STUDIES IN BLISTER BLIGHT CONTROL

*PART V. MECHANICAL DUSTING AGAINST BLISTER BLIGHT—SECTION 2.

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"Cuprosana" dust is a highly effective fungicide, specially made for use with the "Whirlwind Duster," this combination of duster and dust providing the most efficient means for blister blight control on tea estates. For some time it was thought that wind and air currents would present very troublesome matters which would be very difficult to overcome, but by making intelligent use of these natural elements, and drawing up a wind current plan together with a map of the estate paths, it has been found that these wind currents can be of considerable use in improving the dusting range.

The "Whirlwind Duster," can, for purposes of use, be mounted on a jeep, trailer, small caterpillar, a three or four wheel trolley or carried by four coolies. During the dusting operation it is advisable to have a "spotter" to observe that sufficient coverage is being made by dust on the tea bushes. If the deposit is seen by the "spotter" to be insufficient from any cause, it is possible to inform the operator who can rectify this deficiency. It may also be found that a specified plot is difficult to dust every day at a particular time, owing to adverse wind currents, generally it is noticeable that at certain hours of the day, this adverse wind is either not blowing or in a favourable direction for the dusting to be proceeded with. By making notes of these matters it is possible to draw up a wind draft or wind current plan, which will save time and enable the dusting operator to make a uniform and even coverage.

*The Institute does not necessarily endorse the views expressed in papers contributed by persons other than members of the staff.

On sunny days rising air currents may sometimes cause the loss of a small percentage of the chemical dust employed. Dusting in misty weather, drizzles or slight showers is found to be most favourable and effective, owing to reduced drift and to the copper particles being well dispersed over the leaf surface immediately after the settling of the dust on the wet foliage. Weather records were kept during the monsoon period, and it was observed that at least four hours each day were favourable for dusting. The advantage of working with a machine having a capacity of 30-40 acres per hour is that the superintendent can select the best time to assure a good coverage of the tea bushes. The economical aspect is the saving in wages, as during very wet periods only a few men are idle compared with more than a hundred men when knapsack sprayers are used, whilst the capacity of the machine still enables the labourer to perform the daily task. In this connection the influence of heavy rains on dusting in operation was investigated. When dusting was carried out in torrential rain, the drifting dust could not be "spotted" in the downpour. After several showers, six hours later, analyses were made to ascertain the copper deposit and dispersal over the leaf surface. These analyses showed that the cppper or the dust had immediately dispersed in the rain over the leaf surface in an even distribution and was still available. Some typical figures are given below :—

Distance from Machine.	Cu p.p.m.	Cu p.p.m.
100 feet	217	227
200 feet	157	204
300 feet	102	154

Thousands of analyses were made, from which data were obtained regarding the range, drifting, deposits after heavy, moderate and light dusting and the copper contents in the residues immediately after dusting and just prior to plucking. However, one of the most important questions still to be answered was, "What is the minimum amount of copper required in the residue to give efficient control of blister blight in the field?" The answer to this question was given by the dusting results on plot No. 1 on Castlereagh Estate. This was a plot at an altitude of 3,600 feet six months from pruning, situated in a damp hollow which contained a number of streams, had little air movement, and was thus very susceptible to blister blight.

An endeavour was made to dust this plot with a uniform and even distribution of 7-9 lbs. per acre of "Cuprosana 2" a 2 per cent copper dust, but owing to adverse wind currents at times, the dusting was found to form sometimes a heavier cover on the leaves in some places than in others. Bearing this in mind, and knowing that these heavy deposits are washed away by rain, the practice of plucking the leaf just before dusting was adopted, which left the tested fields exposed to rain for six days following the application of the dust. A check was made by picking at random a number of flushes from the total pluckings of the treated area. These were analysed, and showed that the copper content on the leaves varied from 20—380 p.p.m. The average for the leaves analysed was 60 p.p.m. Similarly the manufactured tea was also tested and showed a copper content of 39 p.p.m.

