DISTRIBUTION OF COPPER CONTAINING DUSTS

By

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As part of a comprehensive series of experiments designed to determine the usefulness of dusting with copper fungicides, as a means of controlling the blister blight disease of tea, an attempt was made, during July 1951, to assess the distribution of various proprietary dust formulations under steady wind conditions.

The site of the experiment was the tunnel on the Ceylon Government Railways' line (single track) at Talawakelle. This tunnel is some 680 feet long. During the experiments here described a fairly steady wind of about 4 m.p.h. blew through the tunnel from south to north. The Whirlwind dusting machine, which was used, made its own small contribution to this steady breeze.

Two pounds of each dust were blown through the dusting machine, the nozzle of which was horizontal and positioned at a height of 6 feet from the ground. The machine was placed some ten yards inside the tunnel to avoid possible wind eddies at the entrance.

Glass plates of uniform size were placed at intervals throughout the length of the tunnel directly in line with the nozzle of the machine. After the projection of the dust the tunnel was allowed to clear completely of dust before the glass plates were collected. The plates were then brought to the laboratory and the amount of copper on each plate was determined using the standard sodium diethyldithiocarbamate colorimetric method.

The following 13 dusts were tested :—

1	Universal Crop Protection Ltd.	—Cuprosana	2% Cu.	as oxychloride
2	Imperial Chemical Industries Ltd.	—Perelan	2% Cu.	„ cuprous oxide
3	„ „ „ „		2% Cu.	„ oxychloride
4	Colombo Commercial Co., Ltd.	—	2% Cu.	„ „
5	Robins	—	2% Cu.	„ „
6	Robins plus bentonite	—	2% Cu.	„ „
7	Universal Crop Protection Ltd.	—Cuprosana	4% Cu.	„ „
8	Imperial Chemical Industries Ltd.	—Perelan	4% Cu.	„ cuprous oxide
9	„ „ „ „	—	4% Cu.	„ oxychloride
10	Universal Crop Protection Ltd.	—Cuprosana	6% Cu.	„ „
11	Colombo Commercial Co., Ltd.	—	6% Cu.	„ „
12	Imperial Chemical Industries Ltd.	—Perelan	8% Cu.	„ cuprous oxide
13	„ „ „ „	—	8% Cu.	„ oxychloride

The total copper deposits on the plates, each of area 100 sq. cms., at various distances from the machine are shown in Table I.

Table I. *Copper deposits, in micrograms per plate, at different distances from the machine*

Distance from machine; feet	DUSTS												
	1	2	3	4	5	6	7	8	9	10	11	12	13
5	300	93	156	—	—	—	—	365	3451	35	132	1363	2797
10	466	288	1100	31	—	—	27	3847	1046	365	165	18780	9840
25	253	3500	1647	258	36	87	97	3801	8473	786	2571	23380	26270
50	660	994	614	538	257	240	270	1144	3145	205	961	4084	6760
75	239	515	212	186	266	370	277	497	1312	481	461	1198	2209
100	125	578	127	100	206	277	177	lost	406	212	281	234	2400
150	38	76	58	80	172	200	105	60	110	124	155	230	131
200	12	11	82	—	103	110	63	37	39	90	140	226	—
250	—	10	—	—	56	60	32	—	—	65	174	217	—
350	15	—	—	—	6	—	6	—	—	49	—	—	—
450	—	—	—	—	2	—	2	—	—	19	—	—	—
550	—	—	—	—	—	—	—	—	—	—	—	—	—

Discussion

The various dusts behaved differently on issuing from the machine. Formulations Nos. 2, 8, 9, 12 and 13 formed rather dense clouds which did not billow out sideways until they had travelled some 50 feet from the machine. This is considered to be the reason for the excessive deposits which these dusts gave on the plates close to the machine. In considering the figures it must be borne in mind that the copper contents of the dusts ranged from 2% to 8%.

The other dusts rapidly filled the whole width of the tunnel and advanced as clouds. An observer at the north end of the tunnel reported that with every formulation a considerable cloud of dust emerged from that end of the tunnel. Considering the values obtained for the copper deposits on the plates at between 250 and 550 feet from the machine, it will be seen that, except for dust No. 10, virtually no copper settled on the plates placed at 350 feet or more from the machine. Hence it may be concluded that the dust clouds which emerged from the north end of the tunnel were either devoid of copper or consisted of particles so fine that they did not settle under the prevailing wind conditions. Small but definite deposits of dust were visible on the plates at 350, 450 and 500 feet from the machine with all formulations and it would appear therefore that the very fine clouds of dust which emerged from the north end of the tunnel carried little or no copper with them. From other experiments, which will be reported in due course, it seems as if appreciable amounts of copper are necessary to protect young tea leaves against the blister blight fungus and the observation that only very small quantities of copper travel beyond 350 feet, even with the best formulations, may be of considerable importance. The absence of deposits on the plates close to the machine in the case of some dusts is not important since the nozzle of the machine was fixed in a horizontal position, which would not be the case in field practice. Even on those plates which showed deposits at 5 and 10 feet, the deposits were not even but consisted mainly of large spots, apparently due to aggregates and small lumps which fell out immediately on leaving the nozzle of the machine.

