STUDIES IN BLISTER BLIGHT CONTROL

X. EVALUATION OF SOME COPPER CONTAINING FUNGICIDAL DUSTS IN THE CONTROL OF BLISTER DISEASE OF TEA

By

C. A. Loos

In a recent publication Haworth[1] reported on the copper deposited on glass plates, placed at varying distances from a power dusting machine, when certain copper dust formulations were tested, under the steady wind conditions prevailing in a railway tunnel. In those experiments the greater part of the copper, even in the best formulations, was deposited within 150 feet of the dusting machine. Plates beyond 150 feet received comparatively little copper although dust clouds emerged from the opposite end of the tunnel 680 feet away. Plates set between 10 and 75 feet from the machine showed very considerable copper deposits, indicating that the greatest fall of copper, under drift conditions, occurred between 25 and 75 feet from the dusting point. The blast from the power duster may be considered to have dissipated itself within 25 feet of the machine. It is, therefore, reasonable to assume that if the dust is dependent on wind drift for a fairly even distribution of copper it is advisable to dust in swathes or bands of 50–75 feet width.

Efficient dusting of large areas of tea, exclusively by means of a power duster, will in consequence only be possible in areas with a network of roads which will facilitate applications under varying wind conditions. Obviously, no such road systems exist on tea estates, and it is unlikely that they ever will.

Power dusting may, however, be replaced or supplemented by hand dusting with portable machines sufficiently light and convenient for a labourer to carry between the fairly closely planted tea rows.

The experiment described in this publication was designed to test dusting by means of the portable hand operated duster. Although the results of Haworth's tests were not available at the time the experiment was designed, the layout proved to be quite satisfactory.

Haworth's tunnel tests were on dust formulations identical with those employed in this experiment. The five proprietary dusts issued as 13 formulations were as follows :—

(1) Universal Crop Protection Ltd.—Cuprosana 2% copper as oxychloride (European manufacture).

(2) Imperial Chemical Industries Ltd.—Perelan 2% as cuprous oxide. (Indian manufacture).

(3) Imperial Chemical Industries Ltd.—2% copper as oxychloride. (Indian manufacture).

(4) Colombo Commercial Co., Ltd.—2% copper as oxychloride. (Continental manufacture).

(5) Robins—2% copper as oxychloride. (American manufacture).

(6) Robins plus Bentonite—2% copper as oxychloride. (American manufacture).

(7) Universal Crop Protection Ltd.—Cuprosana 4% copper as oxychloride.

(8) Imperial Chemical Industries Ltd.—Perelan 4% copper as oxide.

(9) Imperial Chemical Industries Ltd.—4% copper as oxychloride.

(10) Universal Crop Protection Ltd.—Cuprosana 6% copper as oxychloride.

(11) Colombo Commercial Co., Ltd.—6% copper as oxychloride.

(12) Imperial Chemical Industries Ltd.—Perelan 8% copper as oxide.

(13) Imperial Chemical Industries Ltd.—8% copper as oxychloride.

Each formulation was tested at three application rates, the application in each case being through the 'Orient' hand duster as supplied by Messrs. Walker Sons & Co., Ltd., Colombo :—

5 lbs. per acre every 5 days.
10 lbs. per acre every 5 days.
10 lbs. per acre every 10 days.

In addition to the above, Cuprosana 2% copper formulation has been tested at application rates of 7½, 12½ and 15 lbs. per acre, at five day intervals, in the hope that an application rate would be found at which total control of blister blight would be possible.

To assess the degree of protection afforded by the dusts, two plots were left unprotected and two plots sprayed at ten-day intervals with Perenox at a concentration of 4 ounces in 10 gallons water, at an application rate of 15-17 gallons per acre.