The monsoon had broken about the 25th of May, but the first dusting was not commenced until June the 5th by which time spores of the fungus had already germinated and unfortunately gained entry into the leaves. After six weeks of dusting definite visual results were to be seen in the very much larger amount of young flush making its appearance. Counts of flush infections from dusted and undusted areas were made to ascertain the percentage of infected leaves. On the undusted areas, not only was there a high percentage of stem infections, but very young flushes failed to mature if infected at an early stage, as they shrivelled up and turned black. A still more detrimental form of local infection is the bud-infection which blackens and destroys one

generation of buds after the other and leaves the bushes completely defoliated. In the dusted areas most of the buds commenced to grow and flushes reached a pluckable stage. Although a certain number of leaves showed signs of very light infection (translucent spots) these were nearly all plucked before reaching the blister stage and thus were not a source of danger for further infection. In these areas there is a considerable amount of young and vigorously growing susceptible leaf tissues, whilst much of this growth in undusted areas is blackened and so may never be included in any count or reckoning, from which it will be evident that infection counts between dusted and undusted bushes are not a satisfactory means of arriving at precise figures. A more reliable method of obtaining results can however be obtained by combining infection counts and plucking weights.

The plucking weight method, although not exact, as it may be influenced by factors such as better yield due to sheltered conditions, or otherwise in wind swept areas, was definitely in favour of the dusted areas.

The amount of dust required is 7-10 lbs. per acre. The price of "Cuprosana 2" is circa Rs. 0.27 per pound weight, therefore the cost per acre for weekly dusting rounds would be less than about Rs. 2.38 (dust) + Rs. 0.12 (labour) = Rs. 2.50.*

TABLE IV.

Yields, costs and blister blight infections in fields 6 — 34 months from pruning.

Time from Pruning	6 months		8 months		20 months		30 months		34 months	
	Dust	No. D	Dust	No. D	Dust	No. D	Dust	No. D	Dust	No. D
10th July	95	56	—	—	mist belt		—	—	—	—
	92	54	86	57	—	—	—	—	—	—
Yield of green leaf	100	58	56	38	48	16	67	36	45	36
in lbs. per acre.	97	66	64	53	31	11	88	54	52	50
	150	80	80	61	39	28	91	50	50	44
	90	68	70	59	28	25	60	47	48	47
	93	71	80	77	43	25	—	—	—	—
30th of August	103	72	—	—	—	—	—	—	—	—
	820	525	436	345	189	105	306	187	195	177
Increase in yield in lbs. per acre	295		91		84		119		18	
Increase manuf. tea in lbs. per acre approx.	74		23		21		30		4.5	
Price tea at Rs. 2/30 per lb. Financial increase in Rs. p. acre	185/-		57/50		52/50		75/-		11/25	
Dusting rounds	13		11		10		9		9	
Cost of dusting Rs. p. acre	32/50		27/50		25/-		22/50		22/50	
Financial gain in Rs. p. acre	152/50		30/-		27/50		52/50		11/25	
Stem infections	—	4	—	5	1	5	—	—	—	—
Old active blisters	—	1	1	6	3	13	—	—	—	—
Old brown blisters	—	1	1	12	6	8	—	—	—	—
Flush infections	2	18	18	30	31	57	—	—	—	—
Total infections	2	24	20	53	41	84	—	—	—	—

*Note by Editor: Large scale trials have when costed given a higher figure.

From this table the following conclusions are drawn — Dusting of tea one and two years from pruning is definitely highly desirable and economically justified. Dusting of tea three years from pruning may not be economical, but the bushes which have been dusted are absolutely free from flush, stem and bud infection, have a healthy appearance and are able to build up sufficient starch reserves for the next pruning.

Whilst weekly dusting has given a certain proportion of control, the frequency of seven days does not appear to be sufficiently effective on new fields. It is probable that rounds of five or six days will be required for effective control.

For a field three years from pruning, where the rate of growth is not so rapid, a ten day dusting period may be sufficient to control defoliation and destruction of buds, by which means the health of the bush can be maintained, and death after pruning due to lack of starch prevented.

Areas pruned in June may require a four day dusting round up to tipping time.

Disadvantages and advantages of the Dusting Method.

There are only a few disadvantages to the dusting method, and fortunately they can be overcome. The most persistent difficulty is the copper content in the manufactured tea, but when the superintendent can develop his plucking-dusting plan, and the operator works intelligently by improving his practical knowledge and skill in using wind drifts to distribute the powder evenly at long range, the copper content can easily be checked, and kept below the stipulated tolerance figure.

From personal experience it is apparent that some of the local labourers show interest in dusting by the "Whirlwind Duster" and are surprisingly quick in mastering a perfect dusting technique.

Official tests of manufactured tea from our experiments have shown no tainting, no excess of copper, and an excellent quality of tea.