Figs. 1, 2 and 3 show, on a logarithmic scale, the distribution of copper with distance.

Conclusions

1. It would appear that, for application by the large drift duster type of machine, formulations Nos. 2, 8, 9, 12 and 13 are of little use since they do not spread out very readily and would probably lead to very heavy but localised deposits of fungicides.

2. The general limit of carry seems to be in the region of 250 feet. Only dust No. 10 can be considered to have given any appreciable deposit beyond this point and the extreme limit with this formulation was about 450 feet.

3. The apparent distance which a dust cloud travels in the field may be very misleading in considering the relative merits of the various formulations, for the chief concern is how far copper, in effective quantities, travels.

4. Since these experiments were carried out under conditions much more favourable than could normally be expected in the field it may be concluded that the probable effective range of the dusts now available, using normal drift dusting technique, is of the order of 200-250 feet. In the case of dust No. 10 the figure is probably about 350 feet.

These results refer to formulations of dusts supplied by the various manufacturers in early 1951.

Acknowledgments

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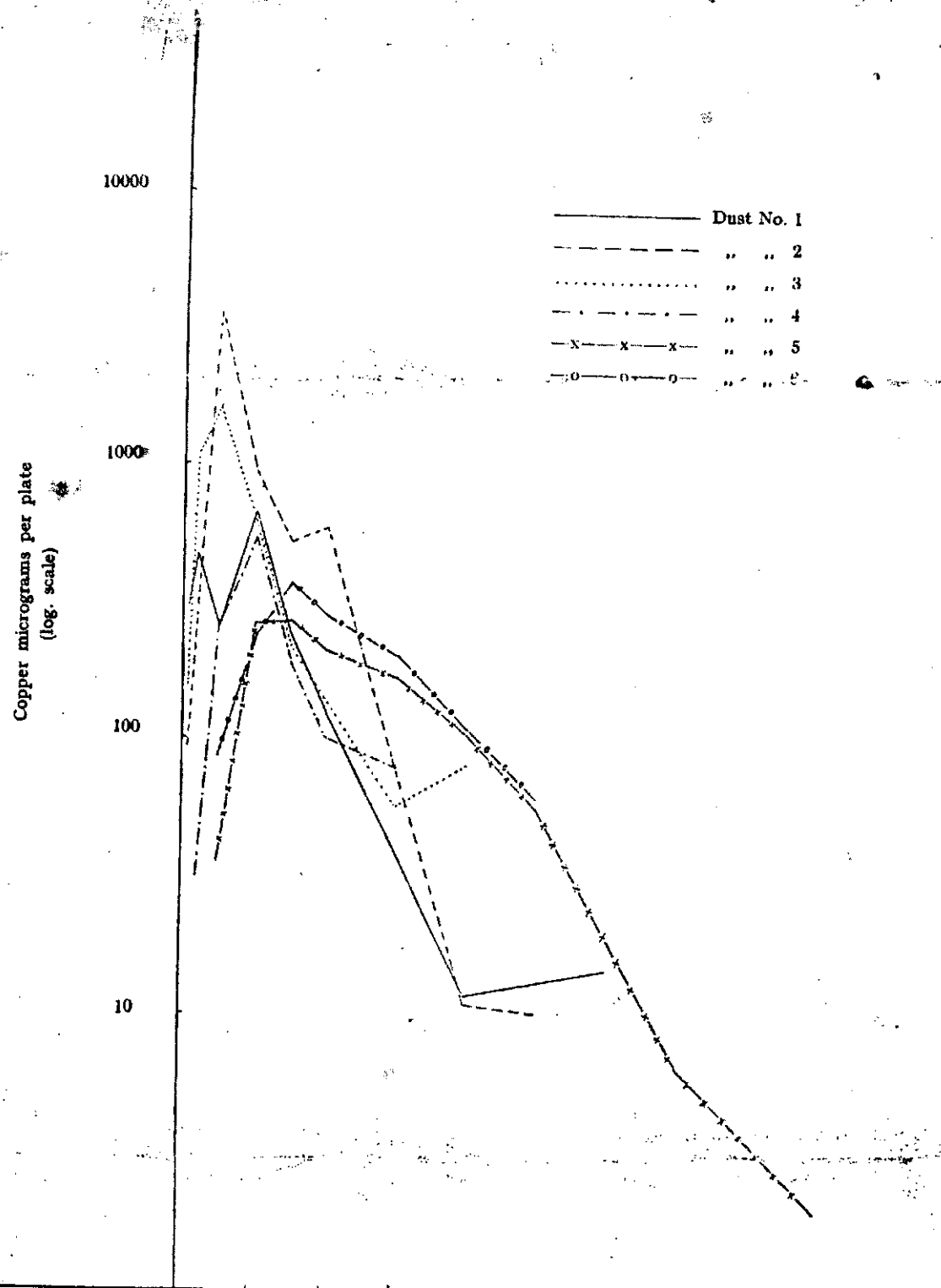