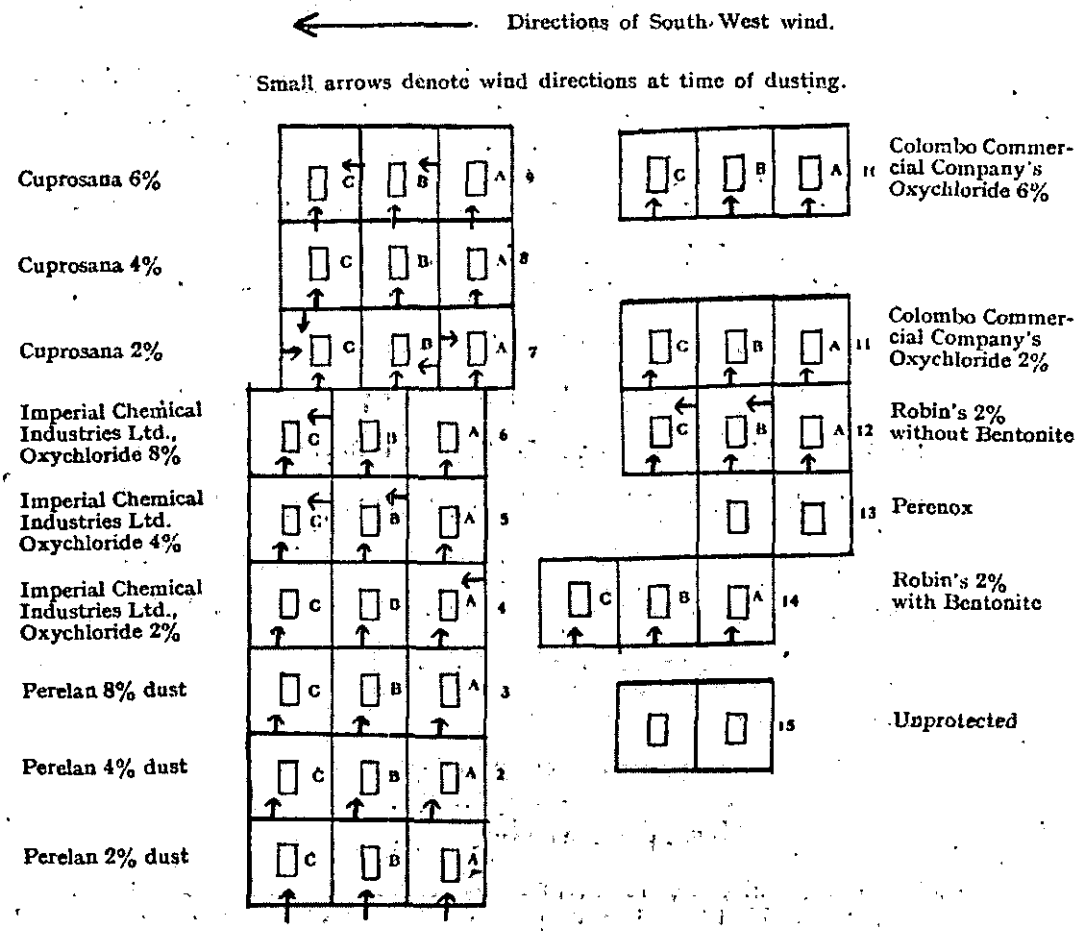
Experimental Plots

The area selected was a fourth year field on the Cairness Division of Mattakelle Estate, Talawakelle. Each plot was approximately one sixth of an acre in extent (80 ft. × 90 ft.) in the centre of which observation sub-plots 30 ft. × 20 ft. were marked out. All observations and evaluations were made in these central sub-plots

the boundaries of which were at no point more than 60 feet from the boundaries of the main plot along which the duster was operated. The plan of the plot layout is shown on the wind direction diagram below :—

DIAGRAM I

Plan of experimental area showing wind directions during dustings on 24th July, 1951.