Advantages.

1. The construction of the machine is simple, no wear and tear.
2. The duster is light in weight and very easy in handling.
3. The very long working range (200 — 800 feet) reduces running tracks to a minimum. Any spot on the estate can be covered as the duster can be mounted on a lorry, jeep, trailer, small caterpillar, trolley or can be carried by coolies.
4. The twinbend with swivel-joints makes the outlet completely adjustable to follow the slighest change in the wind-direction.
5. The whirling in the rolling cloud guarantees an even coverage. Minimum amounts of copper only are required, but the particles must be very fine and highly soluble, as is achieved in the manufacture of "Cuprosana Dust".
6. The dusting capacity of at least 30 acres per hour allows of operations at favourable moments, and permits shorter dusting rounds, should these be required.
7. The saving in labour is great. Four to six men being able to cover the same area for which 100-120 men are required with knapsack spraying.
8. No water is required in connection with the application, which eliminates water haulage. It also reduces the risk of spore germination in an already humid atmospheric condition, which is highly favourable for spore germination. Further water assists the run-off of sprays from wet leaf surfaces.

9. The dust particles are carried by the prevailing wind currents and settle on the same places where the airborne spores are being deposited.
10. The application costs for the dusting are the same as for knapsack spraying, but may become lower in future.
11. The initial capital outlay for the machine is 25 per cent of that for knapsack spraying equipment required to cover the same area.
12. The increase in yield makes dusting applications economically justified.
13. The dusting method may provide an opportunity to return to the normal pruning time.
14. Bushes frequently suffering from defoliation will not stand up to pruning and death of the bushes after pruning may result. The financial loss by deterioration and death of bushes would be considerably heavier than the loss of the crop. It has been definitely proved that dusting considerably reduces bud and stem infections and in turn defoliation and deterioration.

Throughout the whole of our tour, every facility was afforded to study the organisation, methods and technique adopted on tea estates in Ceylon, whilst our stay on the Island was made happy and comfortable by lavish hospitality which was greatly appreciated, and for which we tender our sincerest thanks to :—

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Again we wish to express our thanks and gratitude to all the ladies and gentlemen who have so ably contributed towards our researches and studies, by placing valuable information at our disposal, and for the many kindnesses extended towards us.

Since the Institute began Vegetative Propagation on a large scale the process of applying liquid manure to rooted cuttings, at fortnightly intervals, has been carried out for many years. These experiments have proved that this process has made a definite contribution towards the more luxuriant growth of the plants but has tended towards a steady decrease in the rooting percentages of all clones.

The following experiment was therefore designed to determine whether cuttings rooted better in manured or unmanured soils

Details of the experiment.

An area that had never been manured was selected and four beds were made. Soil was removed to a depth of 18 ins. one half of each bed was filled with unmanured soil and the other with soil from the main vegetative propagation nursery, that had been manured at regular intervals. Both sets of soil were passed through a No. 4 mesh sieve. Other relevant details regarding this experiment are included in Table I.

TABLE I.

		Manured.	Unmanured.
Soil Type	...	Black loam.	Red loam.
ph.	...	5.4	5.4
Eelworm	...	None found	None found
Clone	...	777	777
Type of cutting	...	Green single node.	Green single node.
Planted	...	11.11.49.	11.11.49.
Examined	...	24. 5.50.	24. 5.50.

Results

These are given in Table II below :—

TABLE II.

Total Rooted.

		Manured	Unmanured
Bed 1	...	34	88
2	...	24	78
3	...	41	76
4	...	39	110
Total	...	138	352
Mean	...	34.5	88.0

Little need be said about these figures which are statistically significant. In every bed the rooting in the unmanured plots has been over twice as much as the manured. It is, therefore, quite obvious that cuttings will root very satisfactorily in poor soils of good texture, provided they are properly handled as to water and shade.

Once cuttings have rooted in poor soils, the next problem is to maintain them in a healthy and vigorous condition without using manure. The following alternative methods are suggested for consideration :—

(1) Rooted cuttings from unmanured beds can be transferred to favourable sites. The snag about this method is that there is bound to be a certain amount of root damage resulting in a set back to the plants.

(2) Nurseries that have already received frequent applications of manure could be rested for some time.

(3) The top 4 ins. to 6 in. of regularly manured beds could be made up with soil that is not rich in organic matter.