Fig. 1. *Showing the distribution of copper containing fungicidal dusts under steady wind conditions using the Whirlwind drift dusting machine. Dusts containing 2% copper.*

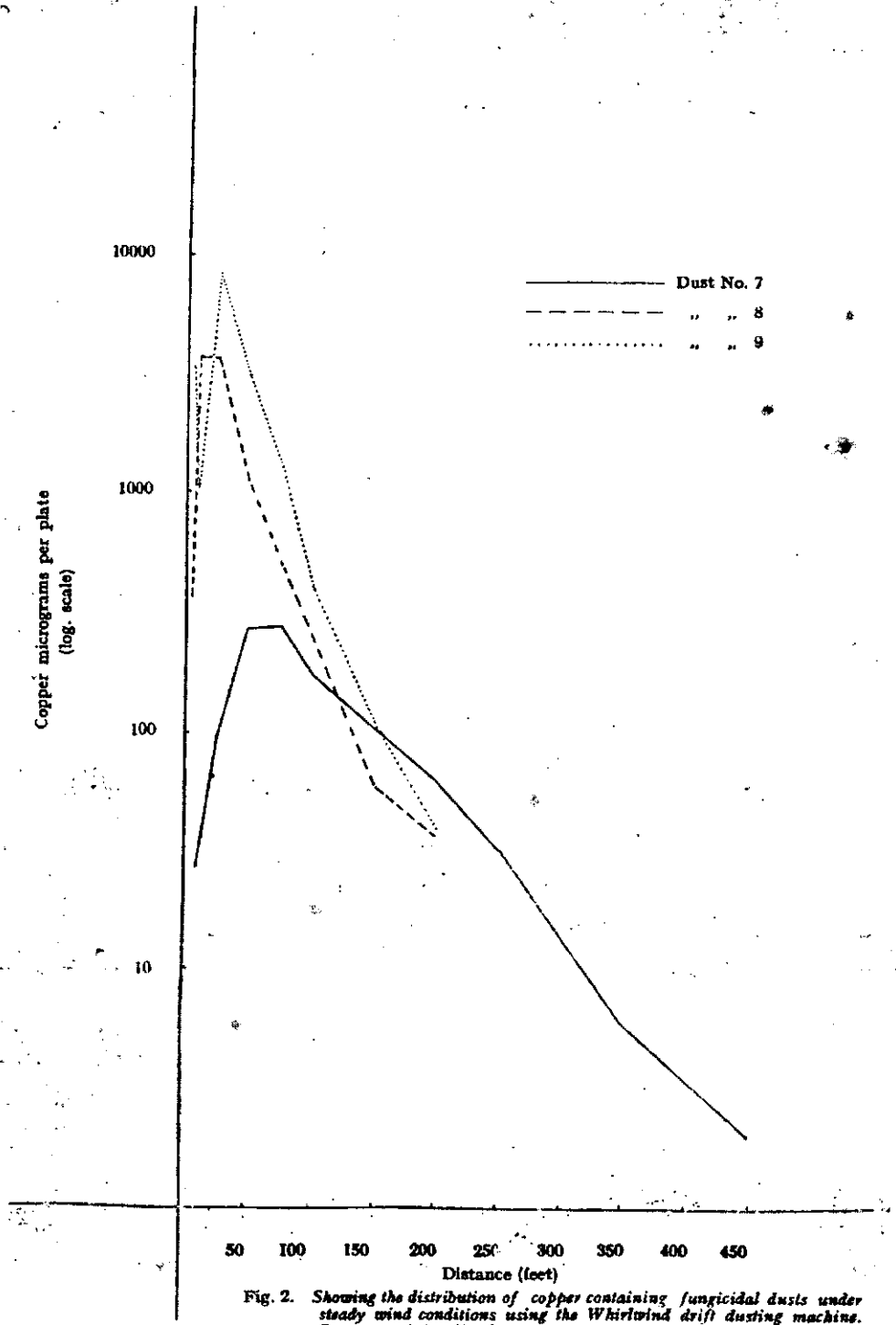

Fig. 2. *Showing the distribution of copper containing fungicidal dusts under steady wind conditions using the Whirlwind drift dusting machine. Dusts containing 4% Copper.*