Weather Conditions

The experiment commenced a few days after the break of the south west monsoon rains on May 29th 1951. Unfortunately, conclusive results with the dust formulations tested were not possible as the monsoon, while the experiment lasted, was comparatively light. The degree of control achieved during the period under review may not, therefore, be representative of control under more severe weather conditions.

Conditions favourable to blister infection did not commence until about the 20th of June. On July 3rd the average number of translucent spots on the 2nd fully expanded leaf of flush points was 2.13 on the unprotected area, and 0.09 on plots sprayed with Perenox. A week later the translucent spots developed into sporing blisters. The spores from these mature blisters would have taken a further 19 days to establish a second generation of blisters but the attack was checked by bright weather which set in on July 26th. This spell of fine weather lasted long enough to reduce the level of infection to insignificance even on the unprotected plots. At the observation on August 21st, the average number of infections on the 2nd leaf on flush points on the unprotected plot was 0.04 and 0.01 in the sprayed area. The disease continued at a low level until a sharp attack developed during the north east monsoon about the end of November. The prolonged and severe attacks normally experienced from July to October did not occur.

Dusting and Wind Directions

As stated previously dusting was done along the boundaries of the main plots with every effort being made to cover the central observation or sub-plot as evenly as possible. The plots were laid out on a hillside with a south -west aspect, each plot having its side boundary running due north-east to enable the south-west winds to carry the dust over the plot while dusting from the plot base. This plan failed. Wind direction changed in a matter of seconds even over small areas and it was often necessary to dust the small sub-plots from three directions. The reproduction on Diagram I show wind directions over the experimental area during dusting under typical conditions. On no occasion during the 37 dusting operations was the wind entirely from one direction.

Experiment Results

It was possible to make reliable comparative evaluations of control on two occasions only—21st July and 27th November. As the experiment was on a small scale, and replications of treatments were not possible, assessments could only be made in very general terms. In the case of 6% copper dust supplied by the Colombo Commercial Company Ltd. the poorer degree of control in comparison with the 2% dust cannot be adequately explained. A possible explanation is that the area over which the Colombo Commercial Company's 6% copper dust was used contained a fairly high percentage of good jat bushes as against the lower hybrid types, less susceptible to blister blight, occurring in the rest of the area.

Tables 1 and 2 give the assessment of control with the dust formulations and spraying in comparison with the blister incidence on the unprotected plots. This assessment is based on the following arbitrary scale:—

(1) Very good	(2) Good to very good	(3) Good
(4) Fairly good	(5) Very fair	(6) Moderate
(7) Fair	(8) Indifferent	(9) Poor

Table. 1. *Visual observations of control on 21st July*, 1951.

	5 lbs. every 5 days	10 lbs. every 5 days	10 lbs. every 10 days
2 per cent. dusts :			
Cuprosana	Fair	Very Fair	Indifferent
Perelan	Fair	Moderate	,,
I.C.I. copper oxychloride	Indifferent	Indifferent	,,
C.C.C. copper oxychloride	Fairly good	Good	Very Fair
Robins & Bentonite	Very Fair	Fair	Indifferent
Robins plain	Fairly good	Very Fair	Moderate
4 per cent. dusts :			
Cuprosana	Good	Good–V.G.	Very Fair
Perelan	Moderate	Very Fair	Fair
I.C.I. copper oxychloride	Very Fair	Fairly good	Indifferent
6 & 8 per cent. dusts :			
Cuprosana 6%	Good	Good–V.G.	Good
Perelan 8%	Fairly Good	Good	Fair
I.C.I. copper oxy. 8%	Very Fair	Fairly Good	Very Fair
C.C.C. copper oxy. 6%	Fairly good	Good	Very Fair
Perenox sprayed at 10 day intervals		Good–V.G.	
Unprotected		Fair	

Table 2. *Visual observations of control on 27th November*, 1951.

