of 2 oz per acre
- 4 — Perezin at the rate of 6 oz per acre
- 5 — Perezin at the rate of 4 oz per acre

6 — Perezin at the rate of 2 oz per acre

7 — Unsprayed control

Large fields were used, and assessment of Blister Blight carried out as described earlier (de Silva 1965).

#### *Results*

1 — Both Perezin and Perenox controlled Blister Blight significantly ( $P < 0.01$ ) at the rates of 6 and 4 oz per acre.

2 — Perezin at the rate of 2 oz per acre gave inadequate control.

#### *Field Trial 3 (XP 7)*

Certain fields on St Coombs Estate were sprayed with Perenox and others with Perezin at the rate of 4 oz in  $2\frac{1}{2}$  gallons of water per acre using mistblowers. The assessments of infection were carried out according to the methods described earlier (de Silva 1965). Although Perenox gave better control than Perezin, the level of control in the field with each fungicide was adequate. Mistblowers were found to be suitable for the application of Perezin.

#### *Field Trial 4 (XUP 2)*

In view of the fact that nickel chloride is an eradicant fungicide, a large scale field trial was laid out at Dammeria Group Passara (elevation 3000 ft) to investigate the effect of spraying large isolated tea areas with nickel chloride hexahydrate at the rate of 4 oz per acre in  $2\frac{1}{2}$  gallons of water in mistblowers, compared with Perenox at the same rate of application. Good control of Blister Blight was obtained with both fungicides, but Perenox gave significantly better control than nickel chloride. The natural level of infection in the unsprayed plots was too low for firm conclusions to be drawn.

#### **Discussion**

In all the experiments reported above, the use of the formulation containing 50% copper gave better control of Blister Blight than formulations having lower copper contents. Further, a clear dosage response was obtained in experiments P 15a and b where better control was obtained with higher doses of each copper-based fungicide. It appears, therefore, that blister blight control with copper-based fungicides is closely related to the quantity of copper applied, whether the formulation is a wettable powder or a suspension in liquid. In other words, all three copper-based fungicides used in these experiments were sufficiently well formulated. However, doses as low as 2 oz of Perenox (or 4 oz Perezin or Colloidox) are adequate except for severe monsoon periods when conditions are most conducive for high field infection.

Again, the fungicidal effects of zinc are negligible, although there would be other advantages in using zinc as a foliar spray on tea (Tolhurst, Fernando & Tillekeratne 1966).

Nickel chloride hexahydrate gave satisfactory control of Blister Blight at the rate of 4 oz per acre. Lower dosages gave insufficient control. It can be used in mistblowers provided that proper care is taken to see that the correct quantity of fungicide is applied. Scorching may result if this is not done. Further experiments on the use of nickel chloride hexahydrate on a large scale need to be conducted in order to determine whether infection levels are substantially reduced when eradicant fungicides are used.

### Summary and conclusions

- 1 — Perenox, Perezin, Colloidox and nickel chloride hexahydrate gave adequate protection against Blister Blight when applied at the rate of 4 oz per acre.
- 2 — Perenox gave significantly superior control than any of the other three test fungicides at each rate of application *viz* 4, 2 and 1 oz/acre.
- 3 — There was no significant difference between the control obtained with nickel chloride, Perezin and Colloidox at each rate of application.
- 4 — Perezin gave adequate control of Blister Blight in large scale trials on St Coombs Estate and Lindoola Estate. Nickel chloride gave adequate control of Blister Blight on Hopton Group and Dammeria Group. The rate of application tested was 4 oz per acre.

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