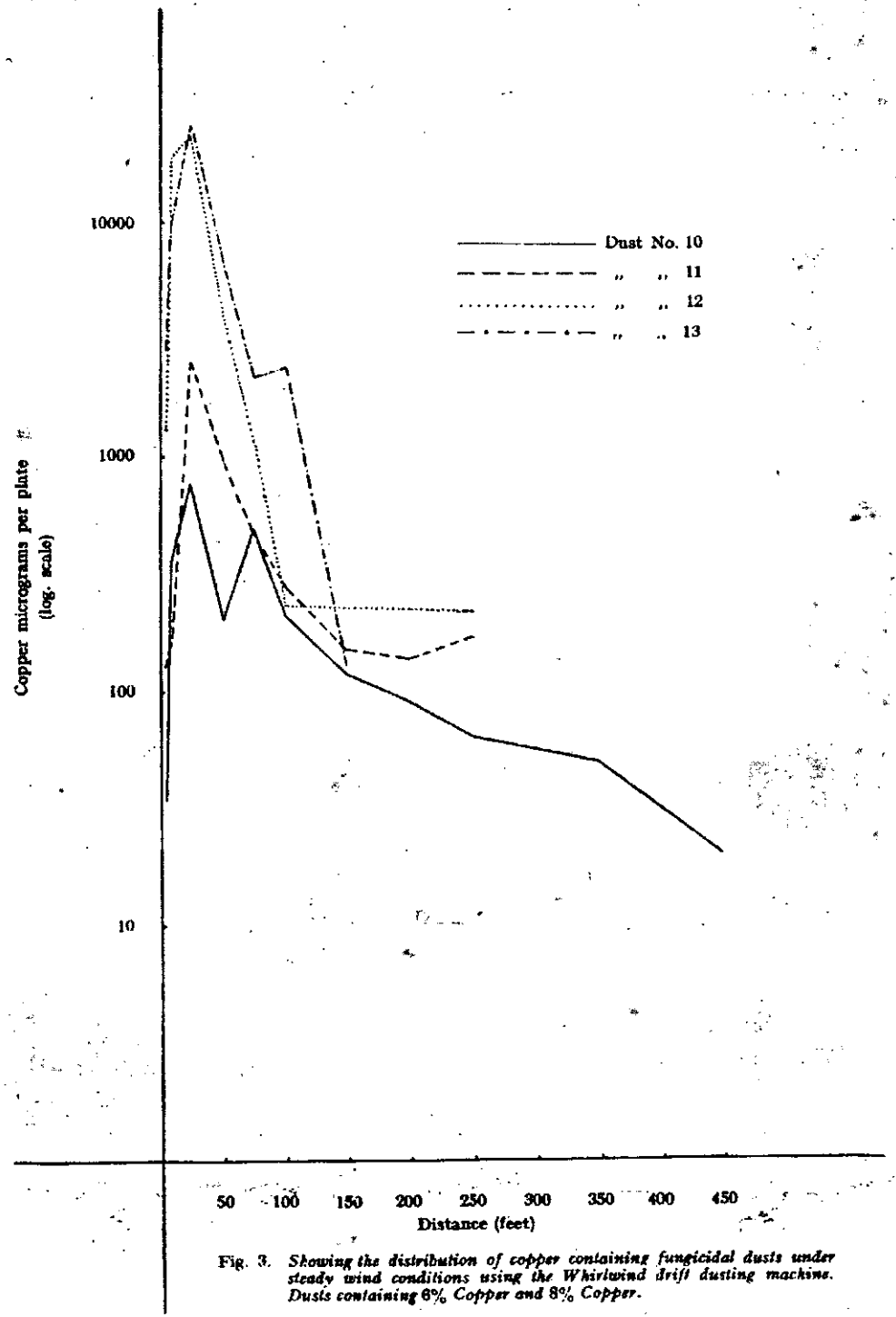

Fig. 3. *Showing the distribution of copper containing fungicidal dusts under steady wind conditions using the Whirlwind drift dusting machine. Dusts containing 6% Copper and 8% Copper.*