	5 lbs. every 5 days	10 lbs. every 5 days	10 lbs. every 10 days
2 per cent. dusts :			
Cuprosana	Good	Good	Good
Perelan	,,	,,	Very Fair
I.C.I. copper oxychloride	,,	,,	Fair
C.C.C. ,, ,,	,,	,,	Good
Robins & Bentonite	Very Fair	Very Fair	Very Fair
Robins plain	Good	Good	Good
4 per cent. dusts :			
Cuprosana	Good	Very Good	Good
Perelan	Fairly Good	Fairly Good	Indifferent
I.C.I. copper oxychloride	Good	Good	Good
6 & 8 per cent. dusts :			
Cuprosana 6%	Good–V.G.	Good–V.G.	Good
Perelan 8%	Good	Good	Good
I.C.I. copper oxy. 8%	Good–V.G.	Good–V.G.	Good
C.C.C. copper oxy. 6%	Fair	Fairly Good	Good
Perenox sprayed at 10 day intervals		Very Good	
Unprotected		Indifferent	

Control on the 21st July was less effective than that on 27th November. On the earlier date spraying gave a control assessed as good to very good in comparison with very good control on 27th November. The rains in July were light but almost continuous, probably causing a heavier attack than at the latter period of the north-east monsoon which is characterised by fine mornings. The degree of control was, in consequence, better when applied during more favourable weather.

2 per cent. copper dusts.—The Colombo Commercial Company's formulation was the best dust employed. It gave a fairly good control at the application rate of 5 lbs. per acre every 5 days when applied during the south west continuous rain. At 10 lbs. per acre every 5 days all formulations proved more effective than the lower application of 5 lbs. per acre every five days. Robins plain copper dust also showed fair promise.

Under the better weather conditions of the north-east monsoon all formulations except Robins plus Bentonite, gave good control. Cuprosana applied at 15 lbs. per acre every five days gave only fairly good control during the south west rains.

4 per cent. copper dusts.—Cuprosana was the best dust tried out. At 10 lbs. per acre every five days control was as good as spraying on 10 day rounds. Five pounds per acre every five days showed good control with no evidence of dieback, although blisters on leaves were fairly numerous.

6 per cent. and 8 per cent. copper dusts.—All formulations, except that of the Colombo Commercial Company, showed good control.

Discussion

The concentration of copper, and the length of round employed in wet spraying have been worked out to give adequate protection at the minimum possible cost. "Adequate" protection does not mean complete protection, which is economically impossible. "Adequate" protection means a degree of protection which is just sufficient or barely sufficient and is a compromise between ideals and a degree of protection which is not worthwhile.

Control less effective than that given by wet spraying should, therefore, be considered as inadequate. On this assumption all the 2 per cent. copper formulations may be ruled out as giving inadequate control even at application rates of 10 lbs. every five days. 4% Cuprosana dust on the other hand showed promise of adequate control, under the conditions we may expect in normal years when 5 lbs. per acre is applied at 5 day intervals. For control as effective as wet spraying 10 lbs. per acre every 5 days may be required. At prevailing prices 6% copper dusts may be ruled out as uneconomic on tea in plucking. The barely perceptible increase in control of 6% dust over that of 4%, in the case of Cuprosana, does not warrant the increased application even if prices were lower.

Acknowledgment

Our thanks are due to the Directors of the United Planters Co., of Ceylon, Ltd., and their agents, Messrs. Boustead Bros. Ltd., for permission to conduct the experiment on the Cairness Division of Mattakelle Estate. We are also deeply indebted to Mr. J. Mac Mahon, the Superintendent of Mattakelle Estate, who gave us every possible assistance.

Thanks are also due to Messrs. Colombo Commercial Co., Ltd., Messrs. Robins of the U. S. A., and Messrs. Imperial Chemical Industries, Ltd., for supplying dust formulations free of cost.

Reference

(1) Haworth, F.—Distribution of copper containing dusts. *Tea Quarterly*, Vol. XXII, part. III, Sept. 1951, pp. 118–120.